UNIT 5: LUBRICATION AND COOLING SYSTEMS DIAGNOSIS AND REPAIR

LESSON 1: LUBRICATION SYSTEM FUNCTION AND COMPONENTS

I. Terms and definitions

A. **Auxiliary oil cooler —** A device that allows air to cool engine oil. The auxiliary oil cooler functions much like a radiator.

B. **Diluted oil —** Oil that has lost its ability to lubricate as a result of being mixed with another liquid.

C. **Dry lubricant —** A lubricant in a metallic or powder form.

D. **Grease —** A thick gelatinous substance that provides lubrication. Grease is usually a gelled form of oil.

E. **Lubricant —** A substance that reduces the friction between moving parts by producing a slippery film between the parts.

F. **Oil —** A liquid form of lubricant.

G. **Oil filter bypass valve —** A valve usually located in the oil filter mounting base. The oil filter bypass valve opens and allows oil to bypass the oil filter if the oil filter becomes clogged.

H. **Oil pressure relief valve —** A valve usually located in or near the oil pump. The oil pressure relief valve opens to limit the maximum oil pressure delivered to the lubrication system.

I. **Oil pump —** An engine-driven pump that delivers oil to the engine's moving parts.

J. **Oil pump drive —** The mechanical connection between the engine and the oil pump.

K. **Pickup screen —** A metal screen through which the oil pump draws its supply of oil.

L. **Turbocharged engine —** An engine that uses exhaust gases to drive a supercharger as part of its induction system.

M. **Viscosity —** The ability of a liquid to resist flow. Viscosity is an essential quality of a lubricant.

II. Three forms of lubricants—liquid, grease, and dry metallic particles

A. Oils are liquids that form a slippery film when they are spread over a surface. Engines are usually lubricated by oil.

1. Oil is graded according to a system developed by the American Petroleum Institute (API). The grades are identified by a two-letter code.

a. The first letter is either an "S" or a "C." The "S" is used for oil for gasoline engines and the "C" is used for oil for diesel engines.

b. The second letter of the grade changes as the oil is upgraded to fulfill performance needs of the latest vehicle engines. At this printing, the current gasoline engine oil grades are SJ and SL.

2. Oils are also classified by viscosity (the ability to resist flow). The classifications are represented by numbers. The larger the number, the more viscous the oil; the more viscous the oil, the more slowly it flows (i.e., the more resistance it has to flow). For example, a grade 40 oil will flow more slowly than a grade 10 oil.

3. Normally, oil viscosity is measured at a temperature of 70°F. To be classified as "winter," which is indicated by the suffix "W," an oil must have the proper viscosity at cold weather temperatures. For example, a grade 40 oil has been checked at 70° and a grade 10W oil has been checked at 0°. A grade 10W-40, which is a multiweight oil, has been checked at both temperatures.

NOTE: The viscosity classification system was developed by the Society of Automotive Engineers (SAE).

4. Always use the appropriate type and quality of oil for the vehicle to be serviced. When designing a vehicle, engineers identify the best oil for the vehicle. The engineers set the oil clearances in the engine bearings in accordance with the recommended oil. Using oil other than that recommended by the manufacturer will prevent the engine from achieving maximum performance and may even damage the engine.

B. Though more solid than oil, grease lubricates in much the same manner. Most grease will not flow freely. Grease is normally used in gearboxes and on steering and suspension joints.

1. Grease is usually classified as appropriate for either high-temperature or low-temperature application. Grease is also identified according to its intended use. For example, some types of grease are wheel bearing grease, rear axle grease, and chassis grease.

2. The vehicle chassis is usually greased at each oil change. The level and condition of the grease in the gearboxes should also be checked at each oil change.

3. In some vehicles, the suspension and steering joints are greased at the manufacturer and do not require periodic lubrication. To determine if lubrication is required, check the appropriate service information.

4. Some gearboxes, transmissions, and final drive units use oil instead of grease. To determine if grease or oil should be used, check the appropriate service information.

C. Dry, metallic lubricants are composed of rounded particles. Materials used as dry, metallic lubricants include graphite and molybdenum disulfide.

1. Dry lubricants are used on devices such as locks and as additives in oil and grease.

2. Dry lubricants may also have other specific applications. Check the appropriate service information to determine how dry lubricants should be used.

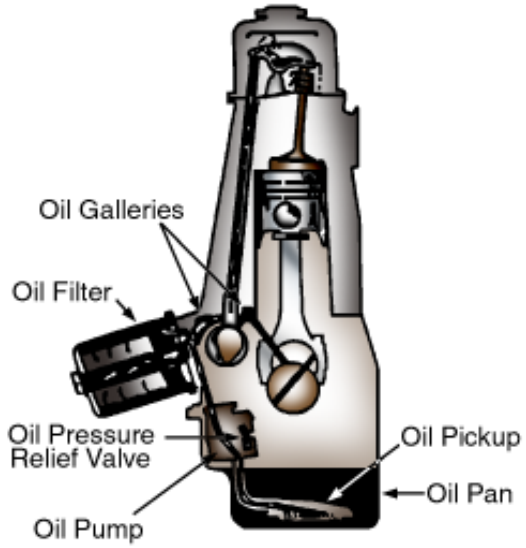
III. Lubrication system components

A. Oil pump

1. The oil pump is located in or on the engine itself and is driven by the camshaft or the crankshaft. The oil pump consists of the pump itself, oil pump drive, pickup screen and tube, and oil pressure relief valve.

