TVET CERTIFICATE III IN AUTOMOBILE ENGINE TECHNOLOGY

LUBRICATION SYSTEM REPAIRING

AUTLS301

REPAIR LUBRICATION SYSTEM

Competence

RTQF Level: 3

Learning Hours: 40

Credits: 4

Sector: Transport and logistics

Sub-sector: Automobile

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Purpose statement

This particular module describes the performance outcomes, skills and knowledge required to maintain engine and its auxiliary systems. It is very core to every mechanic to perform lubricating system service, cooling system service and air intake system service in order to keep our vehicle engine in good condition.

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Learning Unit 1 – Describe lubricating components

Introduction

Engine Lubrication System: Must supply the engine components with an adequate amount of lubricating oil. The correct pressure must be guaranteed in the process, and are used to keep the wear between moving parts as low as possible. They are intended to prevent the surface that slide on each other coming into contact by mean friction.

Lubrication plays a key role in the life expectancy of an engine. Without oil, an engine would succumb to overheating and seizing very quickly. Lubricants help mitigate this problem, and if properly monitored and maintained, can extend the life of your motor. The process of lubrication in an internal combustion engine begins in the sump, commonly referred to as the oil pan. From here, the oil is pulled through a strainer, by the oil pump, removing larger contaminants from the mass of the fluid. The oil then goes through the oil filter. It is important to note that not all filters perform the same.

A filter's ability to remove particles is dependent upon many factors, including the media material (pore size, surface area and depth of filter), the differential pressure across the media, and the flow rate across the media. Oil is pumped through passageways to the various components of the engine such as the cam, main bearings, rod, pistons, etc. Gravity then pulls the oil back down to the bottom of the motor to drain back into the sump, and the cycle repeats.

To appreciate the full impact of the engine lubrication process, you must understand how oils are formulated. All engine oils have two components: additives and base oil. The total volume of additives in motor oil can range from 20 to 30 percent, depending on brand, formulation and application. These additives can enhance, suppress or add properties to the base oil.

Most vehicle engines use some form of multi-grade oil. This type of oil has an additive called a viscosity-index (VI) improver. A common example would be 10W-30 or 5W-40. These VI improvers are long-chain organic molecules that change shape as the temperature of their environment changes.

LO 1.1 - Identify lubrication components

- **Content/Topic 1 Identification the properties of oil**

Identify properties of oil:

Lubricity: It is the ability of oil to reduce wear and friction even in extreme conditions, it is important oil properties which help oil to perform its function between moving parts by providing low friction.

Viscosity: is a measurement of oil's thickness, or resistance to flow. It is the property of the liquid which tends to prevent relative movement between adjacent parts within itself. Generally, thicker the fluid, higher is its viscosity; whereas thinner liquids have lower viscosity.

Viscosity Index: is a term which is mainly related to marine lubricating oils. It can be defined as the change in viscosity of the oil which takes place as a result of change of temperature.

Fire point of oil: Is the temperature at which heated oil will continue to burn for at least five seconds after the ignition source has been removed.

Flash point of oil: Is a temperature at which heated oil can be ignited by an external source. But when the source of ignition is removed, the vapour will cease to burn.

Cloud point: is the point indicates the temperature at which waxes begin to form in the oil.

Pour point: it can be defined as the temperature at which the oil stops to flow.

Oxidation and corrosion: oiling forms a protective coating for the metal and hence prevents it from rusting. Oil can penetrate the oxide-water on the metal and stabilize it.

Flash Point: it can be defined as the lowest temperature at which the oil will give off sufficient inflammable vapour to produce a flash when a small flame is brought to the surface of the oil.

SAE: Society of Automotive Engineers is responsible

SAE 10W-30: means that the oil is SAE certified and has a grade 10 when it is cold (W stands for winter) and 30 when it is hot.

NLGI: National Lubricating Grease Institute

API: American Petroleum Institute

Auto ignition point: auto ignition temperature or kindling point of a substance is the lowest temperature at which it spontaneously ignites in normal atmosphere without an external source of ignition, such as a flame or spark.

Viscosity rating

Viscosity of oil is determined by use of a **viscometer**. This device determines the length of time required for the definite amount of oil to flow through an opening of a definite size. Temperature is taken into consideration during this test

Lubricating oil is general rated using a viscosity scale established by **Society of Automotive Engineers (SAE)**

Commonly used viscosity grade are:

- ✓ Single grade (viscosity)
- ✓ Multi grade (Viscosity)

a) Single weight oil viscosity is greatly affected by the temperature of the oil.

- ✓ At low temperatures the oil has a higher viscosity.
- ✓ At high temperatures the oil becomes thinner and its viscosity lowers.

Ex: SAE5; SAE10; SAE20; SAE30; SAE40.

- ✓ SAE 40 oil performs well at higher temperatures, but becomes thick at low temperatures.

For this reason, most engines use multi-grade oils that are more stable at temperature changes.

b) Multi grade(Viscosity)

Multi-Viscosity oil can perform well across a larger range of oil.

- ✓ Retains a specific viscosity at 0 F.
- ✓ Increase in viscosity at high temperatures.

EX: 5W20: 20W50

- ✓ 5 Low viscosities at cold temperatures
- ✓ W Winter
- ✓ 20 High viscosity at high temperatures

Specific gravity

Specific gravity this property is little important except as an indicator of weight and volume. the specific gravity of oil varies from 0.85 to 0.95

The parts compose grease

- ✓ thickener
- ✓ fluid base
- ✓ additives
- ✓ fillers

Oil additives:

- ✓ Additives are substances that are added to engine oil, transmission oil and coolant to improve their properties. Additives are even added to fuels and oils in refineries.
- ✓ They improve oil lubricating properties

Types of oil additives

- ✓ **Anti-wear additives:** These reduces wear especially in heavily loaded areas such as between cam lobes and lifters
- ✓ **Rust &corrosion inhibitors:** These protect metal parts of the engine against rust and corrosion
- ✓ **Viscosity index improvers:** These increase the VI of the oil.
- ✓ **Anti-foam agents:** These minimize foam during use
- ✓ **Oxidation inhibitors:** These minimize oil thickening and varnish formation at high temperatures
- ✓ **Detergents and dispersants:** They minimize the deposit build up in the engine
- ✓ **Pour point depressants:** These enable the oil to flow at low temperature

Content/Topic 2 Identification the Purpose of Engine Lubrication System

Purpose of Engine Lubrication System

- ✓ **Lubricate:** in order to reduce energy losses and wear inducing friction between those.
- ✓ **Cool:** in order to protect the engine components against overheating because these components cannot give off heat directly to the coolant or to the cooling air.
- ✓ **Seal:** in order to guarantee the precision seal, seal between parts that slide on or against each other (e.g. piston ring against cylinder well)
- ✓ **Clean:** in order to remove abrasion, deposits and combustion residuals or bind them in the oil so as to render them harmless to the engine
- ✓ **Protect against corrosion**
- ✓ **Damp engine noise and vibration damping effect**

- **Content/Topic 3 Identification lubrication components**

Identification lubrication components:

Oil pan/oil sump:

- ✓ The **oil pan** - or sump as it's also called - acts as a reservoir for the engine oil in a car, it store the engine oils and cover the bottom of engine.
- ✓ The oil pan is attached to the bottom of the engine block. It serves as the reservoir for the engine's oil. It is designed to hold the amount of oil that is needed to lubricate the engine when it is running, plus a reserve.
- ✓ The oil pan also helps to cool the oil through its contact with the outside air.
- ✓ The oil pan is normally made of thin sheet metal especial steel or aluminium and bolted to the bottom side of the engine block (cylinder block)
- ✓ It holds a supply of oil for the lubricating system
- ✓ It has drain plug (drain valve) for oil change
- ✓ The sump is the lowest area in oil pan where the oil collects as oil drains from the engine
- ✓ The oil pump can pull oil out of the oil pan for circulation
- ✓ It has baffles may be keep the oil from the suction point (side) during cornering, acceleration and breaking
- ✓ Oil pan also acts as a cooling surface
- ✓ Oil pan sealed by flat gasket or increasingly by liquid seals with silicon

Figure 1 oil pan

Oil strainer/mesh filter:

The engine oil strainer is designed to prevent debris and contaminants from entering the vehicle's *engine oil*, remove contaminants as ***oil*** passes through, it is also called pick up screen tube.

Figure 2 oil strainer

- ✓ The strainer has mesh screen suitable for straining large particles from the oil yet passes a sufficient quantity of oil to the inlet side of the oil pan
- ✓ The strainer is located where all oil entering in the pump from oil pan must flow through it.
- ✓ Some assemblies also incorporate a safety valve that opens in the event the strainer becomes clogged
- ✓ Strainer assemblies may be either the floating or to the fixed types

Oil picks tube

- ✓ Oil pick tube carries oil to the pump
- ✓ Oil pick up is tube that extends from the oil pump to the bottom of the oil pan
- ✓ One end of the pick-up bolted or screens in oil pump or to the engine block, the other end holds the strainer

Oil passages: Oil passages in an engine block are usually called oil gallery

Oil pump

The oil pump draws the oil from the sump and passes it through a filter where dirt is removed.

The oil pump in an internal combustion engine circulates engine oil under pressure to the rotating bearings, the sliding pistons and the camshaft of the engine. A car's oil pump is needed to make sure the engine oil reaches all moving parts that require lubrication during an engine's operation.

