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Design and Analysis of Twin Screw Pump Casing Using FEA

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ABSTRACT: In the present project we have choose the Twin screw pump for the for the Analysis point of view. Twin screw pump consists of screw drives for the acceleration of pressure by the addition of axial rotation the function off the screws are to pull fine clearance on air trapping and interlocking of screw strings. Various types of screw pumps comes into consideration depending upon the application and pressure range. The Design of the Twin Screw Pump Casing Was carried out in Catia V5 R20 and simulation was carried out in ANSYS 2021R2. Strength of materials, Design For Machine Members (DMM), And various physical and mechanical properties and case study has been taken in consideration.

KEYWORDS: Twin Screw Pump, catia, Ansys, Meshing, FEA.

I. INTRODUCTION

It is considered as the subcategory of a positive displacement pump and that operates either one or more screws to function pump activity in its spindle direction. Thus the screw pump functions effectively for the liquids which have the minimal turbulence, Less vibration and self-primed which holds the ability to function with less air pocket having less functioning noise. The implementation of screw pump has directed to numerous multiple axis machinery where screw revolves in the opposite axis or they continue to be in a static position internal on the cavity. The cavity or space might me profiled so that the development of cavities in the pumping equipment will get stuck. And fluid moves into the pump from the suction side and has a linear movement alongside intermeshing screws and from there moves towards the pumps discharge side as the space that exists between the linear and the screw is very minimal the pressure levels of the liquid at the time of the movement.

Depending upon the range of application Screw pumps are classified as:

Flow Rate ranges in Between 50-15000 per each minute
Total head ranges vary in-between 50-4500psi
Horsepower ranges between 5-5000

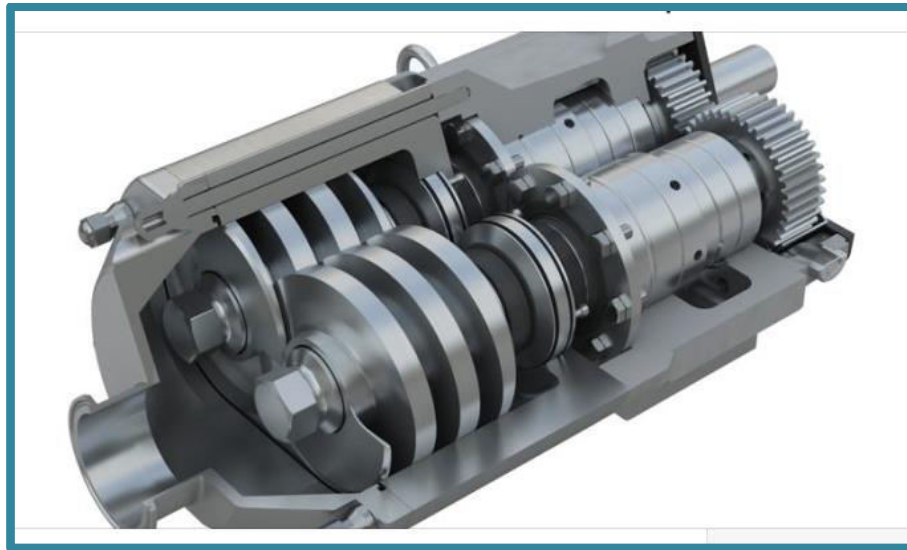


Fig1.Show the cross sectional view of Twin Screw Pump

II. MATERIAL AND MANUFACTURING PROCESSES

Important material selection of components plays a major role. Basically the material selection of the component was selected based on the different mechanical strengths and we need to differentiate all the mechanical failures. The turbine blade is part of a turbocharger component that has to rotate at high speeds by sensing a large amount of high-pressure air or gas with a maximum temperature of up to 1500 degree centigrade. Selected Goods must have Good Power and Life and must withstand damage when receiving loads.

Second Cost Effective is the concern for selecting goods according to usage and should be readily available in the market for a variety of production areas. In the current project we have selected five different items in that two are the previous items and the remaining items are selected according to loading conditions.

