

**Subject:** Applied Technology

**Year/Level:** 13

<b>Strand: 5</b>	<b>AT 13.5: Machines And Engines</b>
<b>Sub Strand</b>	<b>AT 13.5.1 Motorized Machines And Engines</b>
<b>Content Learning Outcome</b>	<b>AT 13.5.1.1 Demonstrate knowledge of the use of motorized Static machines.</b>

### LESSON NOTES

#### Chapter 5: Machines and Engines

Continued from week 17 Lesson notes....

#### **STRAND OUTCOME**

After completing this strand students will be able to:

- Identify and familiarize themselves with motorized machines and four stroke engines.

#### **Working of Four Stroke Diesel Engine**

The power generation process in four stroke diesel engine is also divided into four parts. Each part is known as piston stroke. In IC engine, stroke is referred to the maximum distance travel by the piston in a single direction. The piston is free to move only in upward and downward direction. In four strokes engine the piston move two times up and down and the crankshaft move two complete revolutions to complete four piston cycles. These are suction stroke, compression stroke, expansion stroke and exhaust stroke

**Suction stroke:** In the suction stroke or intake stroke of diesel engine the piston start moves from top end of the cylinder to bottom end of

the cylinder and simultaneously inlet valve opens. At this time air at atmospheric pressure drawn inside the cylinder through the inlet valve by a pump. The inlet valve remains open until the piston reaches the lower end of cylinder. After it inlet valve close and seal the upper end of the cylinder.

#### **Compression stroke:**

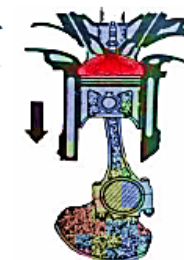
After the piston passes bottom end of the cylinder, it starts moving up. Both valves are closed and the cylinder is sealed at that time. The piston moves upward. This movement of piston compresses the air into a small space between the top of the piston and cylinder head. The air is compressed into 1/22 or less of its original volume. Due to this compression a high pressure and temperature generate inside the cylinder. Both the inlet and exhaust valves do not open during any part of this stroke. At the end of compression stroke the piston is at top end of the cylinder.



COMPRESSION STROKE

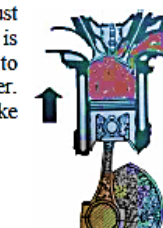
#### **Power stroke:**

At the end of the compression stroke when the piston is at top end of the cylinder a metered quantity of diesel is injected into the cylinder by the injector. The heat of compressed air ignites the diesel fuel and generates high pressure which pushes down the piston. The connection rod carries this force to the crankshaft which turns to move the vehicle. At the end of power stroke the piston reach the bottom end of cylinder.



#### **Exhaust stroke**

When the piston reaches the bottom end of cylinder after the power stroke, the exhaust valve opens. At this time the burn gases inside the cylinder so the cylinder pressure is slightly high from atmospheric pressure. This pressure difference allows burn gases to escape through the exhaust port and the piston move through the top end of the cylinder. At the end of exhaust all burn gases escape and exhaust valve closed. Now again intake valve open and this process running until your vehicle starts.



#### **4 Stroke Engine Advantages and Disadvantages**

Four stroke engine is also called four cycle engine. It uses the piston completes four separate strokes—intake, compression, power, and exhaust. Two-stroke engines are light weight and groovy power band, but the fact is that 4-stroke engines are preferred for almost every road-going vehicle on the planet.

### Advantages

- More torque - This is the most important reasons why people choose a 4-stroke engine. The two-stroke boasts its speed and power, but the four-stroke shows extra torque. It is more reliable and quitter.
- Last longer
- Run much cleaner than 2 strokes
- More efficient use of gas

### Disadvantages

- Complicated
- Half as powerful as two stroke engines
- More expensive than 2 stroke

### Comparison between Two-Stroke and Four-Stroke Engines

S.No	Two-Stroke Engine	Four-Stroke Engine
1	In two-stroke engine thermodynamics cycle is completed in two strokes of the piston or in one revolution of the crankshaft. Thus there is one power stroke for every revolution of the crankshaft.	In four-stroke engine thermodynamic cycle is completed in four strokes of the piston or in two revolutions of the crankshaft. Thus, one power stroke for every two revolutions of the crankshaft.
2	Because of the above, turning moment is more uniform and hence a lighter flywheel can be used.	Because of the above, turning moment is not so uniform and hence a heavier flywheel is required.
3	Again, Because of one power stroke for every evolution, power produced for same size of two-stroke engine is twice, or for the same power of the engine is lighter and more compact.	Because of one power stroke for two revolutions, power produced for same size of four-stroke engine is less or for the same power the engine is heavier and bulkier.
4	Because of one power stroke in one revolution greater cooling and lubrication requirements. Higher rate of wear and tear in two-stroke compared to four-stroke engine.	Because of one power stroke in two revolutions lesser cooling and lubrication requirements. Lower rate of wear and tear in four-stroke engine.

5	Two-stroke engines have no valves but only ports (some two-stroke engines are fitted with convectional exhaust valve or reed valve).	Four-stroke engines have valves and valve actuating mechanisms for opening and closing of the intake and exhaust valves.
6	Because of light weight and simplicity due to the absence of the valve actuating mechanism, initial cost of the two-stroke engine is less.	Because of comparatively higher weight and complicated valve mechanism, the initial cost of the four-stroke engine is more.
7	Two-stroke engine is used where low cost, compactness and light weight are important, viz., in scooters, motorcycles, hand sprayers etc.	Four-stroke engine is used where efficiency is important, viz., in cars, buses, trucks, tractors, industrial engines, airplane, power generation etc.
8	Volumetric efficiency is lower due to lesser time for mixture intake.	Volumetric efficiency is higher due to more time for mixture intake.
9	Lesser thermal efficiency is lower; part load efficiency is poor.	Higher thermal efficiency; part load efficiency is better.

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**THE END**

### **STUDENT ACTIVITY**

1. Explain the difference between suction stroke and compression stroke?

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2. Write down three advantages of a four stroke Engines?

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3. Write down three disadvantages of a four stroke Engines?