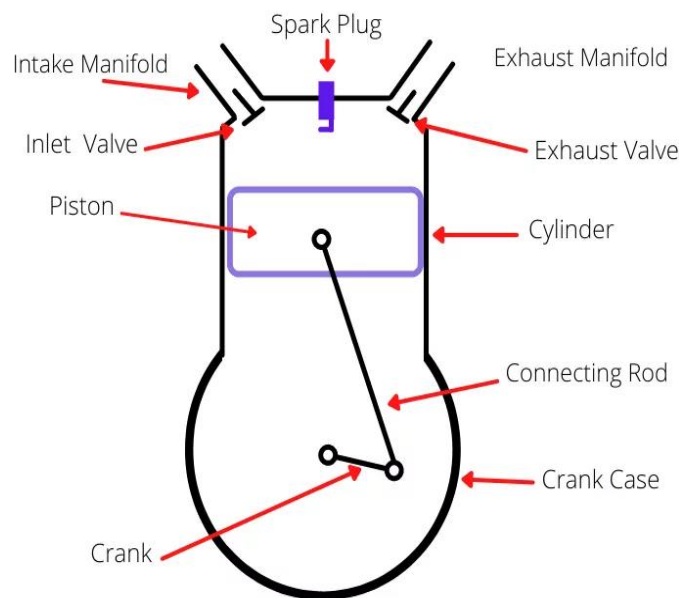


## ***IC ENGINES (Internal Combustion Engines)***

### **1. Single cylinder 4-stroke engine**

Single cylinder 4-stroke engine working can be understood by knowing the process which consists of 4 number of strokes. The engine does two cycles of the crankshaft by completing four strokes of the engine i.e. suction, compression, expansion and exhaust.

It is consist of the following components:



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- a) Cylinder
- b) Cylinder head
- c) Piston
- d) Inlet manifold
- e) Exhaust manifold
- f) Inlet valve
- g) Exhaust valve
- h) Piston rings
- i) Spark plug
- j) Fuel injector
- k) Connecting rod
- l) Crank

Working:

The **working of four stroke engine consists of four strokes of piston** and two crank revolutions.

- **1<sup>st</sup> stroke (Suction stroke)** : In this stroke fresh charge of air or air-fuel mixture is taken inside. For this process piston moves from TDC to BDC
- **2<sup>nd</sup> stroke (Compression stroke)** : The fresh charge is compressed by moving piston from BDC to TDC .
- **3<sup>rd</sup> stroke (Expansion Stroke)** : It is also known as power stroke. In this stroke compressed charge is combusted which generates high pressure hot gases inside of cylinder. It pushes the piston from TDC to BDC In this process hot gases are expanded from TDC to BDC.
- **4<sup>th</sup> stroke (Exhaust stroke)** : In ideal cycle it is known as heat rejection process. In this stroke the hot gases (Combustion products) are expelled out from cylinder by moving piston from BDC to TDC.

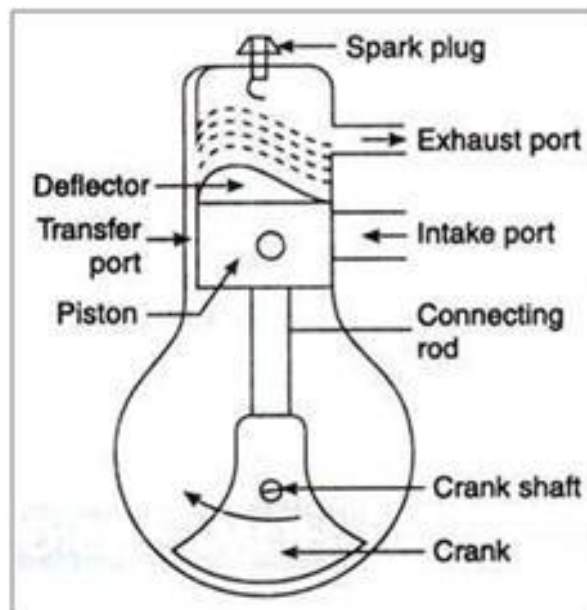
Applications:

1. Four stroke engine widely used in automobile industries.
2. They are used in bus, trucks and other transportation vehicles.
3. They are used in pumping system.
4. These engines find application in mobile electric generators.
5. These engines widely used in aircraft and marine engines.
6. Diesel engines find application in pump sets, construction machinery, air compressor, drilling rigs, etc.