Material	Young's Modulus Pa	Density Kg/m ³	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa
Mild Steel	2.1e+011	7870	0.29	1.6667e+11	8.1395e+10
Aluminium Alloy	7.1e+10	2770	0.33	6.9608e+10	2.6692e+10
HCS	2.1e+11	7920	0.3	1.6e+11	7.6923+10
Structural Steel	2e+11	7850	0.3	1.6667e+11	7.6923e+10
Sand Cast Magnesium Alloy	4.5e+10	1810	0.35	5e+10	1.6667e+10

Table1.Shows the material properties

III. MODELLING AND ANALYSIS PROCEDURE

For Twin Screw pump Modelling we have selected the CATIAV5 R21 which is an excellent user-friendly software with a different module as part, Surface and Assembly Design. The process of creating blades is next take a plane and place a drawing here we have created a 2D Sketch as a Geometric element that needs to be bound and converted into part by inserting the body. Essential Toolbar used for pad, revolve, pattern, slot etc. and After design the Turbine blade is saved in STP (Step File) format which can be easily uploaded to the ANSYS Workbench.

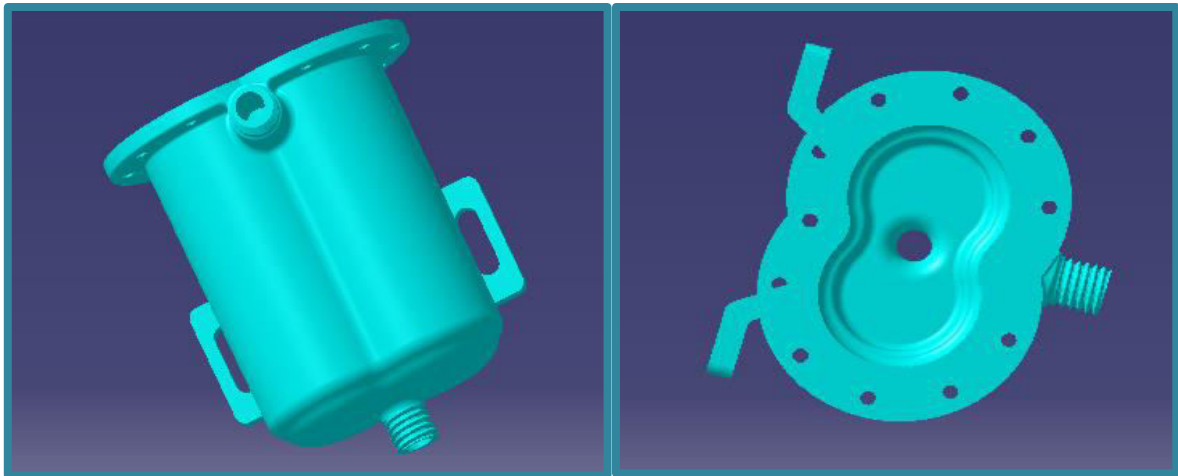


Fig2.Shows the representation of cad model

Meshing is the most important internal Simulation process in the ANSYS. What happens is that it separates or separates the solid with a small amount of material to make solution resolution and greater accuracy. Here we have created a meshing of the Tetrahedron feature with a controllable type of system and 1mm corner with a standard size of 5mm.

ANSYS is a Finite element Analysis Software package. Different types of analysis can be done using Ansys such as Structural, Model, and Thermal etc. Ansys is made up of an internal sequence of steps namely, Pre-processing, Coordinating, Border Conditions Posting Processing, resolving and ultimately results.

