INTRODUCTION TO IC ENGINES

Prateek Guleria

Ph.D. Research Scholar, School of Core Engineering, Shoolini University, Solan

An internal combustion engine is one in which combustion (the burning of fuel) occurs within the engine's cylinder. High temperature and pressure forces are generated by the combustion of the fuel. This pressure force is employed to move the vehicle or rotate the wheels by the usage of a mechanism.

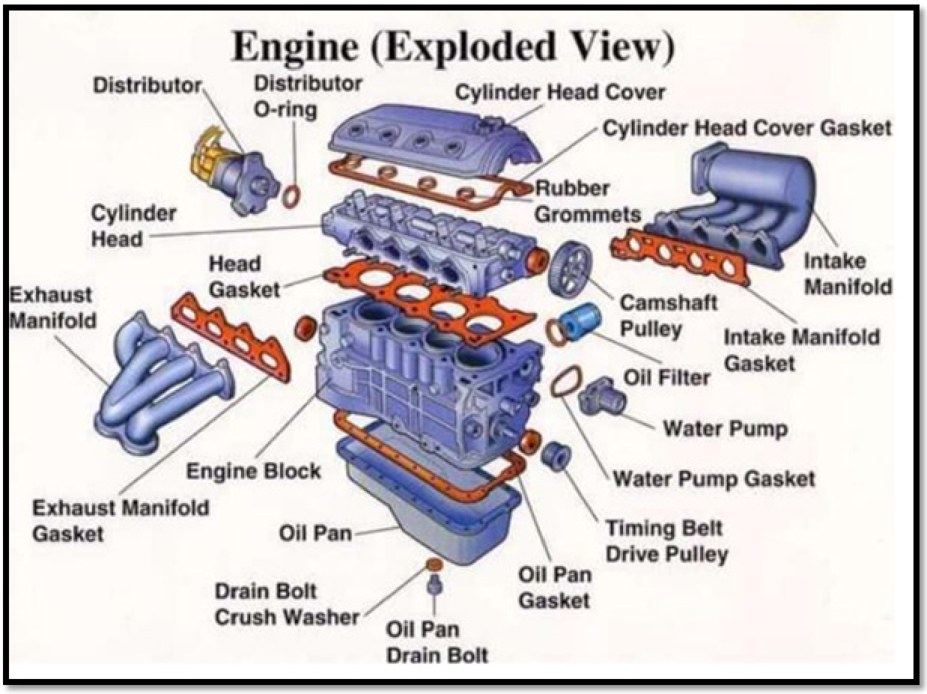


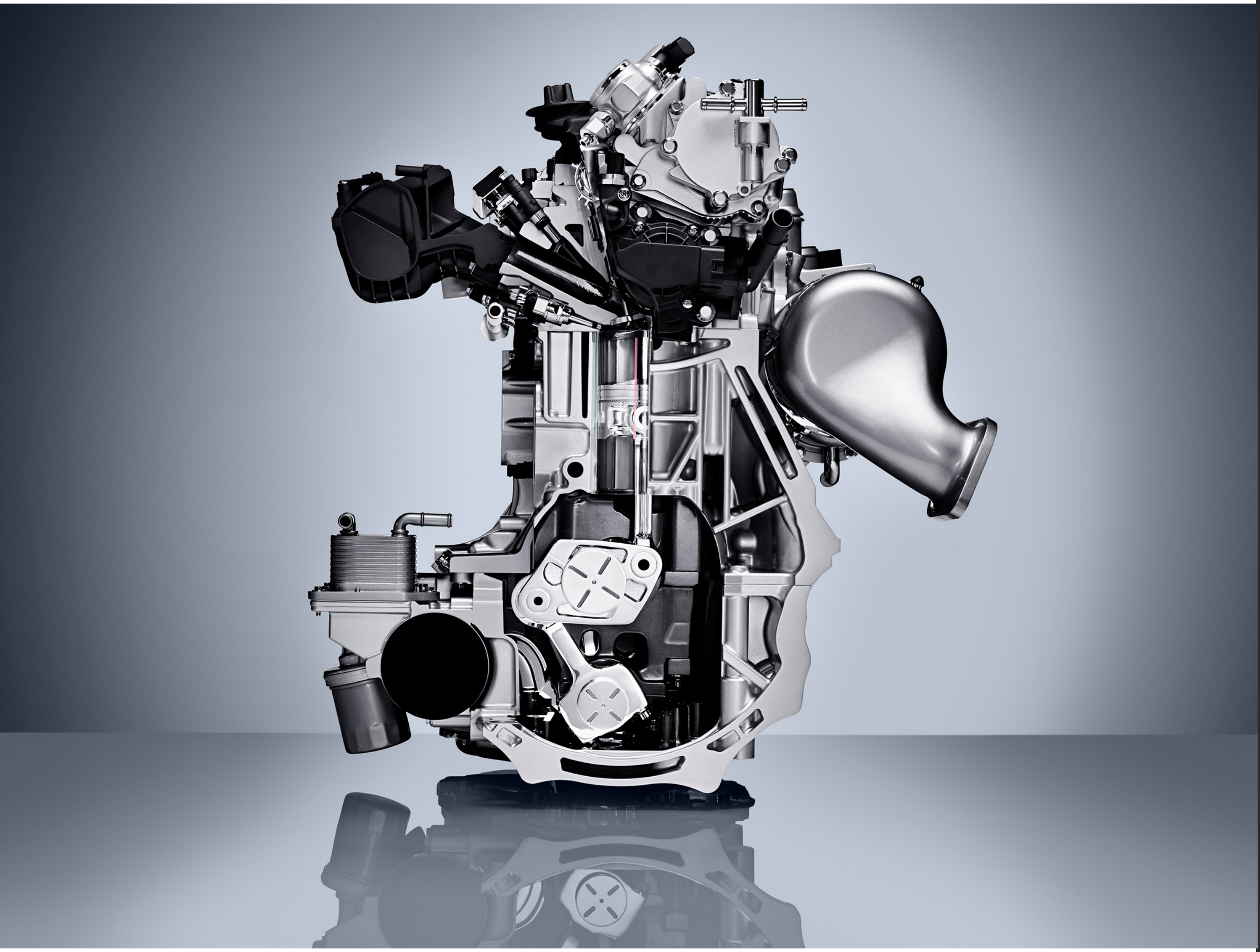
Figure 1: IC Engines Parts

Engine Development varies slightly depending on size and design. The size and design of the engine are determined by its intended function, and the type of metal used to construct it is determined by the temperature at which it will work. The current trend in engine building and design is toward engine families to simplify service parts and processes in the field. There are two categories of engine parts: (I) stationary parts and (ii) moving parts of an engine.

We were just considering the stationary parts of an engine in these drafts, which included the cylinder block and cylinders, the cylinder head or heads, and the exhaust and intake manifolds, among other things. These components form the engine's structure.

1. Engine Cylinder Block:
The cylinder block, whether in-line, horizontally opposed or V-type, is the fundamental frame of a liquid-cooled engine. The cylinder block is a solid casting consisting of cast iron or aluminum that houses the crankcase, cylinders, coolant and lubrication passageways, and, in the case of flathead engines, valve seats, ports, and guides. The cylinder block is typically a one-piece casting constructed of an iron alloy including nickel and molybdenum. This is the finest material for cylinder blocks in general. It has good wear properties, inexpensive material, and production costs, and changes dimensions vary slightly when heated.