Types of oil pumps used in engine lubrication

Gear pump (external gear pump, internal gear pump or crescent pump, rotor gear pump)

External gear pump

In these types of pump, the oil carried in the tooth spaces and delivered along the inner pump wall to the other side the meshing of the teeth of two gears prevents the oil from flowing back. A vacuum pressure and an over pressure are generated on the section side and the pressure side respectively

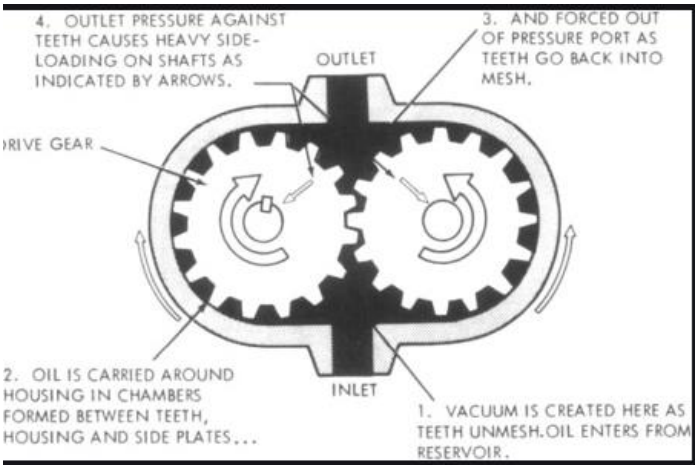


Figure 3 external gear pump

Internal gear pump Crescent pump

- ✓ This is a special type of gear pump
- ✓ It located opposite side of fly wheel
- ✓ Its inner gear is usually seated direction the engine crank shaft
- ✓ An outer gear mounted in the pump housing is arranged eccentrically to the inner gear

- ✓ This creates a suction chamber and a pressure chamber which are separated from each other by a crescent shaped space
- ✓ The oil is delivered in the tooth spaces a long both the crescent-shape spacer

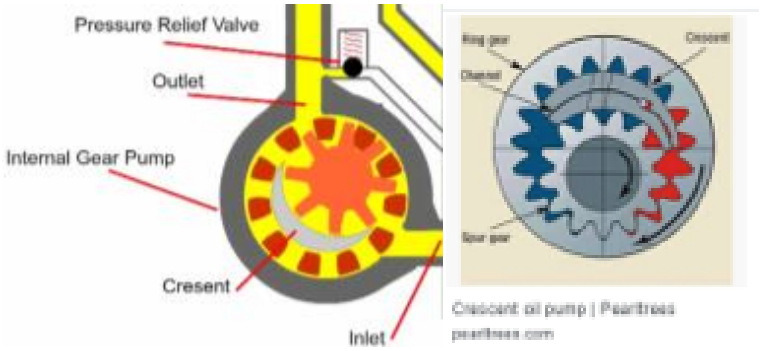


Figure 4 internal gear pump

Advantage of oil crescent pump over conventional gear pump is that it has higher delivery rate, especially at low engine speed.

Rotary oil pump

- ✓ This consist of an internal toothed outer rotor and externally toothed inner rotor
- ✓ The inner rotor has one less tooth than the outer rotor and is connected to drive shaft
- ✓ The tooting of the inner rotor is shaped as such a way that each tooth touches the outer rotor and largely seals the chamber created
- ✓ As the rotors rotate, the pump chambers on suction side continually increase in size and the pump draws in oil.
- ✓ The chambers on the pressure side decrease in size and the oil is forced into the pressure line
- ✓ The oil is simultaneously forced by several narrowing pump cells into the pressure line so that the rotor pump operates uniformly
- ✓ It is able to generate high pressure with a high delivery flow.

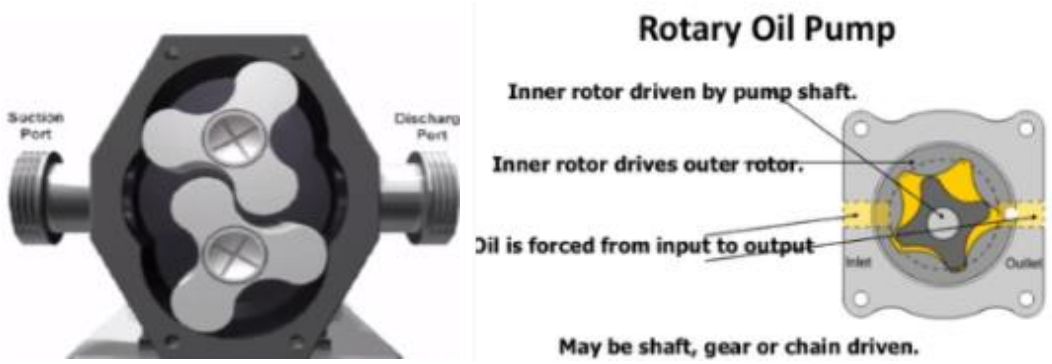


Figure 5 rotary gear pump

Oil Filter

These are installed to prevent premature deterioration of lubrication oil caused by solid impurities

For examples metal abrasion, soot, dust particles,

- ✓ Oil filter however, are enable to remove liquid contaminations or contaminants dissolved in the oil.

All of the oil that leaves the oil pump is directed to an oil filter. This ensures that small particles of dirt and metal suspended in the oil will not reach the close-fitting engine parts. This stops those impurities, which can cause premature wear, from circulating through the engine.

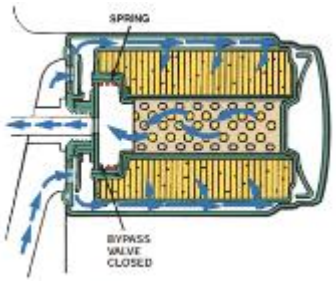


Figure 6 oil filter

Filtering also increases the usable life of the oil. The filter assembly threads directly onto the main oil gallery tube. The oil from the pump enters the filter and passes through the element of the filter. From the element, the oil flows back into the engine's main oil gallery.

Full-flow oil filter:

- ✓ Full-flow oil filtering ensures that not unfiltered oil can reach to the lubrication points
- ✓ All the oil goes to the system through in filter
- ✓ Relief valve is used to ensure oil supply to engine in case of filter clogging
- ✓ In order to facilitate an adequate through out of oil. It is important that flow resistance of the oil filter not be too big.
- ✓ Full-flow oil filtering ensures that no unfiltered oil can reach the lubrication points. In order to facilitate an adequate throughput of oil, it is important that the flow resistance of the filter (pore size) not be too high. This would limit the filter effect. Tiny contaminants would not be filtered out of the oil.

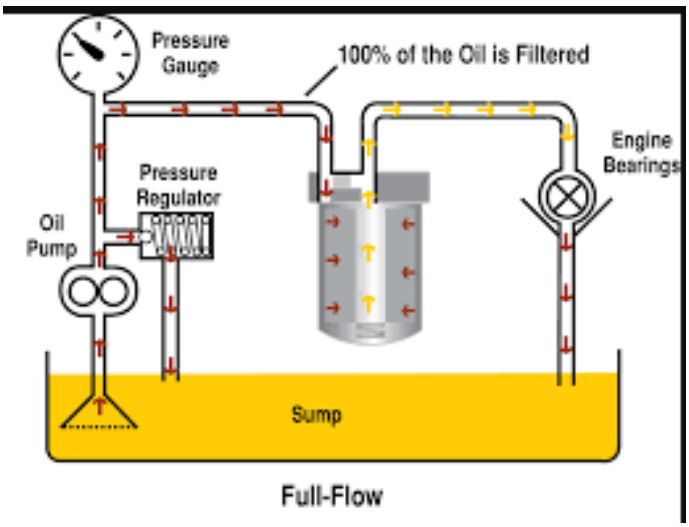


Figure 7 full flow oil filter system

Partial-flow oil filter . This filter is arranged in a branch (partial flow) running parallel to the full flow. Thus only part of the oil delivery (5% to 10%) passes through this filter. In this way, only partially filtered oil reaches the lubrication points. The pore size of the filter can be reduced to such an extent that even tiny contaminants can be filtered out of the partial flow

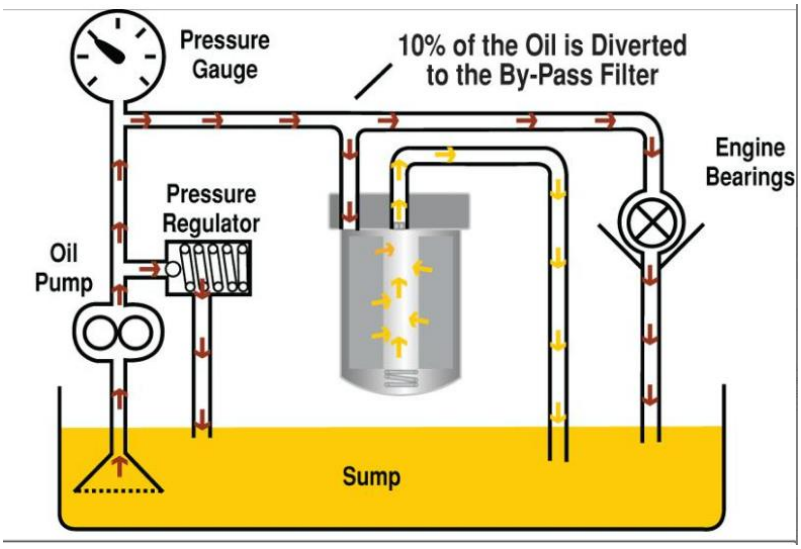
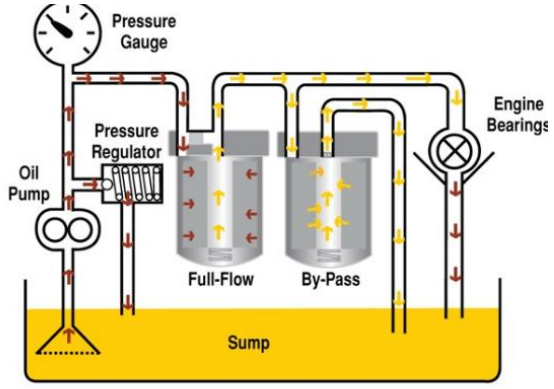


Figure 8 partial flow oil filter

- ✓ This filter is arranged in branch (partial-flow) running parallel to the full-flow
- ✓ Thus only part of the oil delivery (5 to 10%) passes through this filter
- ✓ In this way, only partially filtered oil can reaches the lubrication

Combination of full-flow and partial-flow filters

This combination delivers the best filter effect. They are used, for example, in construction-site vehicles. For cost reasons, however, predominantly full-flow oil filters are used in passenger cars.



