

# Six Stroke Engine

B Ranaprathap Reddy, Batta Mahesh

**Abstract:** It is an era of high speed and high performance engines. Six stroke engine is also a type of internal combustion engine which additionally adding two strokes to the four stroke engine. In the fifth stroke the water is injected into the cylinder and the sixth stroke is exhaust stroke. Generally four stroke engine having only one power stroke and the six stroke engine having two power strokes. It may increase the efficiency of the engine and reduce the fuel consumption. The specific power of the six stroke engine will not be less than the four stroke engine. It may increase in thermal efficiency of the engine due to two additional strokes. By adding these additional strokes we may reduce the noise and thermal pollution. The additional stroke cools the engine by water and removes the need of a cooling system and gives 40% increased efficiency over the normal Otto cycle. The component used in the six stroke engine is quite similar to the four stroke engine with additionally adding of two valves. The research on Six stroke engine has excited our interest to locate its weak points.

**Keywords:** Six Stroke, Thermal Efficiency, Brake Power, Specific Fuel Consumption, Torque

## 1. Introduction

An innovative hybrid design of the I c engine developed in 1990's by combining four stroke engine with two additional strokes known as SIX STROKE ENGINE. Two more additional strokes are the fifth stroke, which called water injection stroke while the last stroke is called exhaust stroke. The specific power of the six-stroke engine will not be less than that of a four-stroke engine. Chemical, noise and thermal pollution are reduced. These engines almost consist of similar components as that of the four stroke engine. It uses water in the second suction stroke i.e. in the fifth stroke. The six-stroke engine is a type of internal combustion engine with an advance feature of more power generation some complexity intended to make it more efficient and utilize the fuel.

The six stroke engine is a radical hybridization of two and four stroke engine that the top portion of two stroke engines and the bottom rather the middle section of a four stroke engine. In six-stroke cycle, two parallel functions occur in two chambers which result in eight event cycle: four events internal combustion cycle and four event external Combustion cycles. The Six Stroke engine is thermodynamically more efficient because the change in volume of the power stroke is greater than the intake stroke and the compression stroke.

By adding the additional stroke cools the engine and removes the need for a cooling system making the engine lighter and giving 25% increased efficiency over the normal Otto or Diesel Cycle. The pistons in this six stroke engine go up and down six times for each injection of fuel. These six stroke engines have 2 power strokes: one by fuel, one by steam.

## 2. Need of Six Stroke Engine

The necessity to develop the six stroke engine is to increase the efficiency of the engine. The disadvantage of the four-stroke cycle is that only half as many power strokes are 2 completed per revolution of the crankshaft as in the two-stroke cycle and only half as much power would be expected from an engine of given size at a given operating speed. The four-stroke cycle, however, provides more positive scavenging and charging of the cylinders with less loss of

fresh charge to the exhaust than the two-stroke cycle. However we want to developed the six stoke engine that can be free us from the entire problem of two stroke & four stroke engine.

## 3. Working Principle of Six Stroke Engine

Internal combustion engine has been modified with the goal of higher efficiency. It is increases the efficiency through the extra power stroke or fifth stroke. The big advantages are the waste of heat created the power in fifth stroke, and power has to be generated in the fifth stroke Due to the waste of heat. The heat is used to generate the steam from the water which is further used as a working fluid for the Additional Power Stroke. As well As extracting power, the additional stroke cools the engine and removes the need for a cooling system making the engine lighter and giving 40% increased efficiency. The six stroke engine has consist of the six processes in a complete cycle such as four stroke engines consist only four process in a complete cycle.

The working principle is as follows:

### First Stroke (Suction Stroke)

During the first stroke the Inlet valves opens and air- fuel mixture from carburettor is sucked into the cylinder through the inlet valve and piston moves from TDC to BDC which results in the formation of a pressure difference due to which pure air enters the cylinder.

### Second Stroke (Compression Stroke)

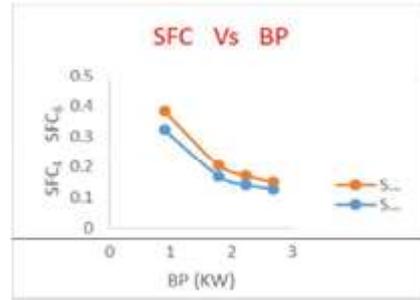
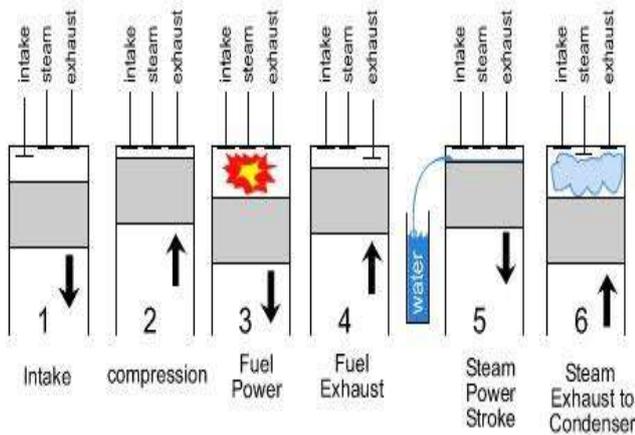
During the second stroke, the inlet valve closes and the heating chamber valve Opens and piston moves upward due to cranking forcing air into heating chamber. The air at this stage is converted to high pressure.