## 2. Stroke petrol Engine

A two-stroke (or two-stroke cycle) engine is a type of internal combustion engine that completes a power cycle with two strokes (up and down movements) of the piston during one power cycle, this power cycle being completed in one revolution of the crankshaft

It is consist of the following components:



- a) Fuel injector
- b) Cylinder
- c) Cylinder head
- d) Spark plug
- e) Crank
- f) Crankshaft
- g) Crankcase
- h) Connecting rod
- i) Ports — inlet, transfer and exhaust
- j) Piston
- k) Piston rings

## Working:

### **1. First Stroke (Suction and Compression)**

During this cycle, the piston moves from the bottom center to the top center, and all three ports — inlet, transfer and exhaust — are closed. The charge above the piston is compressed, and the spark plug ignites the charge and creates a power stroke. That power is transferred with the help of the connecting rod to the crankshaft.

There is also a partial vacuum created in the crankcase, which opens the inlet port and allows the fuel-air mixture inside.

### **2. Second Stroke (Power and Exhaust Stroke)**

During the second cycle, the piston moves down from the top center, and the inlet port is closed. The downward motion of the piston pushes the fuel-air mixture, and the charge from the crankcase comes out through the transfer port.

Because the exhaust port is open, most of the exhaust gas leaves the cylinder. The exhaust gas that remains is pushed through the exhaust port by the pressure of the fuel-air mixture flowing downward. Then, with the help of a fresh charge, the exhaust gas is pushed out.

The parts of a 2-stroke petrol engine work this way, and the parts of a 2-stroke diesel engine work similarly except it has a fuel injector instead of a spark plug.

## Applications:

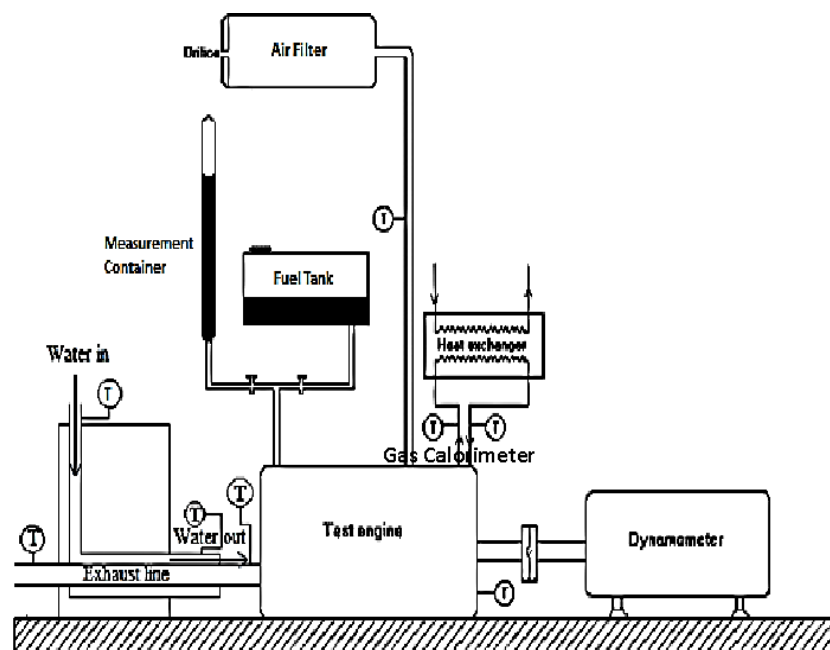
The size and power-to-weight ratio for 2-stroke diesel engine parts and functions make them ideal for smaller-scale applications. You can typically find them on:

- 1) RC toys
- 2) Dirt bikes
- 3) Chainsaws
- 4) Small watercraft
- 5) Landscaping tools

### 3. Ruston oil Engine

Ruston diesel engines were built during the 1940s in Lincoln, which were originally used as excavators, and power shovels. The Ruston engine was built by Ruston, of Ruston & Hornsby, an industrial manufacturing company in Lincoln who were leaders in heavy oil engines, particularly for cars and steam locomotives.