Full-Flow & By-Pass

By pass valve

It is an integral part of the oil filter. The valve is designed to open when the oil filter becomes clogged or when the oil is too thick.

Dipstick

The dipstick is used to measure the level of oil in the oil pan. The end of the stick is marked to indicate when the engine oil level is correct. It also has a mark to indicate the need to add oil to the system.

Figure 9 dipstick

Oil Pressure Indicator

All vehicles have an oil pressure gauge and/or a low-pressure indicator light. Oil gauges are either mechanically or electrically operated and display the actual oil pressure of the engine. The indicator light only warns the driver of low oil pressure.

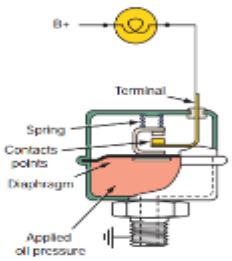


Figure 10 oil pressure indicator

Pressure relief valve

Pressure Relief Valve: This valve allows excess oil flow generated by the engine oil pump to return to the sump.

Closed position

The relief valve spring tension determines the maximum oil pressure. when the pressure delivered by the oil pump is acceptable by lubrication system components, the relief valve is closed (this means that the pressure delivered by the oil pump is less or equal to the relief valve spring tension pressure)

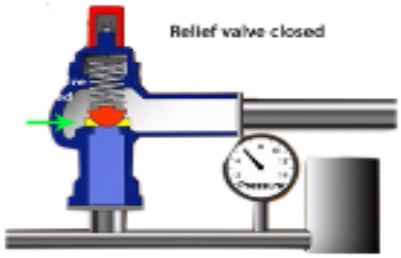


Figure 11 pressure relief valve in closed position

Open position

As the engine's rotation speed increases, the quantity of oil that the pump supplies to the lubrication system increases and the oil pressure of course increases, this cause the oil pressure to be greater than the relief valve spring tension pressure. This cause the spring loaded ball to be compressed and open the passage then the excess oil is bleeded off either to the inlet of pump or to the oil sump.

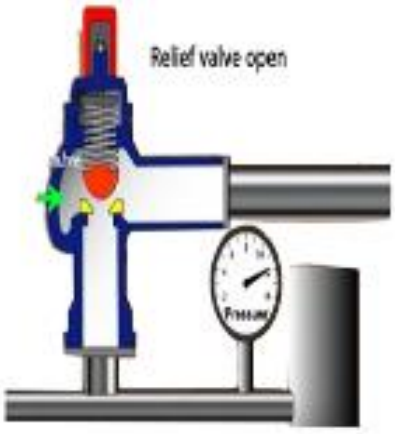


Figure 12 pressure relief valve

LO 1.2 – Identify lubrication types

- Content/Topic 1 identification of the lubrication types

Splash lubrication

Splash Lubrication is pretty primitive. A hook, cast or bolted onto the crankshaft, dips into the oil in the sump and splashes it around the inside of the engine. This system was used on some of the first motorcycles in the early 1900s.

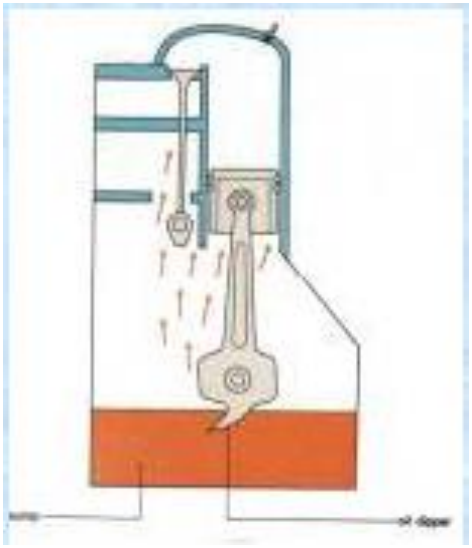


Figure 13 splash lubrication

Forced-feed lubrication: lubricating internal combustion engines in which a pump forces oil into the engine bearings.

- ✓ Engine oil is specially formulated to lubricate and cool engine parts. The moving parts of an engine are fed a constant supply of oil.
- ✓ Engine oil is stored in the oil pan or sump.
- ✓ The oil pump draws the oil from the sump and passes it through a filter where dirt is removed. The oil is then moved throughout the engine via oil passages or galleries.

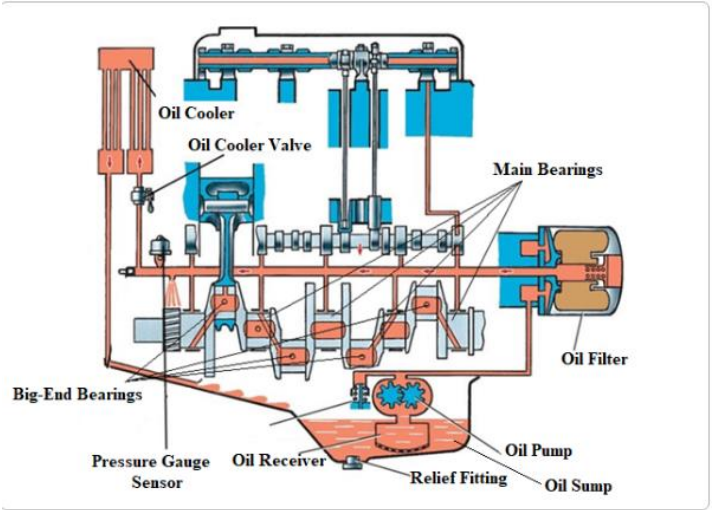


Figure 14 forced feed lubrication

- ✓ After circulating through the engine, the oil returns to the sump. The oil pump pickup is a line from the oil pump to the oil stored in the oil pan.
- ✓ It usually contains a filter screen, which is submerged in the oil at all times.
- ✓ The screen serves to keep large particles from reaching the oil pump.
- ✓ This screen should be cleaned any time the oil pan is removed. The pickup may also contain a by-pass valve that allows oil to enter the pump if the screen becomes totally plugged.
- ✓ Because the oil pump is a positive displacement pump, an oil pressure relief valve is used to prevent excessively high system pressures from occurring as engine speed is increased.
- ✓ Once oil pressure exceeds a preset limit, the spring-loaded pressure relief valve opens and allows the excess oil to bypass the rest of the system and return directly to the sump.

Dry-sump lubrication:

- The term sump is used to describe a location where oil is stored or held. In most engines, oil is held in the oil pan and the oil pump draws the oil from the bottom. This type of system is called a wet sump oil system.

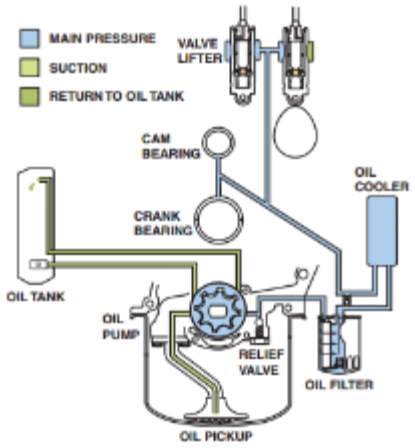


Figure 15 dry sump lubrication

- ✓ In a dry sump system, the oil pan is shallow and the oil is pumped into a remote reservoir.
- ✓ In this reservoir, the oil is cooled and any rapped air is allowed to escape before being pumped back to the engine. A dry sump system uses an externally mounted oil reservoir.

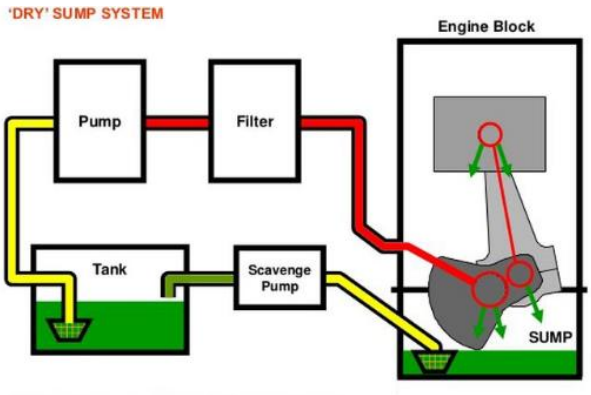


Figure 16 dry sump lubrication system

The dry-sump system uses two or more oil pumps and a separate oil reservoir .A dry-sump engine requires a pressure relief valve to regulate negative pressure inside the engine.

- ✓ In a dry-sump, the oil still falls to the base of the engine, however instead of collecting in a reservoir-style oil sump, it falls into a much shallower sump, where one or more scavenge pumps draw it away and transfer it to a (usually external) reservoir, where it is both cooled and de-aerated before being re-circulated through the engine by a pressure pump.
- ✓ Dry-sump designs frequently mount the pressure pump and scavenge pumps on a common crankshaft, so that one pulley at the front of the system can run as many pumps as the engine design requires.

Advantages

The advantages of a dry sump system are as follows:

1. A shallow oil pan allows the engine to be mounted lower in the vehicle to improve cornering.
2. The oil capacity can be greatly expanded because the size of the reservoir is not limited. A larger quantity of oil means that the oil temperature can be controlled.
3. A dry sump system allows the vehicle to corner and brake for long periods, which is not able to be done with a wet sump system due to the oil being thrown to one side and away from the oil pickup.
4. A dry sump system also allows the engine to develop more power as the oil is kept away from the moving crankshaft
5. The flat oil pan reduces the height of the engine, and thus the vehicle Centre of gravity.

