

# Review and Feasibility Study of Six Stroke Engine

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**Abstract:** *The current 4 stroke inner combustion engine has been widely carried out due to great energy to weight ratio and reliability. However, the principal disadvantage of the even most efficient current 4 stroke engine is the production of large quantities of extra warmth strength, dissipated although the cylinder walls of the engine and expelled as waste strength at some point of the exhaust stroke of the cycle. The development of an extra green six stroke inner combustion engine for growing the performance of four stroke engine for that the final strokes designed to use of exhaust and convert it into energy stroke and ultimately six stroke running as exhaust stroke and also batter scavenging. Some of primary adjustments are achieved in 4 stroke engine and made a six stroke engine we can growth the brake thermal efficiency of the engine. Additionally the dramatic reduction in pollution and batter scavenging is occurs.*

**Keywords:** Design and Analysis of Six Stroke Engine, Engine, stroke, efficiency, fuel, and heat

## 1. Introduction

Six stroke internal combustion engines is development over the prevailing 4 stroke internal combustion engine which employs the same precept as that of the four stroke inner combustion engine. The 5th stroke or the second one energy stroke makes use of the warmth evolved in the exhaust stroke (directly or not directly) as heat required for the unexpected expansion of the secondary gas (air or water) which pushes the piston downward for the 2nd strength stroke thereby rotating the crankshaft for any other half cycle. As heat advanced in the 4th stroke is not wasted, the requirement for a cooling device is eliminated. Here fuel is injected as soon as in each three whole cycles of the crankshaft which is any time higher than a four stroke internal combustion engine where fuel is injected once in 2 entire cycles of the crankshaft.

It must be mentioned that performance of the 6 stroke inner combustion engine is more than the existing four stroke inner combustion engine. Essential sort of secondary fuels used inside the 5th stroke is air and water. Various researches are taking place for the development of gasoline economy of engines. However because the call for and availability for petrol and diesel is fairly unbalanced and there's a need to stability considering that that is especially took place because of big boom in wide variety of cars. If the equal situation continues then the situation can be more disastrous and petrol and diesel will be greater luxurious and constrained. With extended use and the depletion of fossil fuels, nowadays greater emphasis is given at the exchange fuels.

In six stroke engine, there are additional two strokes, namely another power and exhaust strokes. The engine works through harnessing wasted heat energy created by the fuel combustion. After the combustion stage water is injected into the superheated cylinder. The water explodes into steam and force the piston down. It in turn helps to cool the engine. That resulted in normal levels of power but using much less fuel. It also has the advantage of not requiring an external cooling system. In order to achieve these benefits, major

modifications of conventional internal combustion engine must be done.

## 2. Working of Six Stroke Engine

Workings of the all strokes of the engines are given below:

### 2.1 First Stroke (Suction Stroke)

In the course of the primary stroke, the inlet valve pens and air-fuel mixture from carburettor is sucked into the cylinder thru the inlet manifold.

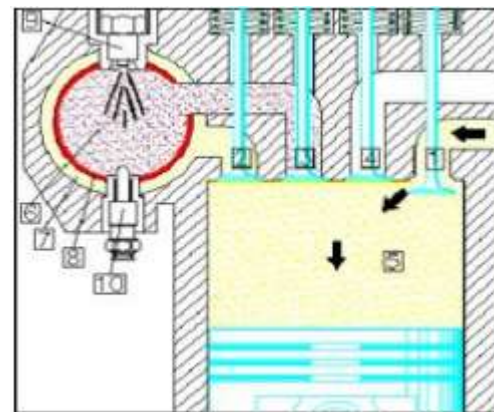
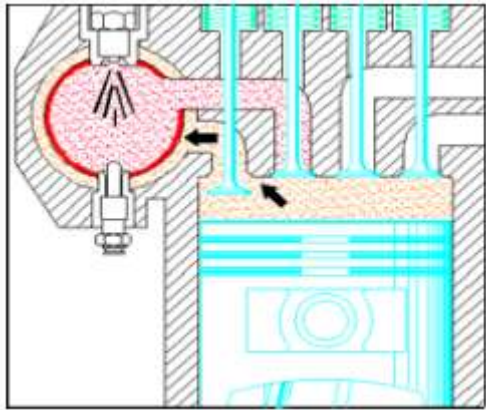


Figure 1: Intake of pure air in cylinder

### 2.2 Second Stroke (Compression Stroke)

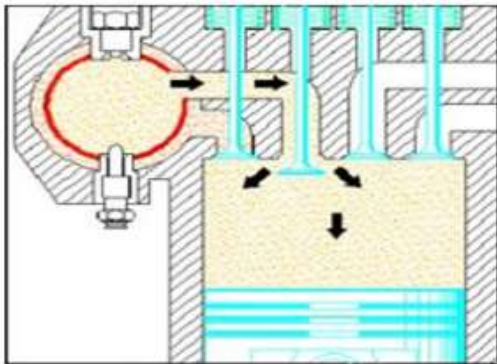
All through the second stroke, piston moves from backside dead Centre to pinnacle useless middle, both the inlet valve and exhaust valves are closed and air-gas mixture is compressed.



