

BOILER

According to "American Society of mechanical engineer (ASME)" it is a steam generating unit which is used for producing furnishing and recovering heat, together with the apparatus for transporting heat, so made available to the fluid being heated and vapourized.

TYPES OF BOILERS

There are three types of boilers :-

- (1). Shell and tube type boilers
- (2). Fire-tube boilers or "Smoke-tube boilers"
- (3). Water-tube boilers

(1). SHELL AND TUBE TYPE BOILERS

This type of boiler is used for raising small quantities of heat and hence used on smaller plants, they consist of a cylindrical drum containing one or two fire tubes. The efficiency of this type of boiler may be high as 80%. The Lancashire boilers and Cornish boilers are its types.
Cornish

(2). FIRE-TUBE BOILERS

These types of boilers consist of a nest of tubes through which the hot gases flow. The tubes being surrounded by water. Since, the contact area b/w the water & hot gases is greater than in the case of shell & tube type, hence it has the ability to generate larger quantities of steam. It has efficiency definitely greater than shell & tube type. The Marine boilers and locomotive boilers are its examples. Nelox boiler is a modern fire tube boiler.
scotch

(3). WATER-TUBE BOILERS

These are the most efficient boilers. Water runs in the tubes and the hot gases surround it, hence the heat transfer area is

STROKE

"A stroke is movement of the piston from top dead centre (T.D.C) to bottom dead centre (B.D.C) or from B.D.C to T.D.C."

CYCLE

"It is a series of event that repeat themselves."

FOUR-STROKE ENGINE

Four-stroke cycle engine works on four stroke principle, i.e. there are four strokes in one cycle of such engine. Four-stroke cycle engine is also called "four-cycle engine" or "Otto-cycle engine."

The four strokes of Otto-cycle engine are:

- ✓ ① Intake stroke
- ✓ ② Compression stroke
- ✓ ③ Power stroke
- ✓ ④ Exhaust stroke

①. INTAKE STROKE

On the intake stroke, the piston is moving down due to which a partial vacuum is produced inside the cylinder. The intake valve is open, therefore, atmospheric pressure pushes the fresh air-fuel mixture in the cylinder through the intake valve.

②. COMPRESSION STROKE

When the piston reaches the B.D.C on the intake stroke, the intake valve closes. When the piston moves up on the compression stroke. During this stroke, both the valves are closed, therefore, no air-fuel mixture can enter or goes out of the cylinder. Therefore, when the piston moves up,

The mixture inside the cylinder is compressed. In modern engine, it is compressed to one-eighth or one-ninth of the original volume. The amount to which the air-fuel mixture is compressed is called "the compression ratio".

If the mixture is compressed to one-eighth of the original volume, the compression ratio is "8" to "1" (8:1).

3. POWER STROKE

During the compression stroke, the piston moves up when it gets near T.D.C, the spark plug produces a spark which ignites the compressed air-fuel mixture. Due to which the temperature and the pressure of gas rises. The pressure becomes about 600 Psi which push the piston down. As during this stroke, we obtain power therefore it is called "power stroke".

The piston transmit this power through the connecting rod to the crank due to which the crankshaft rotates. This rotary motion is carried through shafts and gears to the car wheels due to which wheel turns and car moves.

4. EXHAUST STROKE

During the power stroke as the piston reaches B.D.C, the exhaust valve opens. Then the piston moves up on exhaust stroke. When the piston moves up, it pushes out the burnt gases from the cylinder through exhaust valve. When the piston reaches I.D.C, the exhaust valve closes and intake valve opens for the second cycle.

COMPRESSION RATIO

The volume in which piston reciprocates. i.e. the volume from B.D.C to T.D.C is called "Swept volume (V_s)".
The volume in which fresh air-fuel mixture is

Compressed by the piston in the cylinder is called "Clearance Volume".
Thus the total volume of the cylinder is the sum of the swept volume and clearance volume.

$$V_T = V_s + V_c$$

And the compression ratio is the ratio of the total volume to the clearance volume.

$$\text{ie. Compression ratio} = \frac{\text{Total volume}}{\text{Clearance volume}} = \frac{V_T}{V_c}$$

OPENING & CLOSING OF VALVES IN FOUR-CYCLE ENGINE

The opening and closing operation of valves is done with camshaft. The camshaft has a lobe, so as the camshaft rotates and the lobe comes under the valve lifter it pushes the push rod up due to which one open end of rocker arm moves up while the other (valve end) moves down (like a see-saw), which pushes the valve down, i.e. opens the valve. The valve stem has a spring which is called "Valve Spring", which closes the valve.