   Perfect lubrication is guaranteed in the event of large engine inclinations.

Disadvantages

A dry sump system has the following disadvantages.

1. The system is expensive as it requires components and plumbing not needed in a wet sump system.
2. The system is complex because the plumbing and connections, plus the extra components, result in more places where oil leaks can occur and change the way routine maintenance is handled.

Likewise in two-stroke engines:

Mixture lubrication: Lubricating oil is mixed with the fuel, either manually beforehand (the petrol and oil method), or automatically via an oil pump. Prior to being burned in the combustion chamber, this air/fuel/oil mixture passes through the engine's crankcase, lubricating the moving parts as it does so. In order to reduce exhaust smoke, the Kawasaki H2 750 cc (46 cu in) 2-stroke triple motorcycle had a scavenge pump with a spring-loaded ball-valve under each crankcase to return surplus oil to the tank for reuse

Total-loss lubrication:

- A total-loss oiling system is an engine lubrication system whereby oil is introduced into the engine, and then either burned or ejected overboard. Now rare in four-stroke engines, total loss oiling is still used in many two-stroke engines. Two-stroke engines, and most model engines, have a total-loss lubrication system.
- A total-loss oiling system is an engine lubrication system whereby oil is introduced into the engine, either burned or ejected overboard. Now rare in four-stroke engines, total loss oiling is still used in many two-stroke engines. Steam engines used many separate oil boxes, dotted around the engine; each one was filled before starting and refilled during running. Where access was difficult because the oil box was on a moving component, the oil box had to be large enough to contain enough oil for a long working shift.

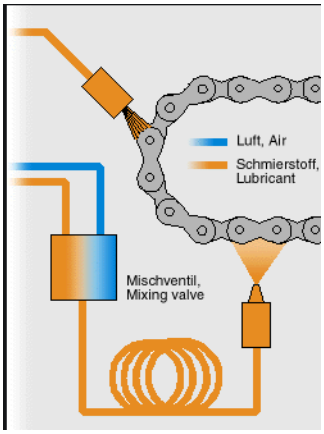


Figure 17 motorcycle

LO 1.3 – Identify of oil pollution

- Content/Topic 1 identification of oil pollution

There are 4 main elements of engine oil pollution

1. **Temperature:** When the engine temperature increase the oil start to lose their original properties according to the change of temperature in the engine.
2. **Dust:** During refilling engine oil dust can get into the oil so that they can pollute the oil
3. **Metal particles:** Particles from friction of internal components are the source of dirty to the engine oil.
4. **Carbon deposit:** According to the operation of different moving parts dirty can stack in the joints of components so that the can cause the oil to be damaged.

Note: Mechanical contamination through dust; metal abrasion and combustion residues can be largely eliminating by suitable filters. The reason for regular oil changes:

Oil pollutions (stresses, contaminations) cause the following effects to the oil.

Oil ageing: Air and combustion gases force their way into the crankcase between the piston and the cylinder. This causes the oil to oxidase (age). Acids may be formed in the process.

Oil slugging: separated oleoresins, road sweepings, metallic abrasion and released combustion residues cause oil sludge to form.

Oil dilation: the high-boiling fuel constituents, which get into the oil particularly when the engine is cold, result in oil dilution. The high temperature causes oil becomes thin

Oil thickening: the heavy oil oxidation combined with the depositing of soot particles, occasionally cause the oil to become thicken, mainly in diesel engines.

Oil consumption: every engine has a certain level of normal oil consumption, which must be compensated. This comes about because the oil gets in to the combustion chamber (e.g. oil film on the cylinder wall, valve guides), where it burns.

Note: For these reasons, it is necessary to check the oil level at regular intervals and if necessary to top up the oil. Oil changes must be carried out within the framework of vehicle servicing in accordance with the manufacturer's recommendations or in accordance with the flexible interval display.

Learning Unit 2 – Check of lubrication system

LO 2.1 – Select tools and materials

- Content/Topic 1 (From Curriculum)

Select tools:

Spanners.

A1. Wrenches

The word *wrench* means twist. A wrench is a tool for twisting and/or holding bolt heads or nuts. Nearly all bolt heads and nuts have six sides; the jaw of a wrench fits around these sides to turn the bolt or nut. All technicians should have a complete collection of wrenches. This includes both metric and SAE wrenches in a variety of sizes and styles

Figure 18 wrenches spanner

The following is a brief discussion of the types of wrenches used by automotive technicians.

A.1.1.**Open-End Wrench** The jaws of the open-end wrench allow the wrench to slide around two sides of a bolt or nut head where there might be insufficient clearance above or on one side of the nut to accept a box wrench.

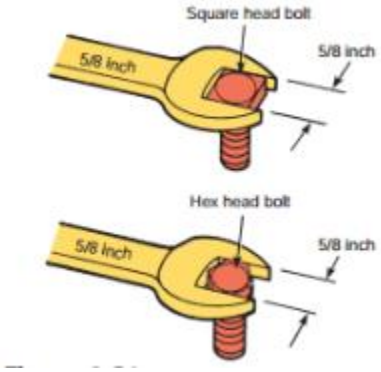


Figure 19 open end wrench

A1.2.Box-End Wrench The end of the box-end wrench is boxed or closed rather than open. The jaws of the wrench fit completely around a bolt or nut, gripping each point on the fastener. The box-end wrench is not likely to slip off a nut or bolt. It is safer than an open-end wrench. Box-end wrenches are available as 6 point and 12 point**)**. The 6-point box end grips the screw more securely than a 12-point box-end wrench can and avoids damage to the bolt head.

Figure 20 box end wrench

A1.3.Allen Wrench Setscrews are used to fasten door handles, instrument panel knobs, engine parts, and even brake callipers. A set of fractional and metric hex head wrenches, or Allen wrenches, should be in every technician's toolbox. An Allen wrench can be L-shaped or can be mounted in a socket driver and used with a ratchet.

Figure 21 allen wrench

A.2.Sockets and Ratchets

A set of Imperial and metric sockets combined with a ratchet handle and a few extensions should be the top side of a socket has a square hole that accepts a square lug on the socket handle.

This square hole is the drive hole. One handle fits all the sockets in a set. On better-quality handles, a spring loaded ball in the square drive lug fits into a depression in the socket. This ball holds the socket to the handle. An assortment of socket (ratchet) handles is shown.

Figure 22 sockets and ratchets

Not all socket handles are ratchet Some are called breaker bars, are simply long arms with a swivel drive used to provide extra torque onto a bolt to help loosen it.

Figure 23 breaker bar

A2.1.Special Sockets Screwdriver and Allen wrench attachments are also available for use with a socket wrench.

Figure 24 special sockets

A.3.Torque Wrenches

Torque wrenches measure how tight a nut or bolt is. Many of a car's nuts and bolts should be tightened to a certain amount and have a torque specification that is expressed in foot-pounds (U.S.)

Figure 25 torque wrench

A.4.Extensions: An extension is commonly used to separate the socket from the ratchet or handle. The extension moves the handle away from the bolt and makes the use of a ratchet more feasible. Extensions are available in all common drive sizes and in a variety of lengths.

Figure 26 extension

A.5.Screwdrivers

A screwdriver drives a variety of threaded fasteners used in the automotive industry. You also should have an assortment of special screwdrivers, such as those with a head design

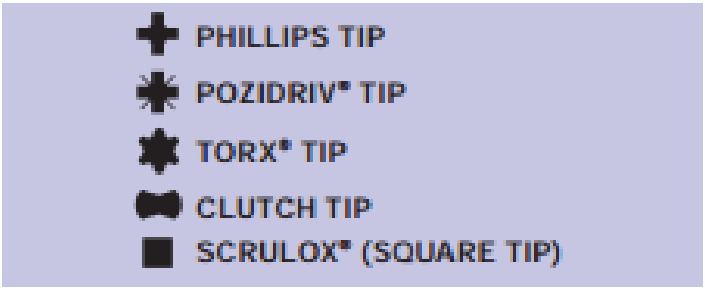


Figure 27 screw driver design

Standard Tip Screwdriver: A slotted screw accepts a screwdriver with a standard or blade-type tip. The standard tip screwdriver is probably the most common type It is useful for turning carriage bolts, machine screws, and sheet metal screws. The width and thickness of the blade determine the size of a standard screwdriver. Always use a blade that fills the slot in the fastener.

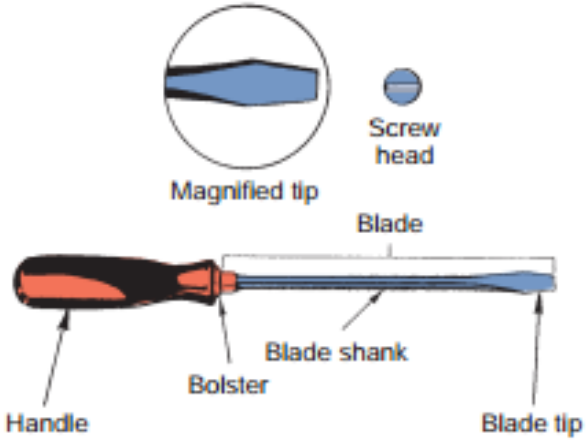


Figure 28 screw driver parts

A.5.1.Phillips Screwdriver: The tip of a **Phillips screwdriver** has four prongs that fit the four slots in a Phillips head screw The four surfaces enclose the screwdriver tip so it is less likely
that the screwdriver will slip out of the fastener.