**Figure 2:** Compression of pure air in heating chamber

### 2.3 Third Stroke (Fuel Power Stroke)

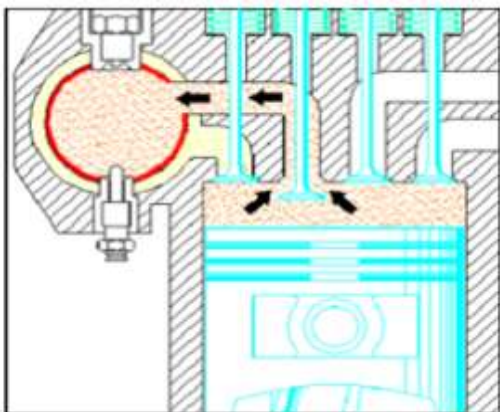
At some point of the third stroke, power is acquired from the engine through igniting the air - gasoline combination the usage of a spark plug. Each valve remains closed. Piston actions are from a pinnacle dead middle to bottom lifeless center.



**Figure 3:** Release of combustion gases in cylinder

### 2.4 Fourth Stroke (Re – Compression Stroke)

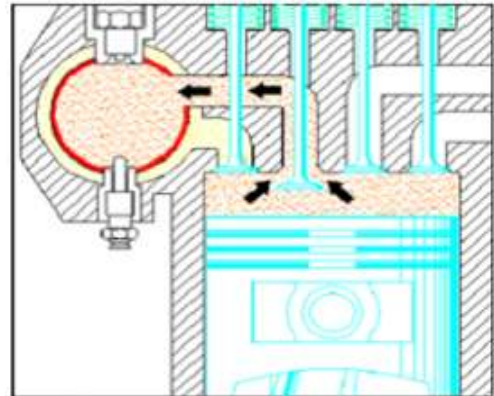
Throughout the 4<sup>th</sup> stroke, piston moves from backside useless middle to top lifeless middle. Each the inlet and the exhaust valves are closed. By the time piston reaches pinnacle useless middle, water injector injects water which is then converted to steam.



**Figure 4:** Recompression of the pure air in chamber

### 2.5 Fifth Stroke (Steam Power Stroke)

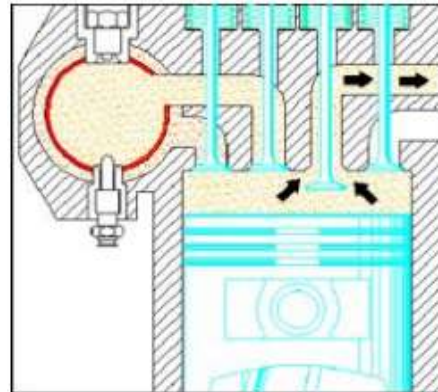
At some stage in the 5th stroke, the steam initiates the second one strength stroke. Each valve stay closed. Piston actions are from the pinnacle lifeless centre to bottom lifeless centre



**Figure 5:** Recompression of the pure air in chamber

### 2.6 Sixth Stroke (Exhaust Stroke)

For the duration of the sixth stroke, piston moves from bottom useless centre to pinnacle useless middle. The inlet valve remains closed. The exhaust valve opens and the exhaust gases are launched.



**Figure 6:** Exhaust of combustion gases

## 3. Previous Work

In six stroke engine, there are additional strokes, particularly any other energy and exhaust strokes. The engine works via harnessing wasted warmness strength created by using the fuel combustion. After the combustion level water is injected into the superheated cylinder. The water explodes into steam and pressure the piston down. It in turn allows cooling the engine. That resulted in normal degrees of power but the usage of lots less gasoline. It also has the benefit of now not requiring an external cooling system. For you to attain these advantages, fundamental modifications of traditional inner combustion engine ought to be accomplished.

## 4. Basic Parts Modification

### 4.1 Crankshaft to Camshaft Speed Ratio

The unique angular pace of the camshaft is one-1/2 that of the crankshaft, such that the camshaft rotates once for every two revolutions (or four strokes) of the crankshaft. The

crankshaft pulley of the unmodified (four-stroke engine) engine has a 21 teeth and camshaft pulley of the engine has a 42 teeth. In traditional four stroke engine, the crankshaft must rotate  $720^\circ$  even as the camshaft rotates  $360^\circ$  to complete one cycle.

