Figure 23-1 Oil molecules cling to metal surfaces but easily slide against each other.

Figure 23-2 Wedge-shaped oil film developed below a moving block.
Figure 23-3  Wedge-shaped oil film curved around a bearing journal.

Figure 23-4  The dash oil pressure gauge may be a good indicator of engine oil pressure. If there is any concern about the oil pressure, always use a mechanical gauge to be sure.

Figure 23-5  An oil pump driven by the camshaft.
Figure 23-6: In an external gear-type oil pump, the oil flows through the pump around the outside of each gear. This is an example of a positive displacement pump, wherein everything entering the pump must leave the pump.

Figure 23-7: A typical internal/external oil pump mounted in the front cover of the engine that is driven by the crankshaft.

Figure 23-8: The operation of a rotor-type oil pump.

- Oil is picked up in lobe of outer rotor.
- Oil is moved in lobe of outer rotor to outlet.
- Oil is forced out of outlet because the inner and outer rotors mesh too tightly at point 1 and the oil cannot pass through.
Figure 23-9 Gerotor-type oil pump driven by the crankshaft.

Figure 23-10 Oil pressure relief valves are spring loaded. The stronger the spring tension, the higher the oil pressure.

Figure 23-11 A typical engine design that uses both pressure and splash lubrication. Oil travels under pressure through the galleries (passages) to reach the top of the engine. Other parts are lubricated by splash or gravity return.
**FREQUENTLY ASKED QUESTION**

**Is a High-Pressure or High-Volume Oil Pump Needed?**

No. Engine parts need pressure after the oil reaches the parts that are to be lubricated. The oil film between the parts is developed and maintained by hydrodynamic lubrication. Excessive oil pressure requires more horsepower and provides no better lubrication than the minimum effective pressure. A high-volume pump is physically larger and pumps more oil with each revolution. A high-volume pump is used mostly in race engines where the main and rod bearing clearances are much greater than normal and therefore would need a great volume of oil to make up for the oil leaking from the wide clearances.

---

**Figure 23-12 (a)** A visual inspection indicated that this pump cover was worn.

---

**Figure 23-12 (b)** An embedded particle of something was found on one of the gears, making this pump worthless except for scrap metal.
The oil pump is the only part in an engine that gets unfiltered engine oil. The oil is drawn up from the bottom of the oil pan and is pressurized before flowing to the oil filter.

If debris gets into an oil pump, the drive or distributor shaft can twist and/or break. When this occurs, the engine will lose all oil pressure.

TECH TIP: The New Hemi Engine Oiling System
The Chrysler Hemi V-8 engine uses a unique oiling system because the valve lifters are fed oil from the top of the cylinder heads and through the pushrods. While it is normal to have oil flowing through hollow pushrods, it is unique that in the Hemi V-8 the oil flows backward from normal and from the head down the hollow pushrods to the lifters. Be sure to use the specified viscosity of oil, as this is critical for proper lubrication of the valve lifters.
Figure 23-14  An intermediate shaft drives the oil pump on this overhead camshaft engine. Note the main gallery and other drilled passages in the block and cylinder head.

Figure 23-15  Oil is sent to the rocker arms on this Chevrolet V-8 engine through the hollow pushrods. The oil returns to the oil pan through the oil drainback holes in the cylinder head.

Figure 23-16  A typical oil pan with a built-in windage tray used to keep oil from being churned up by the rotating crankshaft.
Why Is It Called a Windage Tray?
A windage tray is a plate or baffle installed under the crankshaft and is used to help prevent aeration of the oil. Where does the wind come from? Pistons push air down into the crankcase as they move from top dead center to bottom dead center. The pistons also draw air and oil upward when moving from bottom dead center to top dead center. At high engine speeds, this causes a great deal of airflow, which can easily aerate the oil. Therefore, a windage tray is used to help prevent this movement of air (wind) from affecting the oil in the pan. Try the following:
- Take an oil pan and add a few quarts (liters) of oil.
- Then take an electric hair dryer and use it to blow air into the oil pan.
- Oil will be thrown everywhere, which helps illustrate why windage trays are used in all newer engines.

Figure 23-17 A dry sump system as used in a Chevrolet Corvette.

Figure 23-18 Oil is cooled by the flow of coolant through the oil filter adapter.
FREQUENTLY ASKED QUESTION

What Is Acceptable Oil Consumption?

There are a number of opinions regarding what is acceptable oil consumption. Most vehicle owners do not want their engines to use any oil between oil changes, even if they do not change it more often than every 7,500 miles (12,000 km). Engineers have improved machining operations and piston ring designs to help eliminate oil consumption.

Rear axles and hydraulic or industrial engines are not driven on the road and may not accumulate miles but still may consume excessive oil. A general rule for “acceptable” oil consumption is that it should be about 0.002 to 0.004 pound per horsepower per hour. To figure, use the following:

\[
\frac{1.82 \times \text{Quarts used}}{\text{Operating hp} \times \text{Total hours}} = \text{Pound/hp/hr}
\]

Therefore, oil consumption is based on the amount of work an engine performs. Although the formula may not be viable for vehicle engines used for daily transportation, it may be for the marine or industrial engine builder. Generally, oil consumption that is greater than 1 quart for every 600 miles (1 liter per 1,000 km) is considered to be excessive with a motor vehicle.