Figure 29 philips screw driver

A.5.2.Reed and Prince Screwdriver: The tip of a Reed and Prince screwdriver is like a Phillips except that the prongs come to a point rather than to a blunt end.

Figure 30 reed and prince screw drive

A.6.Pliers

Pliers are gripping tools used for working with wires, clips, and pins. At a minimum, an auto technician should own several types: standard pliers for common parts and wires, needle nose for small parts, and large, adjustable pliers for large items and heavy-duty work.

Figure 31 various types of pliers

A.7 Feeler Gauge

A feeler gauge is a thin strip of metal or plastic of known and closely controlled thickness. Several of these metal strips are often assembled together as a feeler gauge set that looks like a pocket knife. The desired thickness gauge can be pivoted away from others for convenient use. A steel feeler gauge pack usually contains strips or leaves of 0.002- to 0.010-inch thickness (in steps of 0.001 inch) and leaves of 0.012- to 0.024-inch thickness (in steps of 0.002 inch). Metric feeler gauges are also available.

Figure 32 feller gauge

B.Oil filter wrench

An oil filter wrench, safety glasses, and a wrench for the drain plug

Figure 33 oil filter wrench

- **Content/Topic 2 Selection materials needed in repairing lubrication system**

Selection of materials:

- **Oil filter**

This ensures that small particles of dirt and metal suspended in the oil will not reach the close-fitting engine parts.

Figure 34 oil filter

- **Seals**

Seals keep oil and other fluids from escaping around a rotating shaft. There are three basic oil seal designs:
the fiber packing, the two-piece split lip design, and the one-piece radial design.

Oil seals are used to protect shafts and bearings from ingress of dirt and foreign matter and egress of **oil** or grease. An **oil seal** generally consists of an outer circular metal part and an inner flexible member that does the actual sealing and is bonded to the metal part by chemical adhesive agent

Figure 35 oil seal

- **Engine oil**
  These oils carry a combined classification such as 10W-30. This rating says the oil has the viscosity of both a 10- and a 30-weight oil. The “W” after the 10 notes that the oil’s viscosity was tested at 0°F (–18°C). This is commonly referred to as the “winter grade.” Therefore, the 10W means the oil has a viscosity of 10 when cold. The 30 rating is the hot rating. This rating was the result of testing the oil’s viscosity at 212°F (100°C).

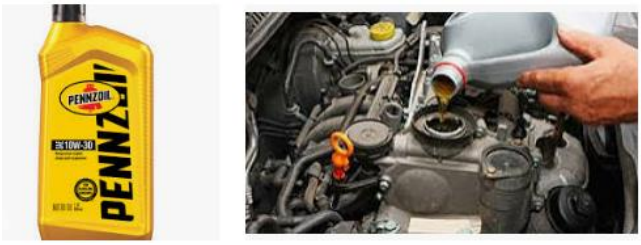


Figure 36 engine oil

- Engine oil is specially formulated so that it Can flow easily through the engine, Provides lubrication without foaming, Reduces friction and wear, Prevents the formation of rust and corrosion, Cools the engine parts it flows over, Keeps internal engine parts clean.

Note: Engine oil contains many additives, each intended to improve the effectiveness of the oil.

- **Gasket**

There are used to provide that seal. Some gaskets seal low pressure fluids, such as oil and coolant, while others also seal high-combustion pressures, such as head gaskets. Gaskets also serve as spacers, wear insulators, and vibration dampers. Gaskets are only used between two stationary parts. Seals are used if one of the parts moves.

Figure 37 oil pan gasket

Gaskets can be made of paper, fiber, steel, cork, synthetic rubber, and combinations of these materials. Most late-model engines have molded silicone rubber gaskets and cut plastic gaskets with silicone sealing beads. The gaskets may incorporate flexible graphite cores, specialized surface coatings, asbestos free materials, elastomeric beading, reinforced cork products, wire-ring combustion seals, flat-plate hoop strength constructions, and many other design variations. The goal of all designs is provide long-term leak-free joints.

- **Silicon**

Silicone Sealants Silicone (or formed-in-place) **gaskets** are a liquid sealant applied directly to mating surfaces and allowed to cure in place. Many technicians use silicone gasketing to aid in sealing the corners, notches, or dovetails of gaskets. **Room temperature vulcanizing (RTV)** silicone sealing products are the most commonly used formed-in place (FIP) gasket products.

Figure 38 silcon

Gasket adhesives form a tough bond when used on clean, dry surfaces. Adhesives do not aid the sealing ability of the gasket. They are meant only to hold gaskets in place during assembly. Use small dabs. Do not assemble components until the adhesive is completely dry.

LO 2.2 – Proper checking of oil pump

- Content/Topic 1 performing oil pump inspection

Visual inspection

To inspect the pump in accordance with the manufacture's specification this will normally involve the use of feller blades, micrometre and verniers and straight edge. These instruments are used in conjunction with a through visual inspection.

How to check if an Oil Pump is bad

Keeping a close eye on your car's oil pump is extremely important because a bad oil pump can deprive your engine of oil pressure and severely damage or ruin it.

Step 1

Look at the dashboard when you slow down and when you take off. If the "check oil pressure" light appears when you are stopped and disappears when you begin moving, this is a sign that your oil pump is having problems.

Step 2

Pop open your hood and remove your oil dipstick to check your oil. If your oil measures low on your dipstick, there may be a crack in your oil pump, debris stuck in the pump, or some other problem with your oil pump.

Step 3

Listen carefully for any noises coming from your engine, such as a rattling or whining noise. A bad oil pump will cause the engine to lose oil pressure and become damaged.

Step 4

Park your car and look underneath. If there is a large amount of oil on the ground, the oil pump has gone out.

Take your car to a mechanic, who will have to remove your oil pump and disassemble it. Reassembling the oil pump and putting it back in your car is the only way to know for sure that your oil pump is the culprit of your car problems.

Tips

- If you are unsure how to locate your oil dipstick, consult your owner's manual to find out. Even if you have nowhere to drive, let your car run for a few minutes each day; an oil pump on a car that has sat for a long period of time can stop working properly.
- To sum up: First look for obvious wear, such as heavy scoring inside the end cover. Then look for traces of metal particles inside the pump body. Lift out the rotor assembly, pump gears or vane assembly and check for scoring and pitting. Note carefully how they come out, so that you can put them back in exactly the same position.
- If the pump shows any obvious signs of wear or damage, fit a new one. If it appears to be in good condition, clean it thoroughly with petrol and put it back together.

- **Content/Topic 2 measuring the oil pump for wear clearance**

Low oil pressure - indicated on the oil-pressure gauge or dashboard warning light - could provide an indication of wear or damage to the pump.

Checking oil for wear:

- ✓ The oil pump wear can be checked on end plate clearance, side (rotor) clearance, rotor tip clearance and gear end play clearance.
- ✓ The oil pump is usually one of three types: the multi-lobe rotor type, the gear type, or the vane type.
- ✓ Whichever type of pump is fitted, it must be removed from the engine before it can be properly checked.
- ✓ The pump can be mounted either outside or inside the engine crankcase. An internally mounted pump can be reached only after removing the sump . This may entail taking out the engine, which is a job for a garage.

- ✓ When you have removed the pump, take out the screws or bolts holding the end cover. Hold the pump with the cover uppermost and take off the cover.
- ✓ Then, using a feeler gauge and a straight-edge - such as a steel rule measure the clearances between the moving parts. If any of the recommended clearances are exceeded (see right), the pump is worn and you should fit a new one.
- ✓ If the clearances are within the specified limits, fill the pump with clean engine oil.
- ✓ Before you replace the end cover, make sure that the sealing ring or gasket is in good condition and positioned correctly.

a) Clearances on a multi-lobe rotor-type pump

- ✓ Turn the drive gear until the tips of an inner and an outer lobe are opposite to each other. The clearance here usually should not be more than .010 in. (.25 mm).
- ✓ Put the feeler gauge between the outer rotor and the pump body. The clearance here should generally be no more than .010 in. (.25 mm).

Figure 39 checking the clearance

b) Centre an inner rotor lobe on an outer rotor lobe and measure the gap between them. Repeat with the other lobes.

- ✓ Make sure that the face of the pump is clean, and put a straightedge across the pump body. The gap between the straight-edge and the rotor surface should generally be no more than .005 in. (-13 mm)

Figure 40 checking the clearance between the tips of the inner and outer rotor lobes.

- ✓ Measure the gap between the straight-edge and the surface of the vanes and rotor, using a 13mm feeler gauge.

Gear-type pump

- ✓ Check the clearance between each gear tooth and the pump body. At the closest point it should typically be no more than .006in. (.15 mm). Make sure that the face of the pump is clean, and put a straightedge across it. The gap between each gear and the straight-edge should typically be no more than 003 in. (.07 mm).

Figure 41 Check the gap between the straight-edge and the face of the two gears.

Figure 42 rotate the gears, and measure the gap between each tooth and pump body.

d) Checking a vane-type oil pump

- ✓ Make sure that the pump is clean, and then put a straight-edge across the face of it. Use a feeler gauge to check the clearance between the straight-edge and the vanes and rotor. The gap should be no more than .005 in. (.13 mm).

- Turn the pump shaft until the locating ring has moved to the outermost edge of one of the vanes. Measure the gap at this point, between the vane and the pump body It should be no more than .005 in. (.13 mm).

- ✓ Without moving the locating ring, measure the gap between the opposite vane and the pump body. It should be no more than •010 in. (.25 mm).

Check the clearance of each vane in its locating groove

- ✓ The clearance should be no more than .005 in. (.13 mm).

Figure 43 checking clearance

Measure the gap between the straight-edge and the surface of the vanes and rotor, using a 13mm feeler gauge.