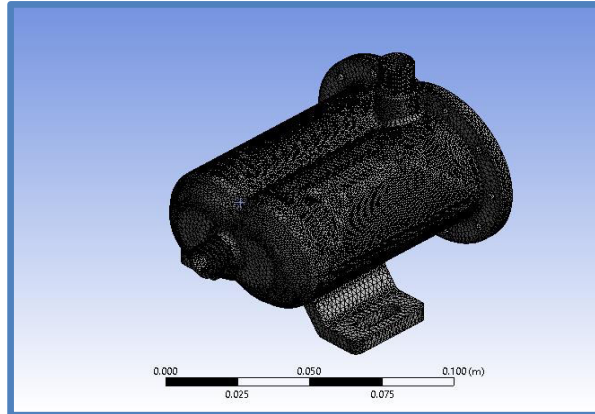
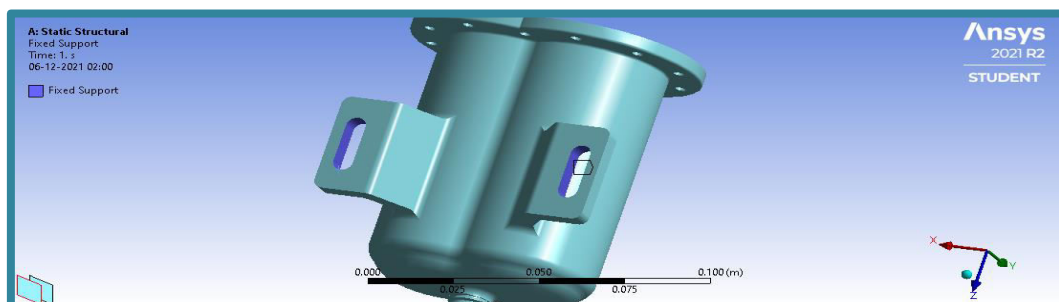
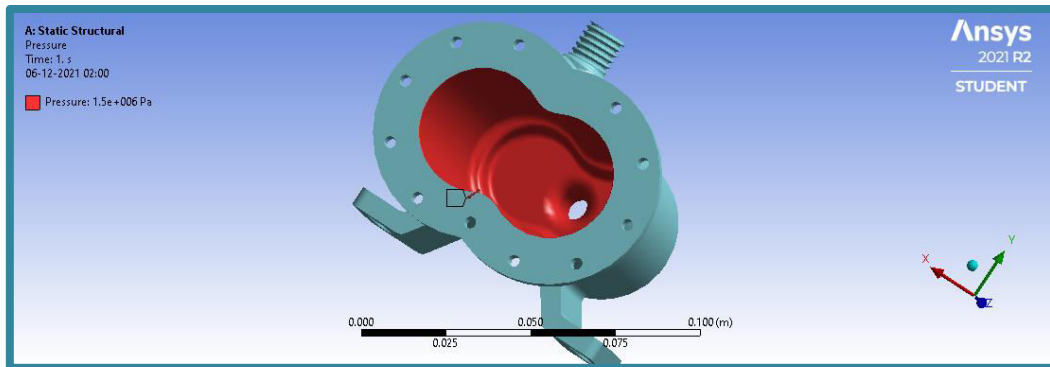


Fig3.shows the mesh presentation

IV. LOADING AND BOUNDARY CONDITIONS

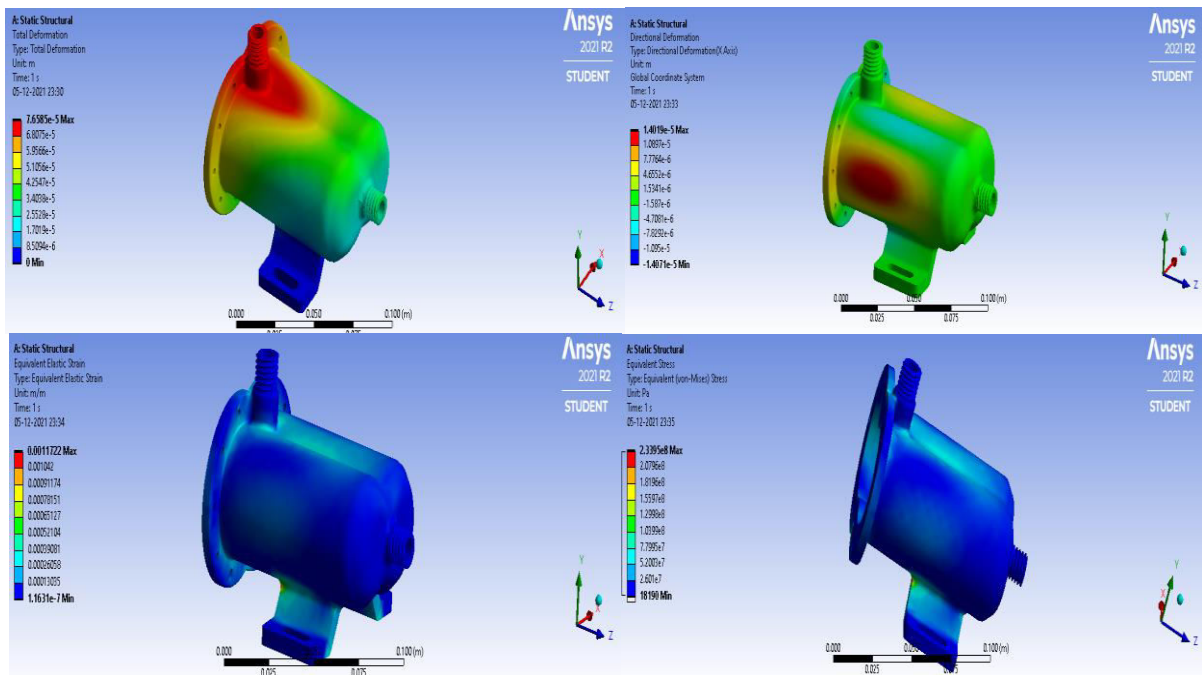
As per the application and functional point of view the base is based is fixed since it was fastened at the ground due the passage of air flow the inside portion will experience a tremendous amount of pressure so the analysis is carried at 15 bar