### Third Stroke (First Power Stroke)

During the third stroke, power is obtained from the engine by igniting the compressed air- fuel mixture using a sparkplug. Both valves remain closed. Piston moves from TDC to BDC. Now we can simply says the combustion chamber valve opens and gases of combustion enter the cylinder.

**Fourth Stroke (Exhaust Stroke)**

During the fourth stroke, the exhaust valve opens to remove the burned gases and the exhaust gases are removed via this valve. From the engine cylinder Piston moves from BDC to TDC



**Torque angle diagram**

In a six stroke engine the energy absorption is less because of slower acceleration of reciprocating parts. It reduces the weight and complexity of the engines head by as much as 50%. Instead of using energy to drive the head. Torque is increased by 35% and efficiency increased by the same. Increased torque and power output.

**Fifth Stroke (Second Power Stroke)**

During the fifth stroke, the exhaust valves remains close and the water Inlet valves open. Fresh water from the water Inlet valves enters the cylinders through the secondary water Induction system. Piston moves from TDC to BDC.

**Sixth Stroke (Second Exhaust Stroke)**

During the sixth stroke, the water exhaust valves remain open. The water sucked into the cylinder during the fifth stroke is removed to the atmosphere through the water exhaust valve. Piston moves from BDC to TDC and six strokes are completed.

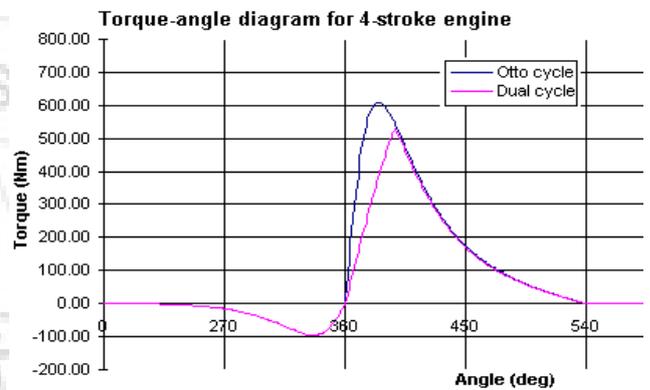


Figure: torque angle diagram of four stroke engine

**4. Performance Curves of the Engine**

**TFC vs. BP:**

Total fuel consumption increases with increase in brake power. It is seen that there is a TFC value when the brake power is zero. It is because of the frictional power. It is also inferred that the TFC<sub>6</sub> is less than TFC<sub>4</sub> for same brake power. It is also inferred that for six stroke engine it takes more time for same 10cc of fuel consumption.



**SFC vs. BP:**

Specific fuel consumption decreases with increase in brake power. It is inferred that the SFC<sub>6</sub> is less than SFC<sub>4</sub> for same brake power.

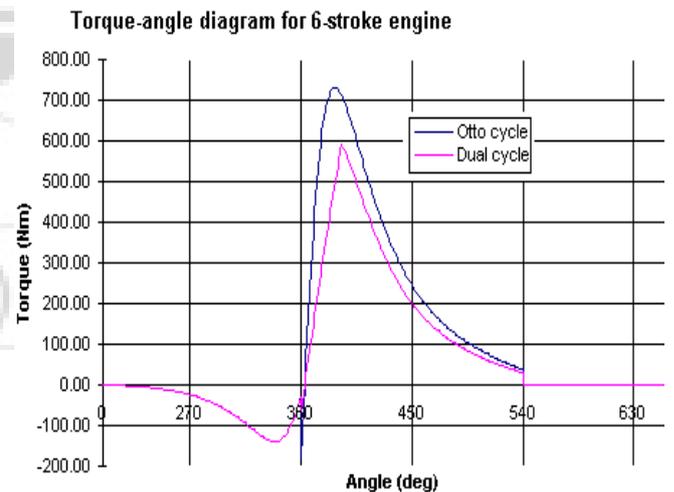


Figure: torque angle diagram of six stroke engine

**Advantage of the Six Stroke Engine**

- Reduction in fuel consumption
- Two expansions (work) in six strokes
- Dramatic reduction in pollution up to 65%
- Low engine temp
- Higher overall efficiency
- Better scavenging and more extraction of work
- Less friction – so, less wear and tear
- It does not require any basic modification to the existing engines

- Less inertia due to lightness of moving parts

#### **Disadvantages**

- Complex cam design for exhaust (due to 2 exhaust strokes)
- Heavier engine
- More maintenance is needed
- Manufacturing cost is high
- Water at high temp comes in contact with metal of cylinder wall, the chances of more corrosion. Reduce life.
- Cam shaft design is complex

### **5. Conclusion**

In a six stroke engine the energy absorption is less because of slower acceleration of reciprocating parts. The piston speed of the upper piston is about a quarter of the main piston; therefore its service life should be at least twice that of the main piston. Torque is increased by 35% and efficiency increased by the same. Better fuel economy and cleaner burning longer service intervals and considerably reduced tooling costs when compared with a conventional four stroke design. The six stroke engine fits perfectly into this view. Its adoption by the automobile industry would have a tremendous impact on the environment and world economy. The six stroke engine promises dramatic reduction of pollution and fuel consumption of an internal combustion engine. Assuming up to 40% reduction in the fuel consumption and 60% to 90% in polluting emissions, depending on the type of fuel being used and the second piston replaces the valve mechanism of a conventional engine and also it increases the compression ratio.

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