Figure 44 measuring gap between vanes and rotor

LO 2.3 – Check defect of lubricating system

- Content/Topic 1 checking causes of defective lubrication system

Check oil pump

1.Low oil pressure:

Low oil pressure can result due to :

(a) Weak relief valve spring

(b) Worn oil pump

(c) Cracked oil line

(d) Obstruction in the oil lines

(e) Very thin oil and

(f) Worn out bearings

Note: Care should be taken to remove these defects as far as possible to increase the oil pressure in the lubricating system. Sometimes defective oil pressure indicator shows low oil pressure. This should be checked.

2. Excessive oil pressure:

Excessive oil pressure may result due to:

(a) Stuck relief valve

(b) Strong valve spring

(c) Clogged oil line and

(d) Very heavy oil

Note: These defects should be removed to reduce the excessive oil pressure in the lubricating system. Sometimes defective oil pressure indicator records high oil pressure. Care should be taken to check this defect.

Check state of oil filter

You can visually inspect used filters once they are removed from the engine just by taking a good look at the filter to see how it appears.

- Check if the filter been damaged,
- Check if the pleats bunched together,
- Check if there may be cut or damage in the pleats.
- Check if filter is properly sealed on the both ends
- Check oil degradation products like varnish, metallic particles and unusual contaminants like paint chips, fiber and seals might show up on the filter as well

Note: it is critical that the oil and filter are changed on a regular basis. Photo Sequence 3 shows the steps involved in changing the engine oil and oil filter. Whenever doing this, make sure the oil is the correct rating for the vehicle.

Check of oil leakages

- To check for engine oil leaks keep a close eye on your oil dipstick, if the level drops over time you are losing oil. While driving check and see if blue smoke is coming from tail pipe, blue smoke

means oil might be leaking into the engine combustion chamber. After a drive take a sniff to smell for burning oil.

- Check for classic oil stains or puddle under engine compartment, especial after it's been sitting overnight. If liquids is red it's probably transmission fluid, if liquid is green or orange and has a sweet smell, coolant is culprit. If brown fluid will indicate an engine oil leak.

Causes of engine oil leaks

- The vast majority of leaks are due to the degraded engine gaskets, oil pan leaks, oil seals or bad connections.
- Crawl under the car and check the oil pan seals,
- Check the oil pan drain plug,
- Check the timing cover seal and valve cover gaskets.

Check causes oil consumption

The reasons for excessive oil consumption are:

(a) More oil goes to combustion chamber and gets burnt

(b) Some leakage occurs in some part of the line and

(c) Loss of oil in form of vapour through ventilating system.

Note: Oil can enter the combustion chamber through rings and cylinder walls, worn piston rings and worn bearings.

Learning Unit 3 – Repair of lubrication system

LO 3.1 – Select tools and materials

- Content/Topic 1 selection of tools and materials

Tools	Material
✓ Spanners ✓ Oil filter wrench ✓ Pliers ✓ Allen key ✓ Filler gauge	✓ Oil filter ✓ Seals ✓ Engine oil ✓ Gasket ✓ Silicon

LO 3.2 – Replace of defected components

- Content/Topic 1 replacement of oil pump

There are many warning signs to tell you that your oil pump is about to fail. Let's learn about five of the most common signs:

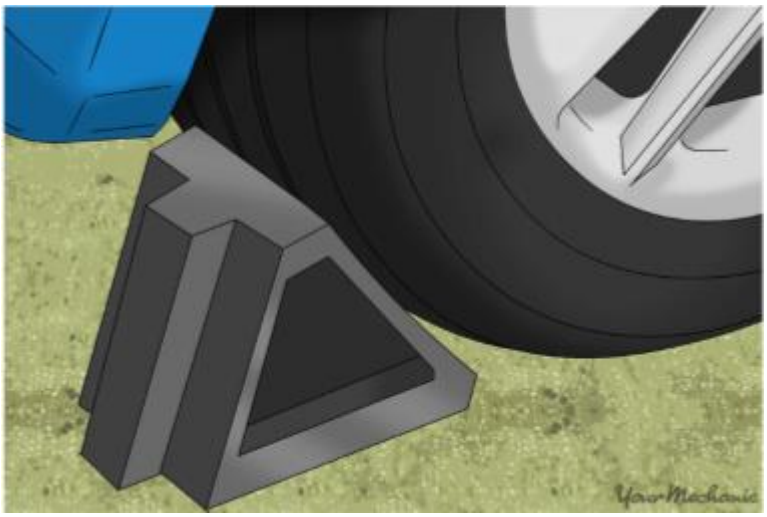
- ✓ A Drop in Oil Pressure
- ✓ Increase in Engine Temperature
- ✓ Noisy Hydraulic Lifters
- ✓ A Loud Valve-Train
- ✓ Low Sound from the Engine Oil Pump
- ✓ Replace oil pump

Procedures of replacing engine oil pump

Part 1 of 3: Prepare the vehicle

Prepare the vehicle and materials needed such as Jack and jack stands, Oil drain pan, Protective gloves, Repair manuals (optional), Safety glasses and Wheel chocks

Step 1: Chock the wheels and set the emergency brake. Park your vehicle on level ground and set the emergency brake. Then place wheel chocks behind the front wheels.

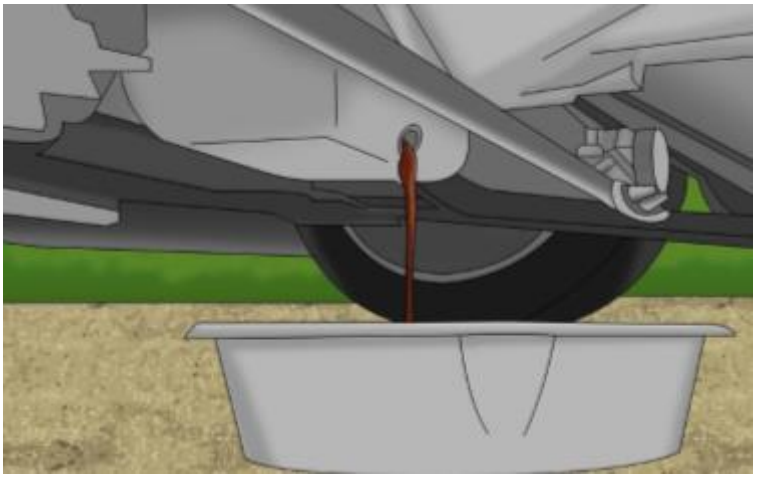


Step 2: Jack up the vehicle and remove the wheels. Place the jack under a sturdy portion of the frame.

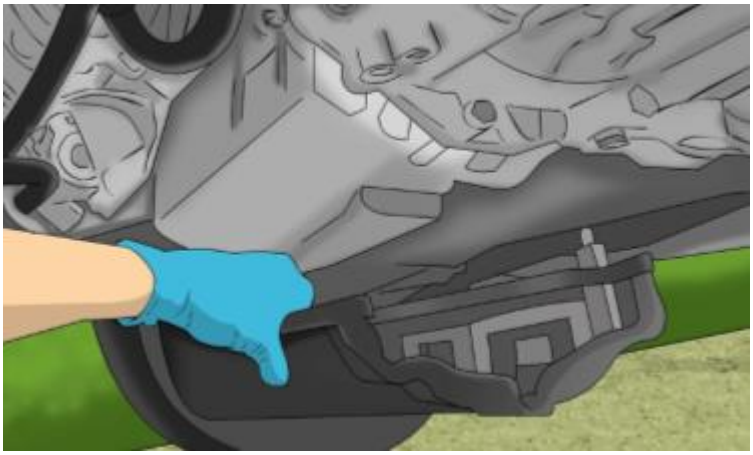
Note: If you have any questions as to where to place the jack on your particular vehicle, consult the repair manual. After you have the vehicle in the air, place jack stands under the frame and lower the jack. Then remove the lug nuts completely and remove the wheel.

Step 3: Disconnect the negative battery cable.

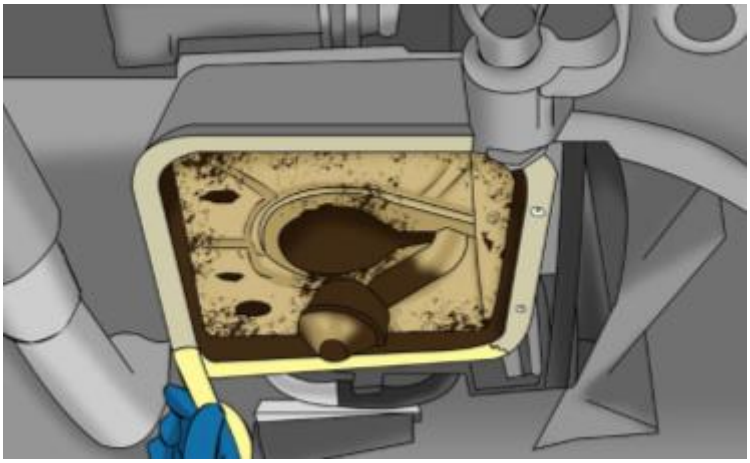
Step 4: Drain the engine oil.



Part 2 of 3: Remove the oil pump

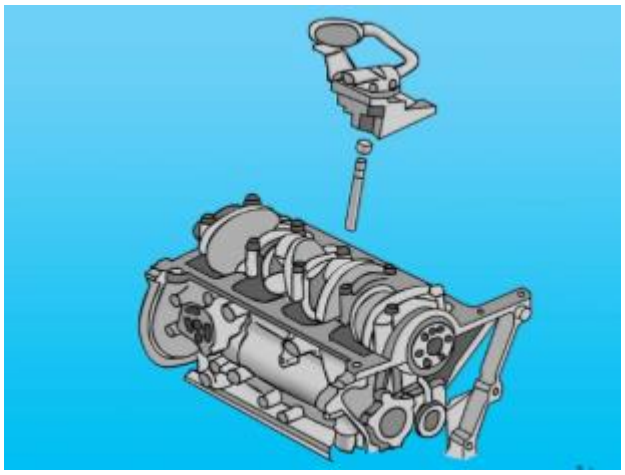


Step 1: Remove the oil pan. Remove the oil pan bolts and then remove the pan.



