



Research Paper

ANALYSIS AND OPTIMIZATION OF SUBMERSIBLE MOTOR PUMP BODY

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This paper covers a complete analysis and optimization of a submersible motor pump body and its product. This project contains a defect free submersible motor pump which provides better strength to the motor body. It also covers a family mold for 3 components namely Top cover, Bottom cover and Bottom pad which reduces the cost of molding by 50% as one mould full fills the requirement of 3 molds and minimized defects. This project reduced the fill time of components without any increment in defects. It also designs and analyzed the Bottom pad which is going to resist the loads of motor body in Ansys 13.0 to determine the various stresses, strain and fatigue life of the material. The software has helped us really to achieve our goal regarding calculating the “total deformation and fatigue life of bottom pad”. As the whole analysis was done by the means of software, therefore results and observations were trustworthy and meet with our expectations. Reduced fill time of every component does not affect the properties of the final component. This project has chosen the 3D mesh and surface mesh for the Central body and Top cover, Bottom cover and Bottom pad respectively. These meshes produced better results and also help us to minimize the defects. The family mold thus formed ultimately helps us to reduce the overall cost of the component and hence this project successfully got its goals.

Keywords: NX 7.5, ANSYS 13.0, 3D Mesh, Family mold

INTRODUCTION

Design Challenge of Component

The design of a motor pump of a cooler contains several complexes and we have tried to meet the requirements as per Original Equipments Manufacturers (OEMs). By using NX 7.5, we have tried and ultimately succeed

with the drawing requirements and draw a complete assembly of motor pump. We have developed the design in 6 Degree of Freedom (DOF) for characteristics and durability to fine tune the designs. The whole design consist of 4 parts namely bottom pad, back cover, central body and top cover.

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Figure 1: Complete Assembly of Motor Pump Body



Complete Assembly

Materialselection

Polypropylene for Top cover, Back cover and Bottom pad.

Preheated ABS (45°C) for Central body

Component Level Analysis

Component level analysis by using Autodesk Mould Flow software.

