Bigger Power with Two Strokes!

By Thomas Yoon

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What is a 2−stroke diesel engine?

As the name suggests, these engines work on reciprocating actions of pistons. One stroke means one linear motion of the piston in one direction. When the piston moves in the opposite direction, that is counted as another stroke.

For a 2−stroke engine, the piston has to move up, and then down to complete one cycle of the engine. In those 2 strokes of the piston, the crankshaft will have turned 1 revolution.

The 2 strokes of the piston is to complete 4 stages of the combustion cycle − air intake, compression, combustion and exhaust. As you might have known, in order for a fire (or explosion) to occur to power the engine, we need a fuel, a heat source, and oxygen coming together at the same time.

Remember how the crankshaft and the piston moves in a cylinder? The reciprocating movement of the piston is converted to rotary motion by means of a crankshaft. The piston reciprocates between Top Dead Center and Bottom Dead Center inside the cylinder liner.

One of the most prominent feature of a 2−stroke engine is the presence of air intake ports on the cylinder liner that will enable fresh air to be led in for combustion.

These air inlet ports are cut into the cylinder liner somewhere at the lower end of the latter. In a typical design, the air inlet port are located about 35 degrees from the Bottom Dead

Center (BDC).

In many designs, the fresh air that is introduced into the cylinder is also used to drive out the spent exhaust gases inside it. Many designs make use of scavenging air fans like electric blowers or turbochargers to slightly pressurize the intake air before the latter is introduced into the cylinder.

In order to allow the exhaust gases to be expelled from the cylinder, exhaust ports are often cut into the cylinder just like the air intake ports. A typical design will have the exhaust port located about 50 degrees from Bottom Dead Center.

So, let's describe our engine stages at the combustion space between the piston top and the cylinder head.

From Bottom Dead Center (BDC), the piston, full of fresh air, moves up the cylinder liner until it covers up the air intake port. The air intake process stops.

The piston moves further up. It then covers up the exhaust port on the cylinder liner. The exhaust process stops.

The piston moves further up. The air inside the combustion space is compressed and becomes hot. The piston has nearly reached Top Dead Center at this point.

Highly atomized fuel is then injected into the combustion space. The fuel burns rapidly causing an explosion inside the combustion space. The explosion causes a tremendous rise in pressure and the piston is pushed down towards BDC.

As the piston moves down, the exhaust ports uncover about 50 degrees from BDC. Exhaust gases are thus led out from the cylinder. The pressure inside the cylinder drops immediately.

The piston moves further down. At 35 degrees from BDC, it uncovers the air intake port. Fresh air is then led into the cylinder.

The piston then reaches BDC. Because of the momentum created from the force of the explosion, the piston reverses in direction and moves upwards towards Top Dead Center (TDC).

The process then repeats itself.

In some designs, the exhaust gases are removed through an exhaust valve, located at the cylinder head and very similar to the 4−stroke engines. This type of scavenging is called uniflow scavenging. The timing of the valve opening and closing will be controlled by a camshaft, push rods, rocker arms or other similar devices.

Well folks, why do we want to squeeze all the strokes into 2 cycles? That could be discussed further...

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writing e−books and articles related to engineering, and management.

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Why Select Two Strokes?

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In our previous publication, we touched on the subject of 2−stroke diesel engines. http://www.free−engineering.com/fwezine26.htm . Today, we ask why we choose to use 2−strokes?

As you might remember, for a 2−stroke engine, the piston has to move up, and then down to complete one cycle of the engine. In those 2 strokes of the piston, the crankshaft will have turned 1 revolution. In those 2 strokes of the piston the engine has also completed 4 stages of the combustion cycle − air intake, compression, combustion and exhaust.

Now, compare that with a 4−stroke engine. The piston moving down will complete the air intake stroke. When it moves up again, the piston completes the compression stroke. Next comes the injection of fuel. Combustion takes place. The piston is forced to move down by the pressure of the gases. When the piston moves up again, it drives out all the exhaust gases in the exhaust stroke.

The piston in a 4−stroke engine will move 4 strokes in order to complete the 4 stages of the combustion cycle − air intake, compression, combustion and exhaust.

The power developed in a 4−stroke engine is based on the formula, Power = PLAN/2, where,

P is the mean effective pressure inside the cylinder,
L is the stroke length of the piston travel,
A is the cylinder bore or the area of the piston top,
N is the number of revolutions per unit time.

In a 2−stroke engine, because the power is developed in the same revolution, the formula for Power becomes,
P = PLAN

This means that with the same mean effective pressure, stroke length and bore (area), the 2−stroke engine can develop twice the power of a 4−stroke engine!

If size, weight, and material cost are causes for

concern, the 2−stroke engine has the clear advantage.

Well folks, 2−strokes have the advantage of higher power with small size. However, there are some disadvantages too. That could be discussed later...

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