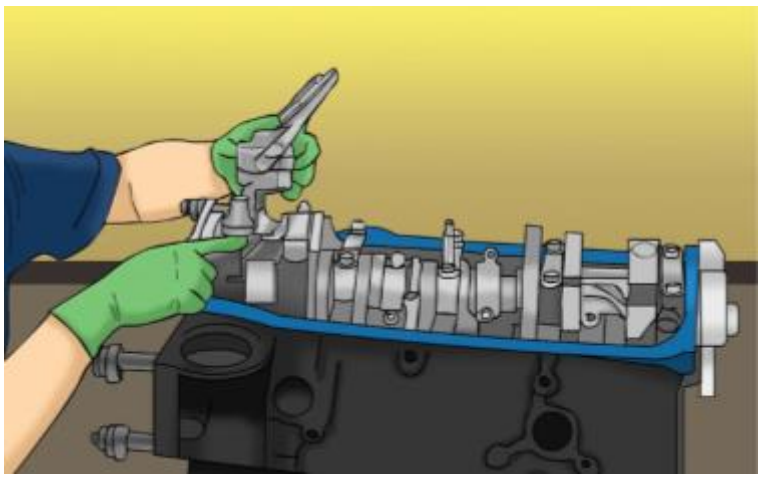
Note: On some vehicles you made need to remove other items first to access the pan, such as the the starter motor, exhaust pipe etc.

Step 2: Remove the old oil pan gasket. Use a gasket scraper if needed, but be careful not to scratch or damage the oil pan.



Step 3: Remove the oil pump. Remove the pump by unfastening the pump to rear bearing cap bolt and remove the pump and extension shaft.

Part 3 of 3: Install the pump



Step 1: Install the oil pump. To install the pump position it and the drive shaft extension.

Note: Engage the drive shaft extension into the drive gear. Then install the pump-to-rear bearing cap bolt and tighten to spec.

Step 2: Install the oil pan. Clean the oil pan and install a new gasket.

Note: Then, mount the pan to the engine, install the bolts and tighten to the spec.

Step 3: Fill the engine with oil. Make sure the drain plug is tight and refill the engine with oil.

Step 4: Remove the jack stands. Jack up the vehicle in the same location as before. Remove the jack stands and lower the vehicle.

Step 5: Remove the wheels chocks.

- **Content/Topic 2 replacement of oil filter**

Replacing of oil filter

Step 1 Always make sure the vehicle is positioned safely on a lift or supported by jack stands before working under it. Before raising the vehicle, allow the engine to run awhile. After it is warm, turn off the engine.

Step 2: The tools and other items needed to change the engine's oil and oil filter are rags, a funnel, an oil filter wrench, safety glasses, and a wrench for the drain plug.

Step 3: Place the oil drain pan under the drain plug before beginning to drain the oil.

Step 4: Loosen the drain plug with the appropriate wrench. After the drain plug is loosened, quickly remove it so the oil can freely drain from the oil pan.

Step 5: Make sure the drain pan is positioned so it can catch all of the oil.

Step 6: While the oil is draining, use an oil filter wrench to loosen and remove the oil filter.

Step 7: Make sure the oil filter seal came off with the filter. Then place the filter into the drain pan so it can drain. After it has completely drained, discard the filter according to local regulations.

Step 8: Wipe off the oil filter sealing area on the engine block. Then apply a coat of clean engine oil onto the new filter's seal.

Step 9: Install the new filter and hand tighten it. Oil filters should be tightened according to the directions given on the filter.

Step 10: Prior to installing the drain plug, wipe off its threads and sealing surface with a clean rag.

Step 11: Tighten the drain plug according to the manufacturer's recommendations. Over tightening can cause thread damage, whereas under tightening can cause an oil leak.

Step 12: with the oil filter and drain plug installed, lower the vehicle and remove the oil filler cap.

Steps 13: carefully pour the oil into the engine. The use of a funnel usually keeps oil from spilling on the engine.

Step 14: after the recommended amount of oil has been put in the engine, check the oil level

Step 15: Start the engine and allow it to reach normal operating temperature. While the engine is running, check the engine for oil leaks, especially around the oil filter and drain plug. If there is a leak, shut down the engine and correct the problem.

Step 16: After the engine has been turned off, recheck the oil level and correct it as necessary.

LO 3.3 – Proper Checking of the functional for lubrication system

- Content/Topic 1 checking engine oil leakage

Check leakages

Step 1: Investigate the leak. Is it even oil?

- ✓ If you notice spotting in your parking place, it's time to do some investigating. First, lay down newspaper or a white plastic plate and try to catch some of the drips. Engine oil is an amber colour, feels thin and slippery, and has a strong chemical odour, which is what you should look for if you suspect an oil leak.
- However, older engine oil can be dark brown to black, with a gritty or gunky texture. (Please note, this is not the ideal state for your oil. Clean engine oil is crucial to the health of your car. Dirty oil is a sure sign that you need to schedule an oil change.)
- ✓ If the fluid is green, bright orange or pink and feels sticky, then you may have an antifreeze leak. Not sticky but still one of these colours? Then it's probably windshield washer fluid, which isn't a major deal unless you plan on driving through a Saharan dust storm sometime soon. Clear or yellowish fluid? Brake fluid.

Note: While antifreeze is extremely toxic, it has a sweet smell and taste that makes it attractive to many pets. If you suspect an antifreeze leak, do Felix and Fido a favor and get it fixed ASAP. Hose down the driveway or garage floor too!

Step 2: Check your fluid levels, across the board.

- ✓ Next, start checking various fluid levels. Check your oil level by inspecting the dipstick (it often has a red or orange plastic tab on it, under the hood).
- ✓ If you have low oil and you're pretty sure you're seeing engine oil drips on your driveway (Remember: look for amber fluid that's slippery and smells like chemicals), then a leak is likely.
- ✓ If the oil looked more reddish, check the power steering reservoir. Does that fluid need to be topped off?

Step 3: Track down the source.

- ✓ Discovering the source of an oil leak takes a bit of detective work that's probably best left up to the professionals. However, common sources of leaking engine oil are a damaged oil pan, an old oil filter, or a worn out gasket somewhere on the engine,
- ✓ Turn the engine off and shine a bright light into the engine area. Is oil pretty much everywhere? Could be a slow leak related to the engine's gaskets.
- ✓ Now turn the engine on. If oil starts wildly spraying like a little kid with a hose on the Fourth of July, then oil is probably seeping past a worn crankshaft or seal. This type of leak will only be apparent when the engine is running though, writes Popular Mechanics.

Step 4: Visit a motor oil expert.

- **Content/Topic 2 checking oil pump pressure**

Check oil pressure

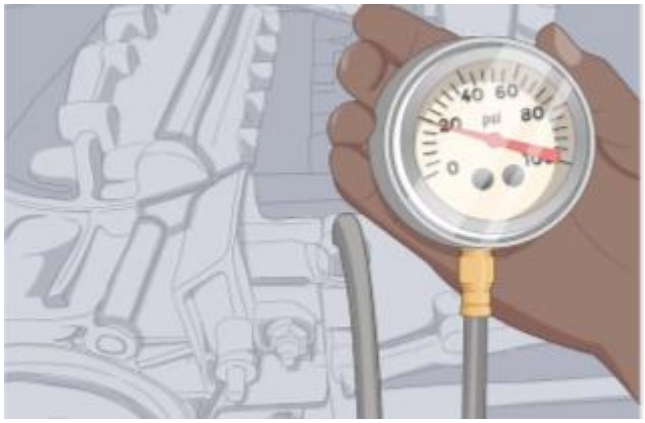
How to Test an Oil Pump

Engine oil pump may start to wear down over time and make your oil flow inefficiently. While there are no ways you or a mechanic can directly test the pump, you can check your oil pressure to determine if there's an underlying problem**.**

a) Method 1Testing the Oil Pressure Manually

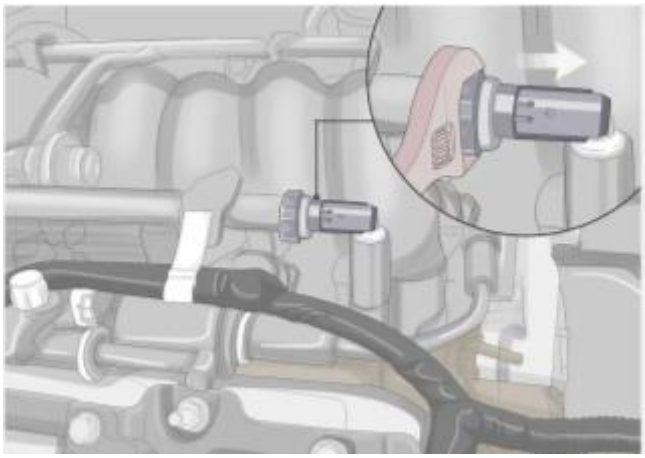
Step 1 Find the normal oil pressure for your engine in your vehicle's manual.

- ✓ Every engine has specific ranges of oil pressure they need to maintain in order to get the maximum lifespan. Look in your vehicle's manual for information about the engine and what the standard pressure levels should be while the vehicle is running.
- ✓ Write down the ranges or numbers listed so you can compare them to your actual readings.
- ✓ You may be able to find the manual for your vehicle online if you don't have one.
- ✓ Roughly, the oil pressure in your vehicle should be about 10 PSI for every 1,000 RPM of engine speed



Step 2 Remove the oil pressure sender from your vehicle's engine block with a wrench.