It is consist of the following components:



- a) the tank
- b) the fuel transfer pump
- c) filters
- d) the injection pump
- e) the injection nozzles
- f) crankshaft
- g) flywheel ring
- h) combustion chamber

1. **Intake stroke:** The intake valve (on the top left of each image) is open and as the piston travels downward, this suction pulls the air/fuel mixture into the cylinder.
2. **Compression stroke:** Both valves are now closed and the piston compresses the air fuel into a much smaller volume, preparing the mixture for ignition.
3. **Power stroke:** With both valves closed, the spark plug—located in the picture between the intake and exhaust valve will fire, igniting the air/fuel mixture. The resulting explosion forces the piston downward and rotates the crankshaft, which in turn propels the vehicle.
4. **Exhaust stroke:** The exhaust valve (on the top right of each image) is now open, allowing the piston to push the spent exhaust gasses out of the engine as it rises. The 4-strokes (1 engine cycle) are now complete, and the process repeats.

### Applications:

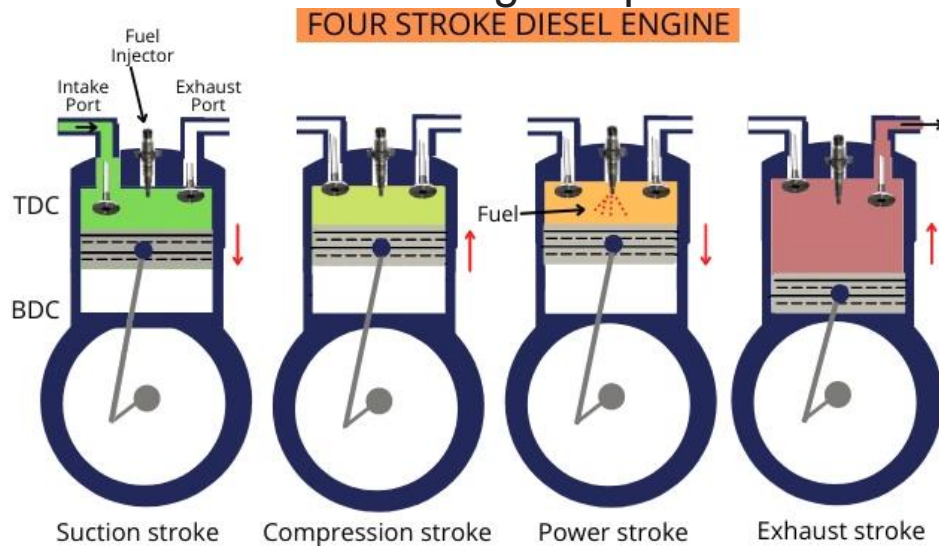
The four-stroke engine is the most common types of internal combustion engines and is used in :

1. various automobiles (that specifically use gasoline as fuel) like cars
2. trucks
3. some motorbikes (many motorbikes use a two stroke engine).

## 4. 2 Cylinder 4 stroke Diesel Engine

Both engines use the combustion cycle to produce energy. The main difference between a 2- and 4-stroke engine is that a 4-stroke engine goes through four stages, or two complete revolutions, to complete one power stroke. A 2-stroke engine goes through 2 stages, or one complete revolution, to complete one power stroke.

It consists of the following components:



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- a) Piston. In an engine, a piston transfers the expanding forces of gas to mechanical rotation of the crankshaft through a connecting rod.
- b) Crankshaft
- c) Connecting Rod
- d) Flywheel
- e) Inlet and Outlet Valves
- f) Spark Plug
- g) Suction/Intake Stroke
- h) Compression Stroke

### Working:

Both engines use the combustion cycle to produce energy. The main difference between a 2- and 4-stroke engine is that a 4-stroke engine goes through four stages, or two complete revolutions, to complete one power stroke. A 2-stroke engine goes through 2 stages, or one complete revolution, to complete one power stroke.