For 6-stroke engine, the crank shaft should rotate  $1080^\circ$  to rotate the cam shaft  $360^\circ$  and to complete one cycle. Consequently their corresponding velocity ratio is 3:1. In changed engine a camshaft pulley has forty two enamel by which is equal as that become in unmodified (4-stroke engine) engine and crankshaft pulley has a 14 tooth that's 1/3 of the camshaft pulley because the rotation ratio of crankshaft to camshaft is three: 1 in six stroke engine. So it's far important to maintain camshaft pulley three times larger than crank shaft pulley.

#### 4.2 Modification in Inlet and Exhaust Manifold

In given 4 stroke engine there is common inlet manifold through which required amount of fresh air is sucked due to movement of piston and vacuum creation and combined with the gas for correct combustion. The not unusual inlet manifold of four-stroke engine parted via welding a plate among the common inlet manifold. The plate welded among the inlet manifold is of aluminium. The principle gain of this manifold is exhaust gases come out at excessive temperature so it will preheat the inlet air so boom the combustion charge.

#### 4.3 Camshaft Modification

In six stroke engine piston movements three times up and down so for that valve open times in a one revolution of an entire cycle. So that in vicinity of 4 stroke engine in six stroke engine two lobes is furnished.

### 5. Advantages, Disadvantages and Features of Six Stroke Engines

#### 5.1 Advantages

- So in 4 stroke engines strength stroke to general strokes ratio is 1:4. But in six stroke engines we get two strength strokes in total six strokes. So the output energy and efficiency of the six stroke engines is greater than four stroke engines.
- The area enclosed in PV diagram of six stroke engines is greater than 4 stroke engines based on both Otto cycle and dual cycle as proven within the determine. So glaringly the work output of six stroke engines is a great deal extra than 4 stroke engines. Hence the general efficiency of six stroke engines will become better than four stroke engines.
- The maximum torque evolved in case of six stroke engines is an awful lot greater better than four stroke engines on the premise of diesel and twin cycle. So here it's also proved that energy advanced in six stroke engines is higher enough.
- Now to provide equal energy in six stroke engines in comparison with four stroke engines, six stroke engines need much less fuel intake (almost 40 % much less). So the exhaust gasoline emission can also be much less. For this

reason pollutants is dramatically reduced in case of six stroke engines.

- There is additionally multi gas machine in six stroke engines to reduce its fuel consumption. Better technology is being adopted to launch six stroke engines in order that its cost might be not a lot than four stroke engines.

#### 5.2 Disadvantages

Generally while knowing the negative aspects approximately the specific system will helps in get a keen concept on specific offerings. The advantage of six stroke engine has greater than every other sort of engine however each invention has consist some of the demerits so the six stroke engine has many negative aspects are as follows.

- Complicated head layout is possible inside the six stroke engine.
- Complex cam design for exhaust due to the two exhaust strokes inside the six stroke engine.
- Heavier engine is come about in the six stroke engine due to the combustion chamber.
- Thermodynamically the engine is solid, yet the designing of components will become more and more complex because the torque requirement increases.
- Water at high temperature will comes in contact with steel of cylinder wall; the possibilities of greater corrosion might be used to lessen the life.

#### 5.3 Features

- Extracts the additional energy from the growth of steam to get best offerings of numerous usages of skilled approach.
- No cooling machine is needed within the six stroke engine.
- Required a supply of natural water to behave as medium for the second energy stroke primarily based on the alternative stroke engines.
- Improves usual engine gasoline intake within the six stroke engine.

### 6. Conclusion

This injection water is heated by the engine coolant, this six stroke concept presented right here recovers power from each the engine coolant and combustion exhaust fuel. For that reason, this concept recovers strength from two waste warmth sources of modern engine designs and converts warmth commonly discarded to useable power and paintings. Provisions might also need to be made to preserve the exhaust after treatment components warm sufficient to function properly. This idea has the capacity of a vast increase in gasoline efficiency over current traditional inner combustion engines even as potentially not decreasing the strength density substantially.

The six stroke engine change guarantees dramatic discount in gasoline intake of an internal combustion engine. The gasoline performance of the engine may be expanded and also the valve timing may be effectively organized to extract extra paintings in step with cycle. The brake thermal efficiency of 4 stroke two cylinder diesel engine can will

increase via changed its a few element and convert into six stroke engine. Higher scavenging is feasible due to the fact exhaust of first cylinder exhaust is grow to be an inlet of 2nd cylinder during the 5<sup>th</sup> stroke and its work as 2nd electricity stroke the exhaust during the sixth stroke.

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