- ✓ The oil pressure sender is a small black cylinder that reads the oil pressure and relays it to the gauge on your dashboard. Pop your hood and check the top or side of your engine for the pressure sender unit. Locate the nut holding the sender in place and use a spanner wrench to loosen it. Set the sender unit aside while you're working so it's out of the way.
- ✓ Some oil may come out from the port for the sender once you remove it. Keep a shop cloth or rag nearby to catch any spills.
- ✓ Test your oil pressure manually even if you can check it on your vehicle's dashboard. The sender unit could be faulty or you may have loose wiring inside your vehicle that may give a false reading.
- ✓ The "Check Oil" notification on your vehicle's dashboard may light up when you disconnect the sender.



Warning: Don't remove the sender unit while your engine is still warm after running your car. The heat thins the oil and makes it flow easier, so it could spill a large amount once the unit's taken off.

Step 3 Attach an oil pressure gauge onto the sender port on your engine.

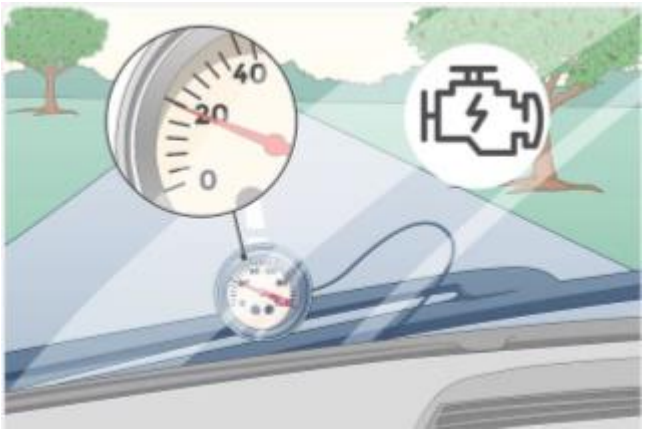
- ✓ Oil pressure gauges have a hose that attaches to your engine and displays the readings on a meter. Screw the end of the gauge's hose to the port that the sender was attached to until it's hand-tight. Use your wrench to tighten the gauge until you aren't able to rotate it anymore.
- ✓ You can buy an oil pressure gauge from auto supply stores or online. Make sure the end of the gauge's hose matches the style port on your engine. Bring the sender unit with you to the store if you need to compare the ports.

Step 4 Turn on your vehicle and take a reading from the meter.

- ✓ Put the gauge in a place where you can easily see it if you're sitting in the driver's seat, like in the gap between your open hood and windshield. Start your vehicle's engine and keep it running throughout your tests.
- ✓ Check the gauge to determine the PSI of your oil while it's still cold.
- ✓ Check that the port isn't leaking oil near the gauge and if it is, try tightening the gauge more.

Step 5 Take a reading from the gauge after the engine warms up. Leave your car running for an additional 10-15 minutes after you first took a reading so the oil warms up and starts to thin out.

- ✓ Check the meter again to compare the actual oil pressure with the recommended pressure listed in the user manual. Write down your measurement so you don't forget it.
- ✓ If there's more than 10 PSI difference between the idle pressure when the oil is hot and the oil is cold, then there may be something wrong with your pump or the bearings inside it.
- ✓ Make sure your vehicle is in a properly ventilated area since running it will create fumes that can be deadly if they build up.



Step 6 Test the oil pressure at 2-3 different RPM levels to see any differences.

- ✓ While your vehicle is still in park, lightly press down on the accelerator and watch the engine speed dial on your dashboard. When you reach 1,000 or 1,500 RPM, keep your foot steady and check the reading on your oil pressure gauge. Once you take the first reading, take another at 2,500-3,000 RPM to compare how the pressure changes as you speed up.
- ✓ If the readings do not match the normal pressures listed in the manual, then you may have an issue with the oil pump.

b) Method 2 Recognizing the Signs of a Bad Pump

Step 1 See if the oil pressure light is lit on your vehicle's dashboard.

- ✓ Turn your vehicle on and look for a light on your dashboard that says "Check Oil" or "Check Oil Pressure." If one of the lights is lit up, then there may be an issue with your pump or another oil-related part. Check the oil pressure manually or take your car in to a mechanic to take a look at it to determine the problem.
- ✓ Dashboard lights could turn on due to faulty wiring or electrical systems in your vehicle as well.

Variation: Your vehicle may have a yellow or orange light in the shape of an oil can if you're having oil issues instead.

Step 2 Look at the engine temperature gauge to see if your engine's overheating.

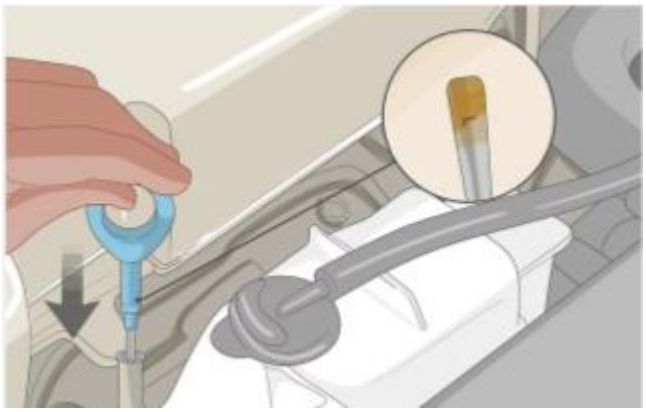
- ✓ Look on either the left or right side of your dashboard for the temperature gauge.
- ✓ Turn on your vehicle so the engine is running and let it warm up for 10-15 minutes.
- ✓ If the temperature gauge continues to rise even after you've warmed up the engine, then there may be friction due to a lack of oil in the system. The temperature gauge on your vehicle could also rise due to the outside heat or other engine problems as well.

Step 3 Listen for whining or clinking noises from your engine while it's running.

- ✓ If your oil pump isn't working properly, parts of your engine may not get properly lubricated and parts may scrape together.
- ✓ Listen to your engine while your vehicle is running to see if you hear any high-pitched whines or clinking and clattering noises.
- ✓ Even if you hear the noises slightly, check the oil pressure on your pump to make sure it's working properly.
- ✓ Engine noises could also be due to old and loose parts as well as faulty spark plugs.

Step 4 Check your vehicle's oil levels to see if there's too much or too little oil.

- ✓ Open the hood of your vehicle so you can access the engine and unscrew the oil dipstick, which usually has a yellow cap.
- ✓ Wipe the dipstick clean on a shop cloth or old rag before dipping it back into the engine. Pull the dipstick out again to see the oil level on the bottom.
- ✓ If the oil levels within the printed range on the dipstick but your engine still makes unusual noises, you may have a faulty pump.
- ✓ If there isn't enough oil inside your engine, add more until it reaches the fill line.
- ✓ If you have too much oil, then you may need to drain some out until it's in the correct range.



- **Content /Topic 3 checking oil temperature and level**

Check oil temperature

- It is fairly easy to check the engine oil level within short intervals.
- The oil temperature will not play a significant part in your results if you can't account for the heat level.
- While you can check the consistency of your oil under either temperature extreme, different products will have a varying reaction.
- ✓ Therefore it's recommended to check the engine oil when the engine oil is hot. Remember: Engine oil can reach temperatures above 120 degrees, and if you are checking the engine oil when it's hot, be very careful to not burn yourself on either the hot engine parts or the engine oil.
- ✓ It is recommended that checking the oil level either before turning on the engine or 5 to 10 minutes after shutting down so you can have all the oil in the oil pan to get an accurate measurement.

How To check your oil:

1. First make sure your engine is off (no matter which temperature you're after).
2. Open your hood and find the dipstick.
3. Pull out the dipstick and wipe off the oil.
4. Reinsert the dipstick into its tube. Be sure to push it all the way in.
5. Pull the dipstick out again and check the oil level, looking at both sides. If the top of the oil streak is between the upper/lower (maximum/minimum) marks, then the level is good. However, if the oil is below the minimum mark, it's time to add some oil.

Bibliography

Erjavec J., Delmar. (2009). *Automotive Technology: A systems approach 5th ed.* USA : Maxwel Drive Clifton Park.

J.D., H. (2012). *Automotive Technology: Principles, diagnosis and service.* New Jersey: Pearson education.

Websites

1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=100994 [Consult. 23 October 2020]
2. http://constructionmanuals.tpub.com/14264/css/Oil-Pickup-and-Strainer-237.html [Consult. 23 October 2020]
3. https://www.yourmechanic.com/article/how-to-replace-an-engine-oil-pump-by-mia-bevacqua_2 [Consult. 23 October 2020]
4. https://napafilters.com/do-it-yourself/step-by-step-filter-maintenance/what-you-need-to-know-about-changing-your-oil-and-oil-filter/ [Consult. 26 October 2020]
5. https://www.howacarworks.com/engine/checking-for-oil-leaks [Consult. 26 October 2020]
6. https://www.aa1car.com/library/problem_engine_oil.htm#:~:text=Oil%20pressure%20can%20be%20checked,bad%20oil%20pressure%20sending%20unit. [Consult. 26 October 2020]
7. https://www.yourmechanic.com/article/how-to-replace-an-engine-oil-pump-by-mia-bevacqua_2 [Consult. 29 October 2020]
8. https://mechanicbase.com/engine-oil/check-the-engine-oil-hot-or-cold/#:~:text=Therefore%20it%27s%20recommended%20to%20check,parts%20or%20the%20engine%20oil [Consult. 29 October 2020]
9. http://www.pearltrees.com/porsche944world/lubrication/id9918667/item98070773 [consult. 19 November 2020]