SNS COLLEGE OF TECHNOLOGY
AN AUTONOMOUS INSTITUTION

Approved by AICTE New Delhi & Affiliated to Anna University Chennai
Accredited by NBA & Accredited by NAAC with A^{++} Grade Recognized by UGC

DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE CODE & NAME: 19AGT301 & HEAT POWER ENGINEERING

III YEAR / V SEMESTER

UNIT : IV IC ENGINE PERFORMANCE AND AIR COMPRESSORS

TOPIC 4 :Factors Affecting the Engine Performance

Factors Affecting the Engine Performance

The factors due to which the indicated power developed by actual engines differs from that of ideal engines are as follows:

(i) The working media is not air but mixture of air and fuel in case of actual engine.

(ii) The chemical composition of working media changes during combustion.

(Hi) The process of combustion is never at constant volume or at constant pressure.

(iv) The process of compression and expansion are not adiabatic.

(v) The specific heats of gases of working media vary considerably with temperature.

(vi) The combustion may be incomplete.

(vii) The residual gases changes the composition, temperature and actual amount of fresh charge.

(viii) The amount of fresh charge is decreased due to pumping losses.

Heat Transfer.

The heat is exchanged in both directions between the gases and engine cylinder walls and the other parts of the engine coming in contact with the gases.

During combustion, expansion, exhaust and the later part of the compression, heat transfer takes place from the gases to the walls and from the wall to the cooling water or ambient air. During suction and the earlier part of the compression, heat transfer takes place from the walls to the gases.

The heat lost to the walls during latter part of compression is almost equal to<the heat received by the gases from the walls during early part of compression. The amount of heat lost during exhaust stroke is unavoidable and unavailable.

The heat lost during combustion and expansion lowers the thermal efficiency of the engine. The factors that affect the heat losses to the walls are as follows:

(i) Duration of combustion of the charge. This increases the heat loss.
(ii) Temperature of combustion. This is turn depends upon the fuel, compression ratio and the load on the engine. The temperature increases with load and compression ratio. This increases the thermal loss.
(Hi) Speed of the engine. The increase of the engine speed decreases the duration of combustion hence decreases the heat loss.
(iv) Shape of the combustion space. The increase in ratio of combustion chamber surface to volume decreases the heat loss. However, turbulence and flame propagation also effect the heat transfer to combustion chamber wall.
(v) Size of the cylinder. The effect of cylinder size is rather complicated. An increase in the cylinder size decreases the ratio of surface to volume but increases the frame travel. This increases the combustion duration and hence engine speed is decreased.
(vi) Ignition timing in S.I. engines and fuel injection timing in C.I. engines. Proper ignition and injection timings give rise in quicker combustion with less after burning and hence less heat loss. The heat flow from the walls to fresh charge during suction stroke increases the temperature of the charge and hence decreases the quantity of charge. This decreases the power that the engine can develop.

Residual Gas

The residual gases left in the compression space from the previous cycle dilute the fresh charge by increasing the amount of inert gases in it. This affects the ignition and combustion.

The residual gases also lower the volumetric efficiency of the suction stroke and raise the temperature of the charge. Both these lower the amount of fresh charge induction.

Valve Resistance

In theoretical cycle of four-stroke engines, it is assumed that the exhaust and intake pressure are equal to atmospheric. But the exhaust pressure is higher and the suction pressure is lower than atmospheric pressure due to the resistances in exhaust and intake manifolds and valves.

The valve resistance affects the volumetric efficiency. The valve resistance causes the pumping losses, which is the negative loop on the indicator diagram. The pumping losses increase with an increase in speed.

In two-stroke engines, the power consumption of scavenge and charging pumps corresponds to the pumping losses in four-stroke engines.

Valve Timing.

In ideal cycle it is assumed that opening and closing of intake and exhaust valves take place on dead centres.

In actual case the exhaust valve closes and intake valve opens approximately on TDC, but the opening of the exhaust valve and the closing of the intake valve vary considerably from the BDC, depending principally on the desired speed.

The net result due to deviations of valve opening and closing other than at dead centres is that the indicator diagram is rounded at the exhaust corner. This reduces the work output by 1 to 2%.

Combustion Time.
In ideal cycle it is assumed that the time of combustion is zero for constant-volume process and combustion occurs at a rate necessary to maintain constant pressure during the constant pressure process. Actually combustion process requires an appreciable amount of time, which depends upon various factors. The increase in the combustion time decreases the ideal efficiency by 2 to 3%.

Incomplete Combustion.
A volumetric analysis of the constituents of the products of combustion indicates an incomplete combustion that amounts to about 2% of the heating value of the fuel. Mixture with excess air tends to reduce this loss to zero; on the other hand rich mixtures result in considerable unburnt fuel due to oxygen deficiency.

Thank You