Two-Stroke Engine Applications and Lubrication Needs

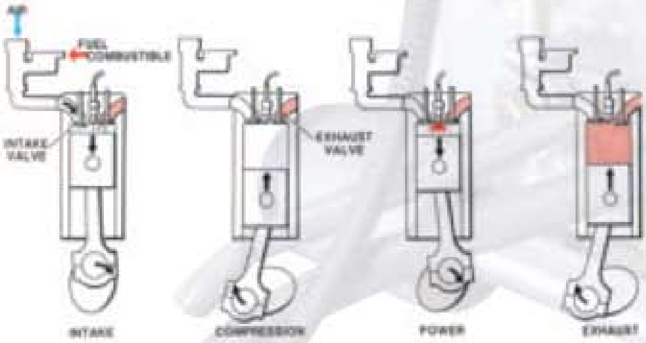
Known for their excellent power-to-weight ratio, two-stroke engines have proven effective and popular for most of the last 100 years. Although pollution concerns have driven the small engine industry to four-stroke engines, they have also helped pave the way for cleaner, more efficient two-stroke motors. Two-stroke engines have design differences and operate under conditions that require different oil chemistries than their four-stroke counterparts. To better service a two-stroke oil customer it is best to know how the engine operates, why it is used in place of a four-stroke engine and where and in what type of applications it is used.

What Is a Two-Stroke Engine?

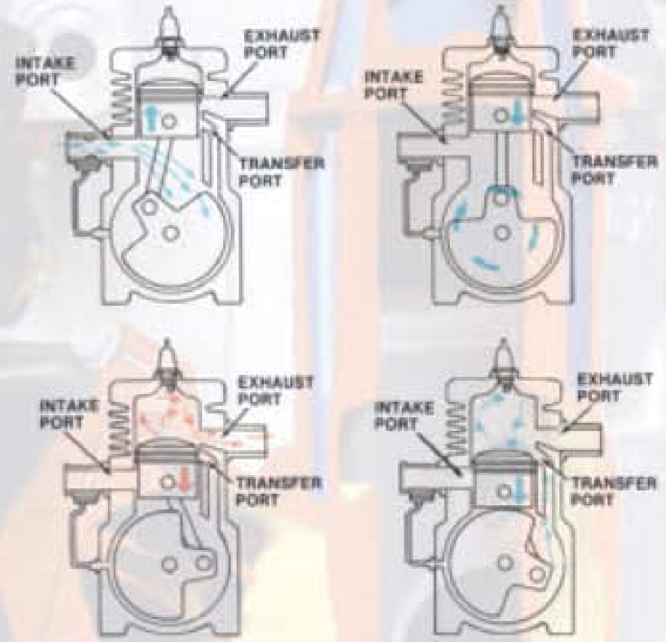
The terms "two-cycle" and "two-stroke" are often interchanged when speaking about two-stroke engines. These engines derive their name from the number of directional changes the pistons make during each power stroke.

Internal combustion engines are used to produce mechanical power from the chemical energy contained in hydrocarbon fuels. The power-producing part of the motor's operating cycle starts inside the motor's cylinders with a compression process. Following this compression, the burning of the fuel-air mixture then releases the fuel's chemical energy and produces high-temperature, high-pressure combustion products. These gases then expand within each cylinder and transfer work to the piston. Thus, as the engine is operated continuously, mechanical power is produced.

Each upward or downward movement of the piston is called a stroke. There are two commonly used internal combustion engine cycles: the two-stroke cycle and the four-stroke cycle.



A four-cycle engine requires four strokes of the piston (two up and two down) and two revolutions of the crankshaft to complete one combustion cycle and provide one power impulse.



Two-cycle motors deliver one power impulse for each revolution of the crankshaft.

How Are Two-Stroke Engines Different from Four-Stroke Engines?

The fundamental difference between two-stroke engines and four-stroke engines is in their gas exchange process, or more simply, the removal of the burned gases at the end of each expansion process and the introduction of a fresh mixture for the next cycle. The two-cycle engine has an expansion, or power stroke, in each cylinder during each revolution of the crankshaft. The exhaust and the charging processes occur simultaneously as the piston moves through its lowest or bottom center position.

In a four-stroke engine, the burned gases are first displaced by the piston during an upward stroke, and then a fresh charge enters the cylinder during the following downward stroke. This means that four-stroke engines require two complete turns of the crankshaft to make a power stroke, versus the single turn necessary in a two-stroke engine. In other words, two-stroke engines operate on 360° of crankshaft rotation, whereas four-stroke engines operate on 720° of crankshaft rotation.

Where Are Two-Stroke Engines Used?