### Applications:

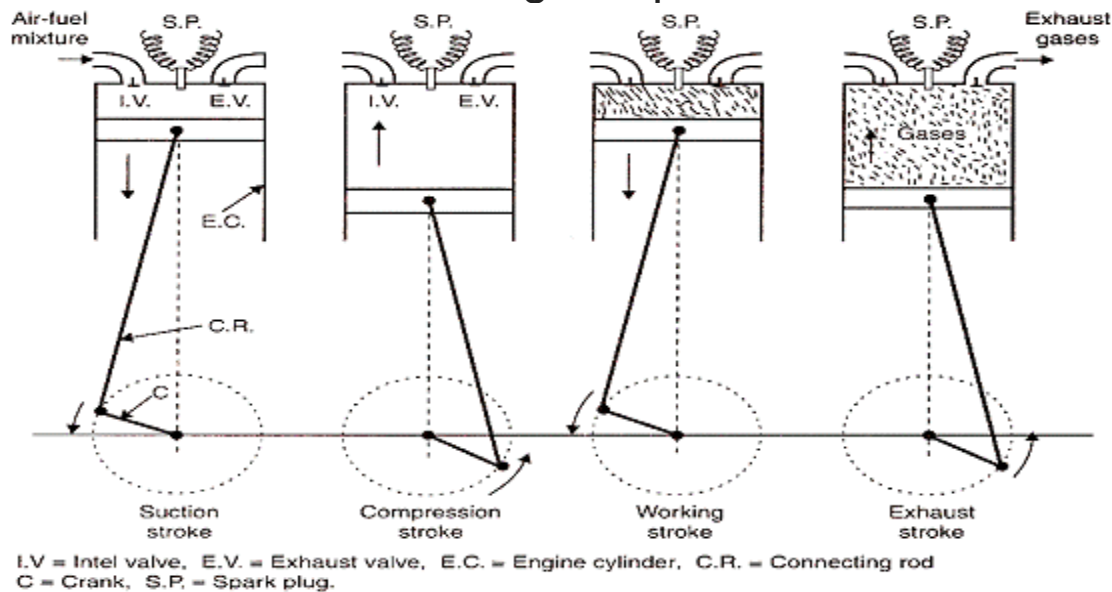
1. Four-stroke engines yield higher levels of torque at a lower RPM during operation.
2. A four-stroke engine only consumes fuel once every four strokes, making it a more fuel-efficient engine option.
3. Four-stroke engines give off less pollution because they do not require oil or lubricant mixed in the fuel.
4. These engines are durable and can withstand higher amounts of wear and tear.
5. You will not need additional oil with a four-stroke engine.
6. A four-stroke engine produces less noise and vibration during operation



## 5. 2 Cylinder 4 Stroke Petrol Engine

An internal-combustion engine goes through four strokes: intake, compression, combustion (power), and exhaust. As the piston moves during each stroke, it turns the crankshaft.

It consists of the following components:



- a) Piston
- b) Crankshaft
- c) Connecting Rod
- d) Flywheel
- e) Inlet and Outlet Valves
- f) Spark Plug
- g) Suction/Intake Stroke
- h) Compression Stroke

## Working:

As the name suggest the **Four Stroke Petrol Engine** uses a cycle of four strokes and petrol as the fuel. Each cycle includes 2 rotations of the crankshaft and four strokes, namely:

1. An Intake Stroke
2. A Compression Stroke
3. A Combustion Stroke also called Power Stroke
4. An Exhaust Stroke

The steps involved are as follows:

### 1. Intake Stroke:

As the name suggests in this stroke the intake of fuel takes place. When the engine starts, the piston descends to the cylinder's bottom from the top. Thus the pressure inside the cylinder reduces. Now the intake valve opens and the fuel and air mixture enters the cylinder. The valve then closes.

### 2. Compression Stroke:

This stroke is known as compression stroke because the compression of the fuel mixture takes place at this stage. When the intake valve closes (exhaust valve is already closed), the piston forced back to the top of the cylinder and the fuel mixture gets compressed. The compression is around 1/8th of the original volume. An engine is considered more efficient if its compression ratio is higher.

### 3. Combustion/Power Stroke:

Now in case of petrol engine when the fuel mixture compresses to the maximum value the spark plug produces spark which ignites the fuel mixture. The combustion leads to the production of high pressure gases. Due to this tremendous force the piston is driven back to the bottom of the cylinder. As the piston moves downwards, the crankshaft rotates which rotates the wheels of the vehicle.