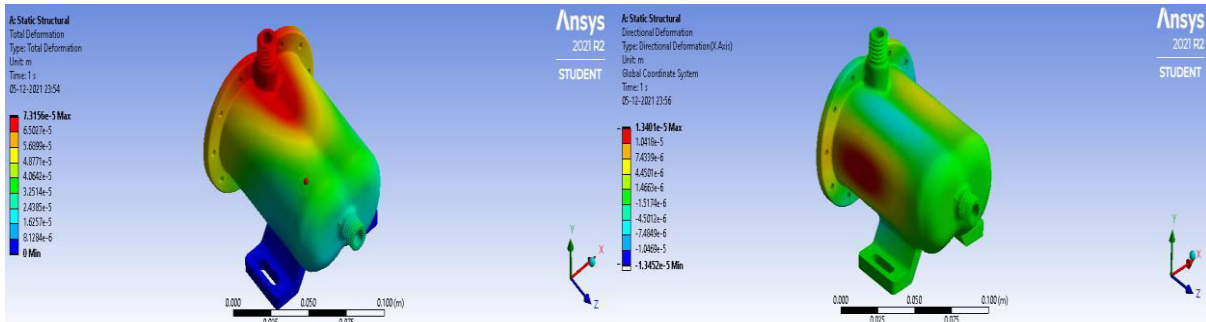


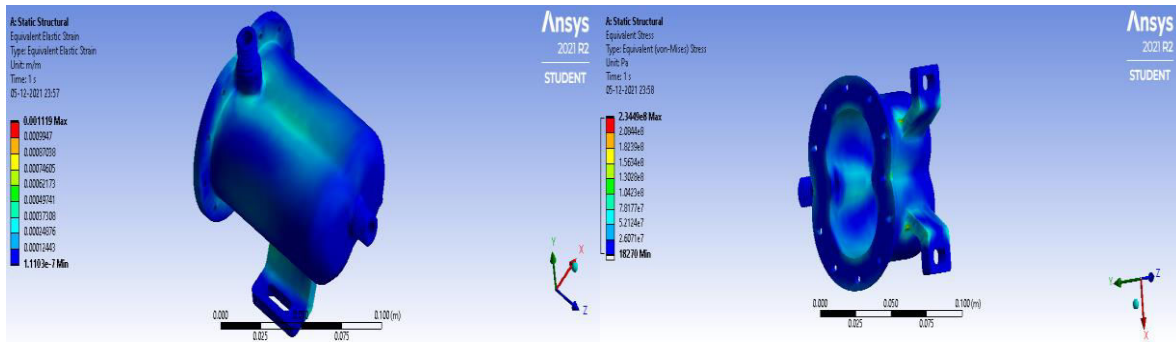
V. EXPERIMENTAL RESULTS

The Structural analysis is carried out on casing at a pressure of 15bar i.e 1.5e+006pa For structural steel

