

Static Structural Analysis of Aluminium & Carbon Pistons

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Abstract— With the increasing levels of technology, the efforts are being put to produce any kind of work that has been continuously decreasing. The efforts required in achieving the desired output can be effectively and economically decreased by the implementation of better designs. As piston is one of the most important part of an engine and is in direct contact with the working substance, it needs to be designed in such a way that most of the energy released by the working substance is converted into useful work and also work in harmony with the other component of engine, so that the losses incurred in the process are minimized and efficiency is enhanced.

In this research work carbon piston is used as a replacing material for piston manufacturing. Carbon being a non-metallic material has certain advantages over its metallic counterparts. The motive behind the use of carbon pistons with is structural analysis is shown in the present study which will also shed lights on various properties and benefits of carbon pistons.

Keywords- Piston, Carbon materials, Finite element analysis, Static Structural Analysis.

I. INTRODUCTION

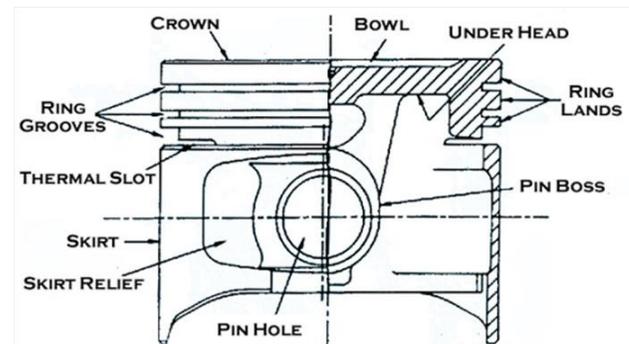
Piston is the reciprocating member of an IC Engine which is confined within the cylinder. The elementary function of piston is to congregate the impulse generated inside the cylinder due to expansion of gases and transfer it to the crankshaft via connecting rod. Piston is the reciprocating component of engine that is contained by the cylinder. It is devised gas-tight with the help of piston rings. Piston also soaks side thrust resulting due to the obliquity of piston rod. Another function of the piston is to dissipate vast amount of heat energy produced in a working cycle. Piston substitutes the work of a valve train by covering and uncovering the ports of the cylinder in case of a 2-stroke engine.

Fig 1-Piston Parts

II. LITRETURE REVIEW

1. A research was carried out by S.Srikanth Reddy & Dr. B.Sudheer Premkumar in their paper titled "Thermal Analysis & Optimization of

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IC Engine Piston Using FEM". The main motive of this research was to investigate and analyze the thermal stress distribution of piston at real engine condition during combustion process. In this research Mesh Optimization using FEA technique is used to anticipate higher stresses and critical region on the component.

2. Another research paper presented by J. Heuer titled "Development and Testing of Carbon Piston" which emphasizes on the use of carbon as a material for piston manufacturing instead of conventional materials because of excellent thermal and physical properties of carbon. This research paper concluded that the weight of the piston can be reduced by 10% and another reduction of weight by 10% can be easily achieved by using ceramic piston pin.
3. In this research paper Ajay Raj Singh and Dr. Pushpendra Kumar Sharma presented their work on Design, Analysis & Optimization of Three Aluminium Piston Alloys Using Finite Element Analysis. The Piston Modeling and analysis is done using ANSYS 12.1. The main aim of this paper was to choose the most suitable aluminium alloy based on stress analysis. Finite Element Analysis method showed stresses and deflections