Two-stroke engines are inexpensive to build and operate when compared to four-stroke engines. They are lighter in weight and they can also produce a higher power-to-weight ratio. For these reasons, two-stroke engines are very useful in applications such as chainsaws, weed eaters, outboards, lawn mowers and motorcycles, to name just a few. Two-stroke engines are also easier to start in cold temperatures. Part of this may be due to their design and the lack of an oil sump. This is a reason why these engines are also commonly used in snowmobiles and snow blowers.

Advantages and Disadvantages of Two-Stroke Engines

Because two-stroke engines can effectively double the number of power strokes per unit time when compared to four-stroke engines, power output is increased. However, it does not increase by a factor of two. The outputs of two-stroke engines range from only 20 to 60 percent above those of equivalent-size four-stroke units. This lower-than-expected increase is a result of the poorer-than-ideal charging efficiency, or in other words, incomplete filling of the cylinder volume with fresh fuel and air.

There is also a major disadvantage in this power transfer scenario: the higher frequency of combustion heat-transfer rates from the hot, burned gases to the motor's combustion chamber walls. Higher temperatures and higher thermal stresses in the cylinder head (especially on the piston crown) result.

Traditional two-stroke engines are also not highly efficient because a scavenging effect allows up to 30 percent of the unburned fuel/oil mixture into the exhaust. In addition, a portion of the exhaust gas remains in the combustion chamber during the cycle. These inefficiencies contribute to power loss when compared to four-stroke engines and explain why two-stroke engines achieve only 20 to 60 percent more power.

How Are Two-Stroke Engines Lubricated?

Two-stroke motors have what are considered total-loss lubricating systems. Because the crankcase is part of the intake process, it cannot act as an oil sump like on four-stroke engines. Lubricating traditional two-stroke engines is achieved by mixing the oil with the fuel. The oil is burned upon combustion of the air/fuel mixture.

Direct injection engines are different because the fuel is directly injected into the combustion chamber while the oil is injected directly into the crankcase. This process is efficient because the fuel is injected after the exhaust port closes, and therefore more complete combustion of fuel occurs and more power is developed. Direct injection engines have a higher power density than traditional two-stroke engines. Because the oil is directly injected into the crankcase, less oil is necessary and lower oil consumption results (80:1 range).

Direct injection motors have higher combustion temperatures, often up to 120°F. They also require more lubricity than traditional two-stroke engines.

AMSOIL Synthetic 2-Cycle Oils

AMSOIL Synthetic 2-Cycle Oils are formulated to provide maximum performance in all types of two-stroke applications. Even though AMSOIL 2-Cycle Oils have been optimized for specific applications, they are multi-functional and recommended for use in many areas. Consult the 2-Cycle Oil Recommendation Chart (G1988) for more information.

hp Injector Synthetic 2-Cycle Oil (HPI)

- Formulated for superior performance in DFI outboard motors
- Helps prevent piston and combustion chamber deposits
- Helps prevent "ring jacking" common to DFI outboards
- Low smoke, low odor product
- Contains up to 30 percent more additives for "super clean" operation
- Helps prevent wear for long engine life
- Helps prevent rust
- Multi-functional and recommended for use in many two-cycle motors
- Low aquatic toxicity
- Recommended for use as injection oil or at a 50:1 pre-mix

Saber Synthetic 2-Cycle Oils (ATP, ATO)

- Saber Professional is "Smokeless"
- Saber Outboard is a very low smoke, low odor product
- At 100:1, both oils produce lower emissions than oils mixed at 50:1
- Saber Professional is recommended for ISO-L-EGD applications
- One mix ratio for everything eliminates confusion
- Both oils are versatile and very good for many applications
- Cost-effective compared to oils mixed at 50:1 or richer
- Saber Outboard exhibits low aquatic toxicity
- Lean mix ratio helps prevent plug fouling and exhaust port deposits

INTERCEPTOR Synthetic 2-Cycle Oil (AIT)

- Excellent exhaust power valve performance
- Low smoke and odor
- Surpasses SAE #4 cold temperature fluidity properties and has a -50°F pour point
- Helps prevent wear on cylinders and bearings for long engine life
- Helps prevent pre-detonation by controlling ignition-promoting deposits called "hot spots"
- Versatile and excellent for all types of recreational equipment
- Recommended for injector systems or at 50:1 mix ratios

DOMINATOR Synthetic 2-Cycle Oil (TDR)

- Provides excellent film strength for high-heat, high-RPM motors
- Reduces friction for maximum power
- Recommended for use with coated or non-coated racing pistons
- Recommended for use with exhaust power valves
- Recommended for use with high-octane racing gas
- Burns clean; Helps prevent ring sticking and plug fouling
- Provides excellent protection at 50:1 pre-mix or in injection systems