2. In a modern vehicle, an oil pump failure is extremely rare. However, an oil pickup screen may become plugged, a pump drive may fail, or a pressure relief valve may malfunction.

3. If discovered in time, a defective oil pump, drive, or screen should be replaced. Failure of these components usually results in severe engine damage, requiring extensive engine repair or replacement.



B. Oil galleries

1. Oil galleries are located throughout the engine block and cylinder head castings. The galleries direct the oil from the oil pump to the various components requiring oil.

2. These galleries require little maintenance. However, during engine overhaul, the galleries should be cleaned. A check should also be done to be sure that all gaskets, seals, and plugs are installed. If not installed properly, these parts can plug the galleries at inappropriate times or cause leakage.

C. Oil seals

1. Oil seals are used when a shaft leads from an "oil environment" to a non-oil environment. In some applications, these devices seal oil pressure in the pump or oil gallery, whereas in other applications, they seal the crankcase area from outside the engine.

2. Most oil seals can be serviced with the engine installed in the vehicle. Most of these leaks are easy to diagnose.

D. Gaskets

1. Gaskets are used to seal and cushion the space between two components. Usually, these components are designed to remain stationary. The gaskets can seal between high- and low-pressure areas or merely form a cushion.

2. Leaking gaskets are typically easy to diagnose and can usually be replaced while the engine is installed in the vehicle. However, if the gasket is leaking oil to the outside of the engine, the result can be disastrous. This kind of leakage can take place at the rubber gasket that is used in the oil filter.

E. Oil filters

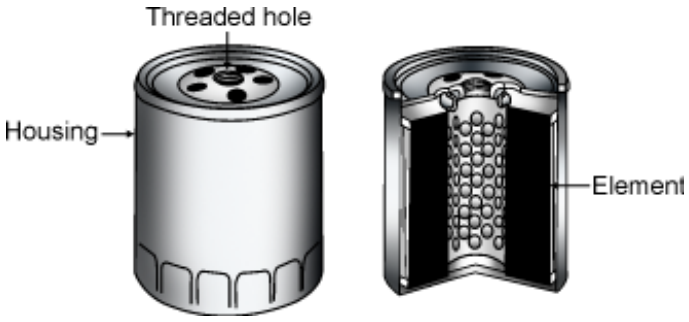
1. An oil filter cleans contaminants, such as rust, metal particles, and dirt, from oil as it leaves the oil pump. Keeping the oil clean helps protect the engine from wear.

2. Manufacturers recommend that the oil filter be replaced at each oil change.

3. A bypass valve located near the oil filter allows oil to bypass the filter if the filter should become clogged. If the filter is bypassed, the engine will still receive oil. However, the oil that is received will not be filtered.

4. Common types of filters

a. The majority of oil filters on vehicles today consist of a paper element encased in a metal housing that is replaced as a unit. These filters are called the "spin-on" type because they thread onto the engine block.



b. In the cartridge design, the oil filter case is a permanent housing and the element is a cartridge that is replaced by itself. The filter housing is carefully inspected and cleaned before installing a new element.

5. Oil filter locations

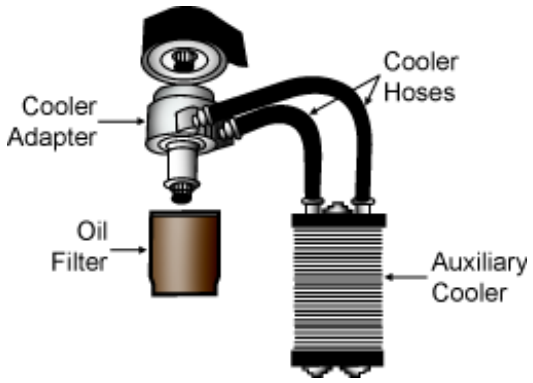
a. Spin-on filters are attached to the lower front or side of the engine.

b. Remote oil filters are mounted away from the engine and connected by lines and hoses.

c. Some oil filters are installed inside the engine oil pan.

G. Auxiliary oil coolers

1. Auxiliary oil coolers are used on many high-performance engines and on many turbocharged engines. Engines using auxiliary oil coolers require more oil than those that do not use auxiliary coolers.



2. Auxiliary oil coolers are subject to oil leakage. This leakage is typically external and thus is usually easily detected.

3. A less easily detected problem that is typical of auxiliary oil coolers is plugged oil passages within the cooler. Plugged passages may not cause a specific engine problem but will reduce the effectiveness of the cooler. Another problem is plugged cooling fins on the outside of the cooler. Plugged fins may prevent proper airflow through the unit.

4. If high oil temperature becomes a problem, thoroughly clean the outside of the auxiliary oil cooler with water and make sure that oil is flowing through the cooler freely.

H. System indicators and sensors

1. Oil pressure warning indicators, located in the instrument panel, are lights designed to alert the driver when oil pressure is below the safe operating level.

2. Some vehicles have an oil pressure gauge that displays the engine oil pressure on the vehicle instrument panel. The advantage of an oil pressure gauge is that the driver can observe the engine's operating oil pressure at all times and potentially catch an oil pressure problem before it causes engine damage.

3. Some vehicles are equipped with a low-pressure safety sensor that is used to shut the engine off if oil pressure falls below the safe operating level.

4. An oil level sensor is used to warn the driver that the engine oil level is low.