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Analysis of Pulsar 150cc Piston by Material Optimization

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Abstract

Reverse engineering is done on a piston of Bajaj Pulsar 150cc bike. Exact design is modeled using solid works and analysis is carried out in Ansys. Material optimization is Changing the existing material with a best material. The strength, weight and cost efficient material is suggested. The analysis results showed that silumin is better than aluminium in all aspects in both structural loading and also in weight.

Key Words: FEA, Solid Works, ANSYS, Thermal Analysis…

1. INTRODUCTION

Demand in automobile industry is a very huge problem to be resolved. The increase in quality of the products can solve the problem as the life increased will reduce the change of spare frequently. The cost of the product should not be affected as increasing the quality. The piston is the sliding component in the engine. This component is directly exposed to the heat while combustion. The performance of the engine is affected by the piston with respect to geometry, strength and thermal ability. The piston should be able to withstand the forces acting on it. And the thermal expansion should not be high as it may result in seizure of engines. These factors are to be considered for optimization.

2. MODELLING

2.1 REVERSE ENGINEERING

Instead of designing a new component of same specification and to reduce time, this process is used. Here, the piston of the pulsar piston is brought out from market and its dimension and geometries are remodeled by 3D software and is subjected to FEA analysis.

2.2 PISTON DESIGN

The piston design is modelled exactly in SolidWorks with basic tools. The measurements are obtained manually with basic measuring tools. The piston design is shown in the fig.1.

2. INPUTS

The 3D model is converted to IGES format. The file in imported in Ansys workbench and meshing is done with fine relevance center. By which the nodes and elements achieved are 44903 and 25532 respectively. The volume of the piston is 46677 cubic mm. Initially, aluminium alloy is assigned and the properties of the same are assigned to the model. The boundary conditions are applied as in the table 1.

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BOUNDARY CONDITIONS			
Analysis type	Static structural & steady state thermal	Volume	46677 mm^3
mesh	Tetrahedrons	Pressure on piston head	2MPa
Nodes	44903	temperature on piston head	200° C
Elements	25532		

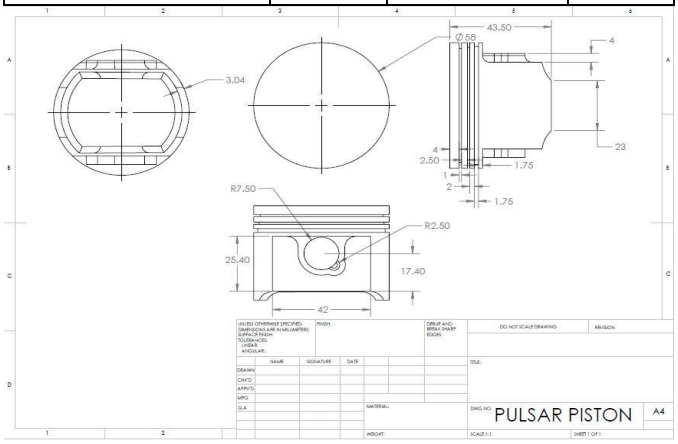

Fig -1: **Piston drawing**

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Properties	Aluminium Alloy	Silumin
Density	2.77E-6 kg /mm^3	2.659 E-6 kg /mm^3
Young's modulus	71000 MPa	317000 MPa
Poisson's ratio	0.33	0.27
Thermal conductivity	0.144 W/mm C	0.134 W/mm C

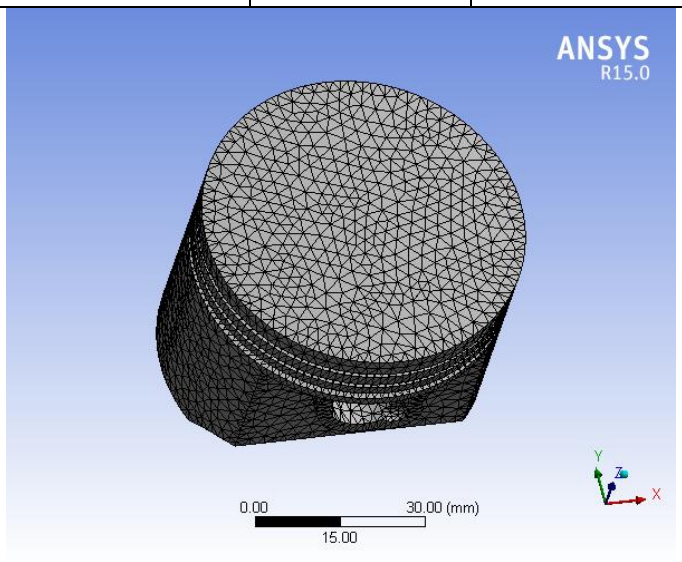

Fig -2: **Pulsar piston**

Meshed model of the piston is shown in fig 2. The results of the aluminium alloy after importing the boundary conditions are obtained. The deformation, stress, strain, temperature distribution and heat flux are tabulated below.

Deformation	0.013274 mm
Stress	43.763 MPa
strain	0.000667 mm/mm
Temperature distribution	200 C
Total heat flux	1.6279 W/mm^2

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Table -3: Results of Aluminium Alloy.

3. RESULTS:

Results Of Aluminium Alloy:

The total deformation in piston with aluminium alloy is obtained due to the input loading condition. The maximum value of 0.013274mm is at the top land of the piston. The result images are shown below,.