2. Cylinder:
The cylinders are drilled directly into the block. A good cylinder must be spherical, with a diameter variation of no more than 0.0005 inches (0.012 mm). The cylinder's diameter must be consistent over its whole length. Cylinder walls wear out of round during regular engine use and may become cracked and scored if not adequately greased and cooled. An air-cooled engine's cylinders are separate from the crankcase. They're manufactured from forged steel. This material is best suited for cylinders because of its superior wear properties and ability to endure the high temperatures attained by air-cooled cylinders. Rows of deep fins are cast into the cylinders to disperse engine heat.



3. Cylinder Sleeve:
Cylinder sleeves, also known as liners, are metal pipe-shaped inserts that fit into the cylinder block. They serve as cylinder walls, allowing the piston to move up and down. Aluminum cylinder blocks frequently employ cast iron sleeves. Sleeves can also be used to restore cylinder walls in cast iron blocks that have been severely damaged. Cylinder sleeves are classified into two types: dry sleeves and wet sleeves.

4. Water Jacket:
The cooling and lubrication systems are also supported by the cylinder block. A liquid-cooled engine's cylinders are encircled by interconnected passageways cast into the block. These channels constitute the water jacket, which allows coolant to circulate between the cylinder block and cylinder head to dissipate excess heat generated by combustion.

5. Core Hole Plug:
The water jacket is accessible via holes drilled in the head and block to facilitate the removal of the material used in the cylinder block casting. These are known as core holes, and they are sealed using core hole plugs (freeze plugs). There are two sorts of plugs: a cup and a disc.