### 4. Exhaust Stroke:

As the wheel moves to the bottom the exhaust valve opens up and due to the momentum gained by the wheel the piston is pushed back to the top of the cylinder. The gases due to combustion are hence expelled out of the cylinder into the atmosphere through the exhaust valve.

The exhaust valve closes after the exhaust stroke and again the intake valve opens and the four strokes are repeated.

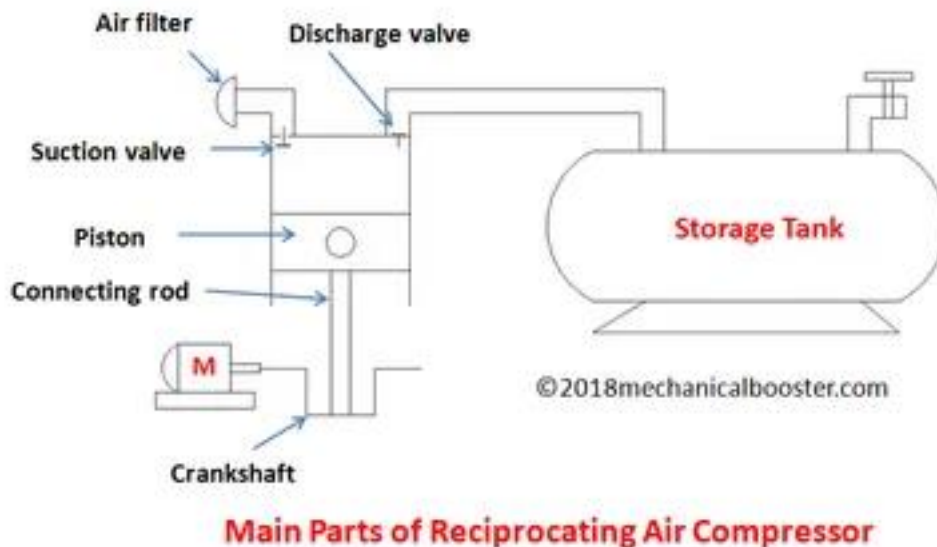
### Applications:

1. used for the ignition of the combustible fuel used in the engine.
2. Most of the cars, bikes and trucks use a 4 stroke engines

## 6. Air Compressor

Air compressors work by forcing air into a container and pressurizing it. Then, the air is forced through an opening in the tank, where pressure builds up. Think of it like an open balloon: the compressed air can be used as energy as it's released.

It consists of the following components:



- a) Cylinder Head,
- b) Suction/ Intake valve
- c) Delivery valve,
- d) Cylinder liner/ Wall/ cooling water jacket

- e) Compressor casing
- f) Crank case
- g) Piston
- h) Connecting rod
- i) Crank shaft
- j) Main Bearings
- k) Bed plate or Bottom structure
- l) Foundation
- m) Lubricating Oil strainer
- n) Stage relief valves
- o) Intercoolers
- p) After-coolers

### Working:

Air compressors work by forcing air into a container and pressurizing it. Then, the air is forced through an opening in the tank, where pressure builds up. Think of it like an open balloon: the compressed air can be used as energy as it's released.

They're powered by an engine that turns electrical energy into kinetic energy. It's similar to how a combustion engine works, using a crankshaft, piston, valve, head and a connecting rod.

From there, the pressurized air can be used to power a variety of tools. Some of the more popular options are impact wrenches, sanders and paint sprayers.

There are different types of air compressors and each one has a different specialty. Generally, the differences aren't too severe: it all boils down to the way a compressor handles air displacement.

## Applications:

1. Air compressors are found in a wide range of environments for an even wider range of uses. You'll see gas stations offering compressed air to inflate your vehicle's tires and your tire shop using compressed air with an air tool to remove your tires.
2. Small desktop air compressors used with an airbrush or a trailer-style gas-powered air compressor at a construction site powering jackhammers and concrete compactors.
3. Crafting
4. yard work
5. Painting vehicles in an auto body shop
6. Sanding in an auto body shop or in woodworking
7. Using pneumatic nail guns for roofing
8. Providing dental and medical services
9. Using pneumatic drills and hammers on construction sites



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