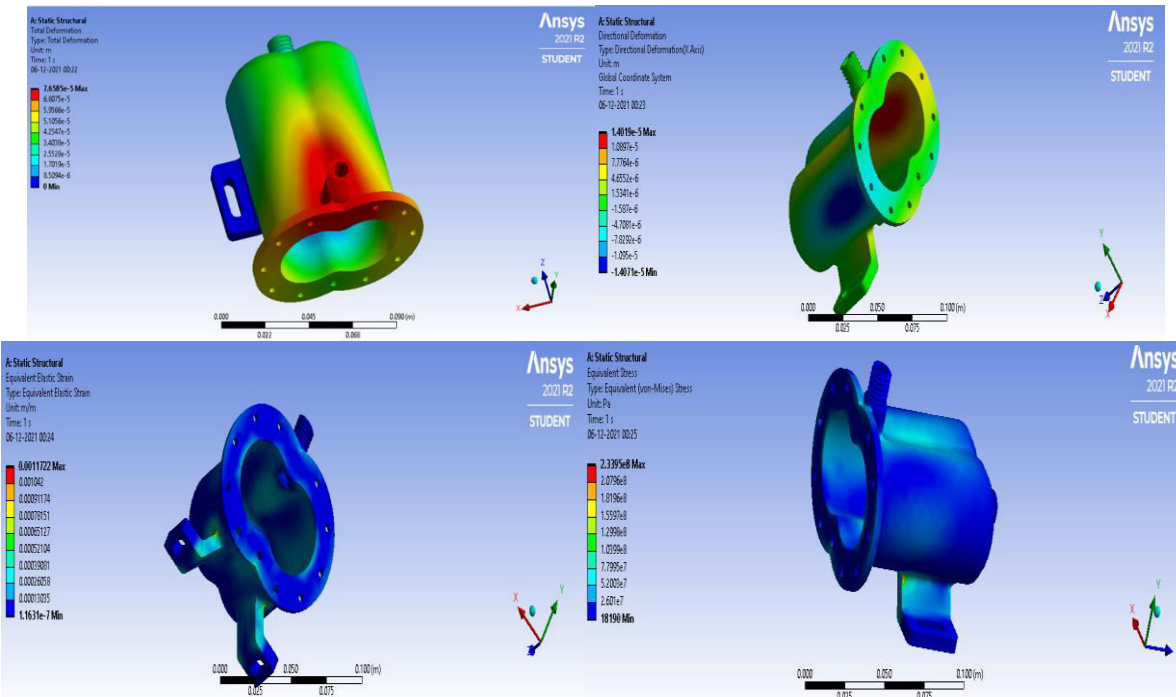


For mild steel

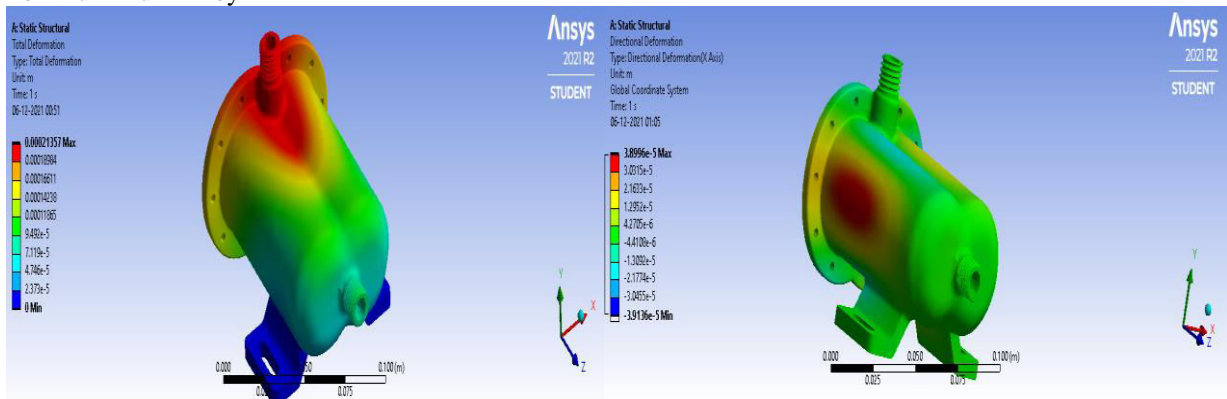


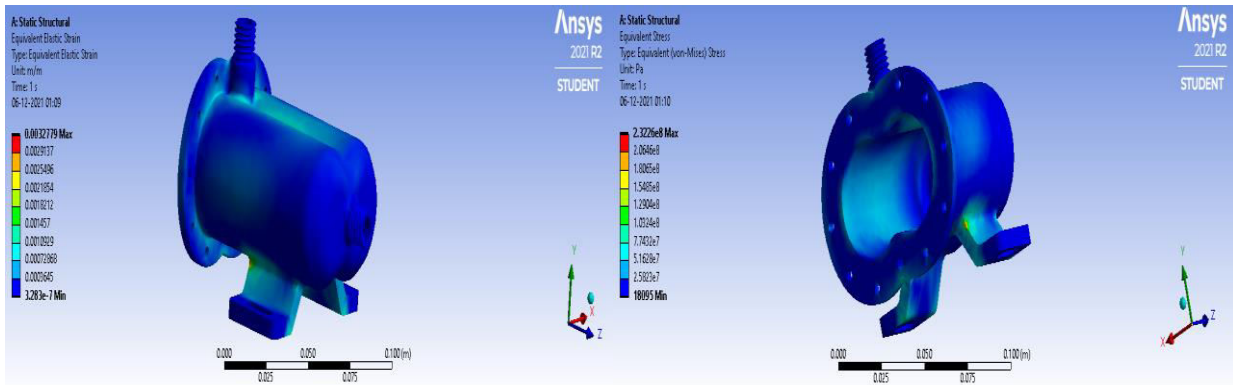


For high Carbon Steel

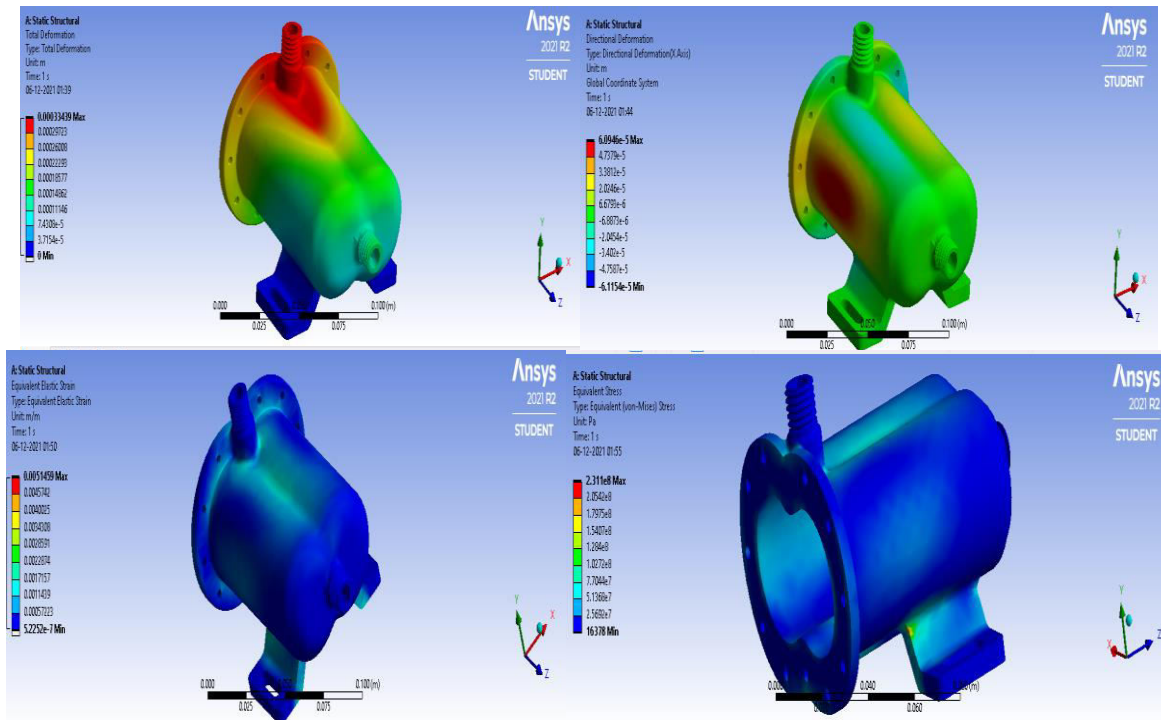


For Aluminium Alloy





For Sand Cast Magnesium Alloy



Material	Total deformation	Directional Deformation	Stress	Strain
Structural steel	7.6585e-5	1.4019e-5	2.3395e8	0.011722
Mild Steel	7.3156e-5	1.3401e-5	2.3449e8	0.001119
Aluminium Alloy	0.00021357	3.8996e-5	2.3226e8	0.56941
High Carbon Steel	7.6585e-5	1.4019e-5	2.3395e8	0.0011722
Sand Cast Magnesium Alloy	0.00033439	6.0496e-5	2.311e8	0.0051549

Table2.Shows the deformation, stress and strain values



VI. CONCLUSION

The Static structural analysis is been carried out on twin screw pump casing to find out the deformation effected zone and with five different materials as mentioned above analysis is done under pressure rate of 15bar i.e 1.5e+006pa the maximum deformation seen on nose of the inlet of the casing the minimum deformation was found with the material aluminium and nearby maximum deformation Structural steel and HCS due to its high density value strain and stress experienced at the base stand that the component is modelled with uniform thickness to avoid the stress concentration. The above materials are safe wrt to the values obtained. Comparatively Aluminium is cost than among other materials can with stand thermal related defects because of its thermal conductivity and material properties. Sand Cast magnesium Alloy also experiences less deformation suggestible

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