



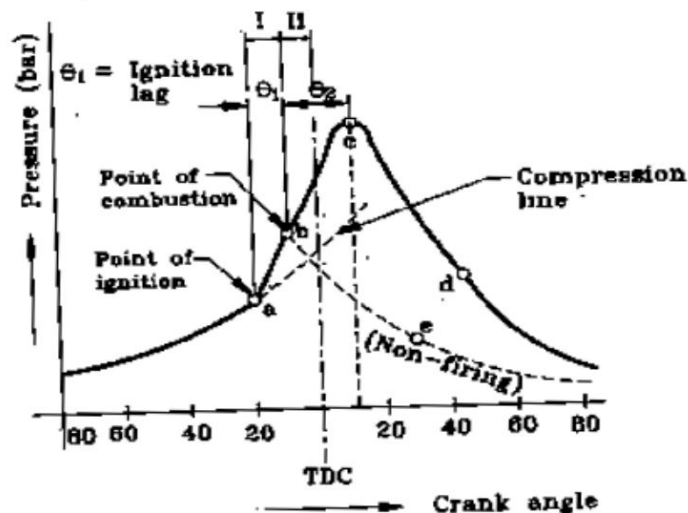
THREE STAGE OF COMBUSTION

There are three stages of combustion in SI Engine as shown

1. Ignition lag stage
2. Flame propagation stage
3. After burning stage

IGNITION LAG STAGE

There is a certain time interval between instant of spark and instant where there is a noticeable rise in pressure due to combustion. This time lag is called IGNITION LAG. Ignition lag is the time interval in the process of chemical reaction during which molecules get heated up to self-ignition temperature, get ignited and produce a self-propagating nucleus of flame. The ignition lag is generally expressed in terms of crank angle (θ_1). The period of ignition lag is shown by path (a-b). Ignition lag is very small and lies between 0.00015 to 0.0002 seconds. An ignition lag of 0.002 seconds corresponds to 35 deg crank rotation when the engine is running at 3000 RPM. Angle of advance increase with the speed. This is a chemical process depending upon the nature of fuel, temperature and pressure, proportions of exhaust gas and rate of oxidation or burning.



FLAME PROPAGATION STAGE

Once the flame is formed at “b”, it should be self sustained and must be able to propagate through the mixture. This is possible when the rate of heat generation by burning is greater than heat lost by flame to surrounding. After the point “b”, the flame propagation is abnormally low at the beginning as heat lost is more than heat generated. Therefore pressure rise is also slow as mass of mixture burned is small. Therefore, it is necessary to provide angle of advance (30-35) degrees, if the



STAGES OF COMBUSTION IN SI ENGINE



peak pressure to be attained (5-10) degrees after TDC. The time required for crank to rotate through an angle (θ_2) is known as combustion period during which propagation of flame takes place.

AFTER BURNING

Combustion will not stop at point “c” but continue after attaining peak pressure and this combustion is known as after burning. This generally happens when the rich mixture is supplied to engine.