6. Crankcase:
It supports and encloses the crankshaft and serves as a lubricating oil reservoir. Mounting brackets are also included in the crankcase to hold the entire engine on the vehicle chassis. These brackets are either built into the crankcase or attached to it in such a way that they support the engine at three or four spots. These places are cushioned by rubber mounts that isolate the vehicle's chassis and body from engine vibration. This protects the engine supports and transmission from harm.

7. Cylinder Head:
The deck of the cylinder block is bolted to the cylinder head. It covers and encloses the cylinders' tops. Combustion chambers, which are tiny pockets generated in the cylinder heads where combustion takes place, are placed directly above the cylinders. Spark plugs (gasoline engines) or injectors (diesel engines) protrude into the combustion chambers through holes. The cylinder head has intake and exhaust openings that are cast in. The intake ports allow air (for diesel engines) or air plus fuel (for gasoline engines) to enter the combustion chambers. The exhaust port exhausts the combustion chamber's burnt gases.

8. Exhaust Manifold:
All the engine cylinders are connected to the rest of the exhaust system by the exhaust manifold. The exhaust manifold bolts to the side of the engine block on L-head engines, whereas it bolts to the side of the cylinder head on overhead-valve engines. It is constructed from cast iron, lightweight aluminum, or stainless-steel tube. If the exhaust manifold is appropriately designed, it can induce a scavenging action in which all of the cylinders help each other get rid of the gases. Backpressure (the force required by the pistons to push out the exhaust gases) can be lowered by designing the manifold with smooth walls and no abrupt bends. Exhaust manifolds on vehicles today are constantly changing in design to allow the use of various types of emission controls.

9. Intake Manifold:
Cast iron, aluminum, or plastic intake manifolds are all options. On a gasoline engine, it transports the air-fuel mixture from the carburetor to the cylinders. The manifold on a diesel engine solely transports air into the cylinders. The gasoline engine intake manifold

is meant to perform the following functions: Deliver the same amount and quantity of air-fuel mixture to the cylinders. This is necessary for the engine to run smoothly. The lengths of the tubes should be as uniform as feasible to evenly disperse the air-fuel combination.

10. Oil Pan:

The oil pan, which is fastened to the bottom of the crankcase, is located at the bottom of the crankcase. The oil pan is composed of cast aluminum or pressed steel and stores the engine's lubricating oil. Because the oil pan is the engine's lowest point, it must be sturdy enough to resist impacts from flying stones and roadside impediments.

11. Cylinder Head:

Gasket A head gasket is typically placed in just one method. Coolant and oil passageways may get clogged if it is put backward, creating major complications. Typically, markings indicate the front or top of the head gasket. The gasket may be labeled "top" or "front," or it may include a line to indicate installation orientation. Metal dowels are frequently used to align the head gasket. The most current, Teflon R-coated, permanent-torque (no retorquing required after engine use) cylinder head gaskets should be placed clean and dry. Sealer is not advised. Some head gaskets, however, may require retorquing and sealing. If in doubt, consult the manufacturer's instructions.

12. Intake and Exhaust Gaskets:

Manifold gaskets are classified into three types: intake manifold, exhaust manifold, and a combination of the two. Each type of manifold gasket has its own set of sealing properties and issues. As a result, when installing them, make sure to follow the manufacturer's recommendations.

13. Oil Pan Gasket:

The oil pan gasket seals the junction between the oil pan and the block's bottom. The bottom of the timing cover and the lower half of the rear main bearing cap may also be sealed by the oil pan gasket. The oil pan gasket must be able to withstand hot, thin motor oil. The gasket is formed of a variety of materials. Synthetic rubber, which is well-known for its long-term sealing capabilities, is a regularly utilized material. It is robust and long-lasting, and it can withstand hot motor oil.

14. Synthetic Rubber:

Seals The most popular form of oil seal is a synthetic rubber seal. It is made out of a metal casing that helps it keep its form and stiffness. A rubber part is connected to the casing, forming a lip or lips that seals against the revolving shaft. A coil spring, also known as a garter spring, is used to adjust the force with which the rubber part is held around the shaft. This enables the seal to accommodate a small shaft runout. Some synthetic rubber seals are positioned in bores surrounding the shaft. This kind is typically divided and does not require a metal casing or garter spring. Internal pressure created during operations drives the sealing lips closer to the rotating shaft. This type of seal operates effectively only against fluid pressure from one direction.