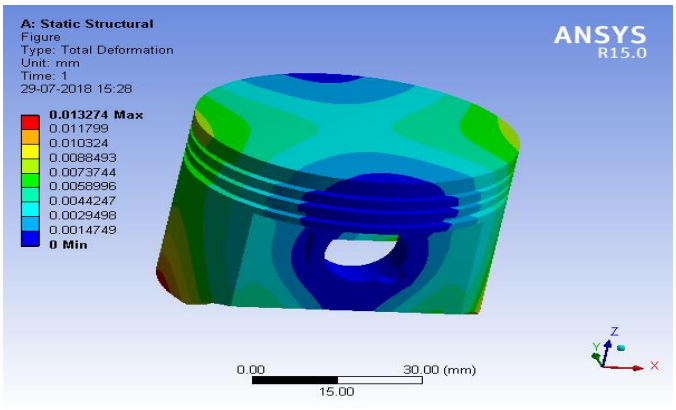

Fig-3 – Total Deformation

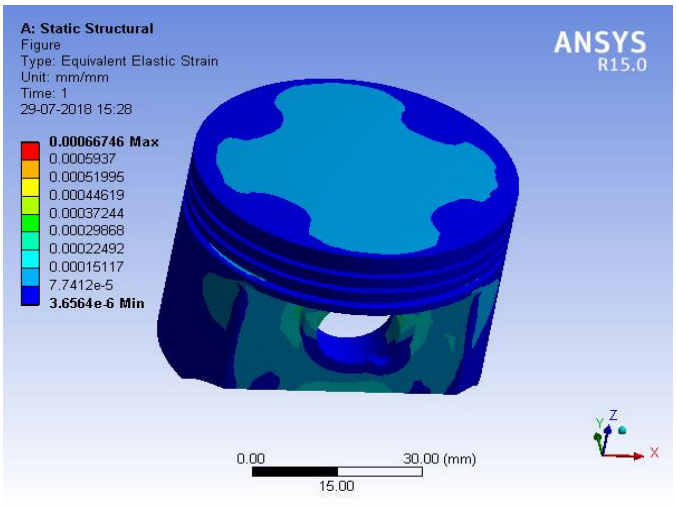

Fig-4 – Strain

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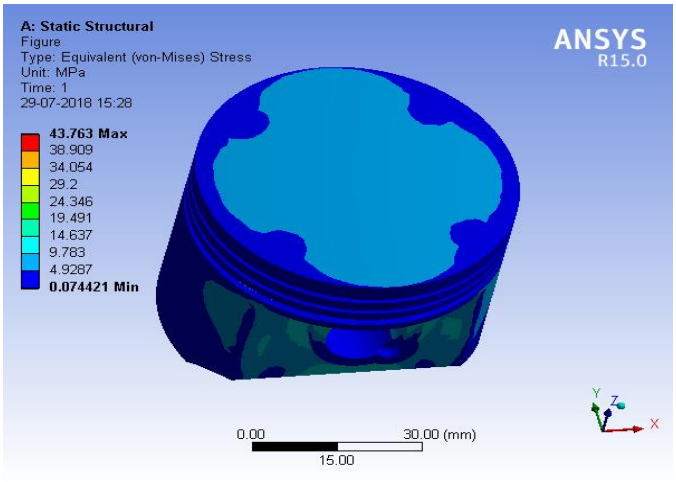

Fig- 5 – Stress

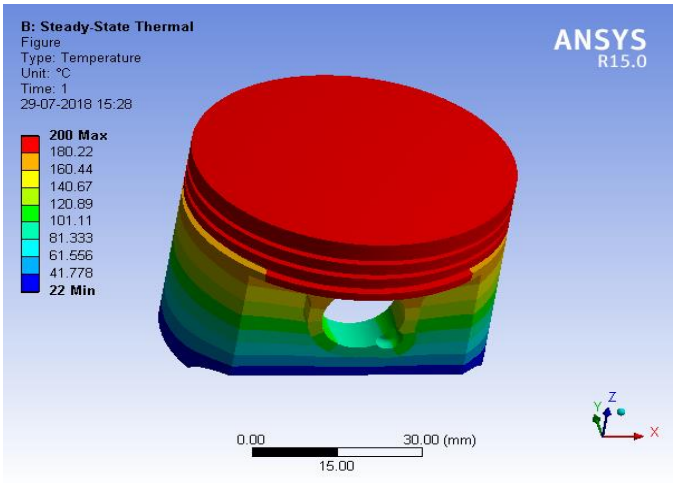

Fig- 6 – Temperature Distribution

Table -4: Results of Silumin.

Deformation	0.002954 mm
Stress	44.5 91 MPa
Strain	0.00015307 mm/mm

Temperature distribution	200 C
Total heat flux	1.3309 W/mm^2

From the analysis by assigning Silumin material to the model, the results are obtained. The result seems to be better than that of aluminium alloy.

4. CONCLUSIONS

The analysis carried out on pulsar piston revealed the effects of forces and temperatures acting on it. Also material optimization was carried out so that better material found to show better resistance to heat and force. Here the silumin has low values of deformation and the weight of silumin is 50g less than aluminium. So silumin can be used instead of aluminium for better life of engine.

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