RESULTS

Reduced Fill Time

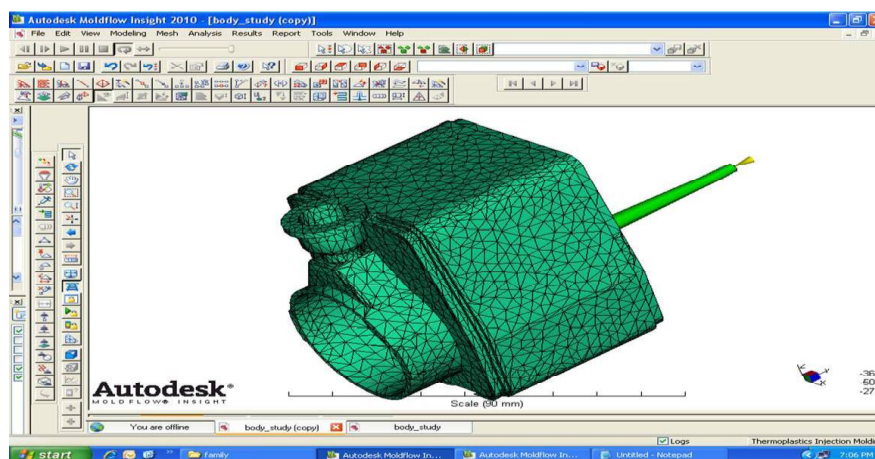
Top cover = 0.7274 sec

Back cover = 0.7855 sec

Central body = 1.704 sec

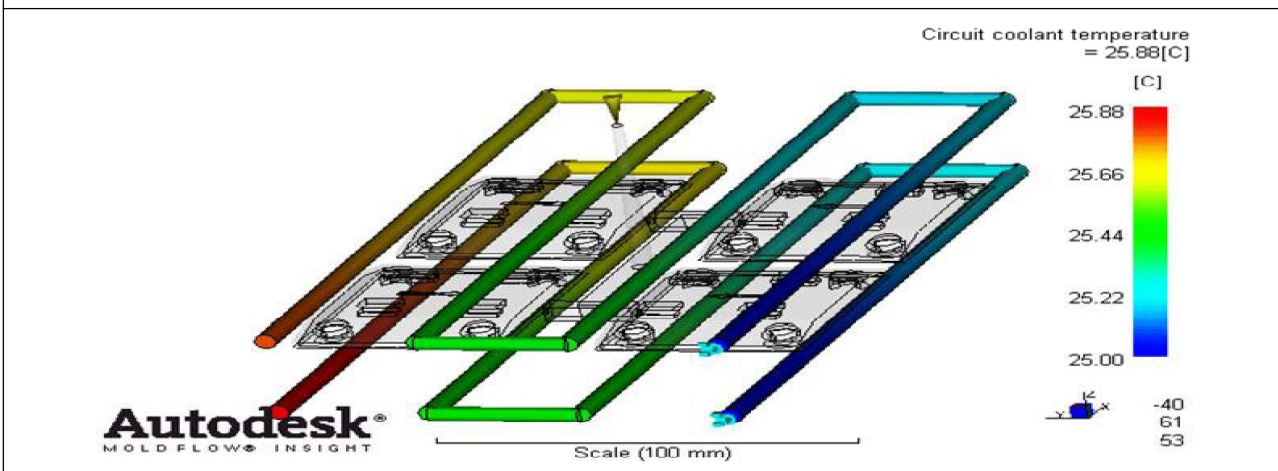
Bottom cover = 1.02 sec

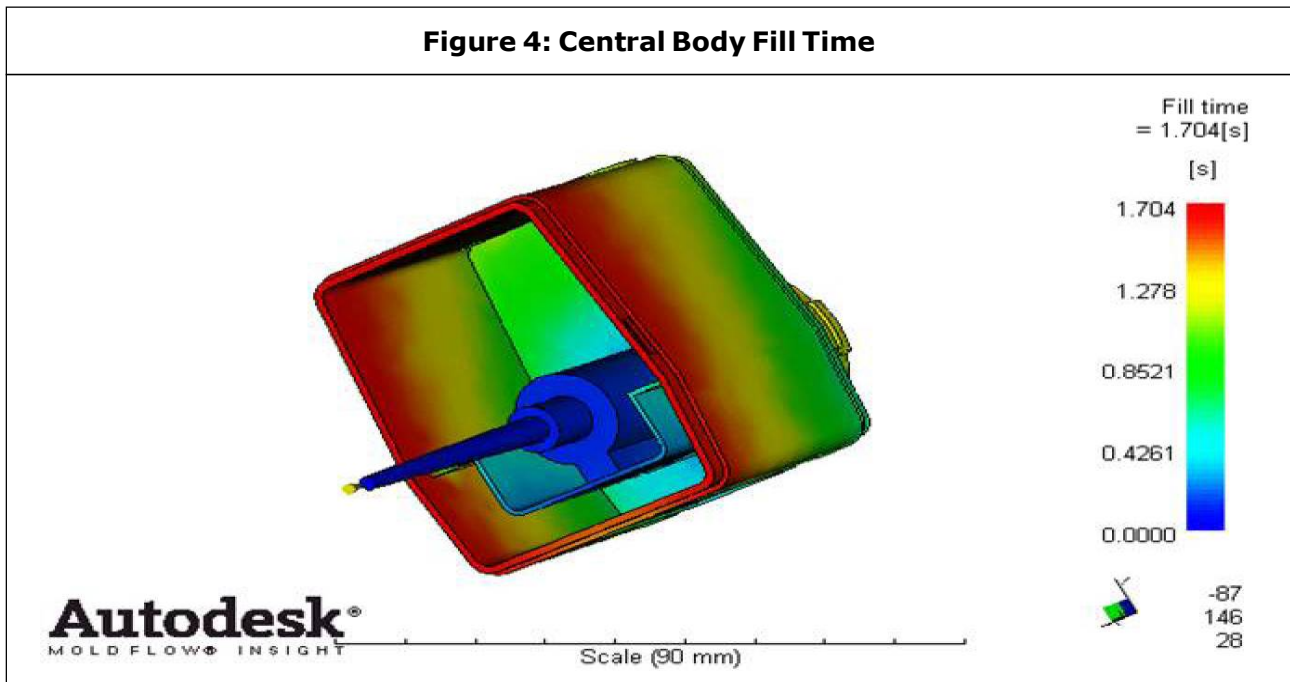
Figure 2: Importing STL File and Meshing



(3D mesh)

Figure 3: Cooling Channels Using Water as a Coolant





Moulding Defects Image

Air Traps Image

Generation of Family Mould

As every 4 cavity for each component cost approx 10 lacs therefore we have created a single mould called family mould for the

following parts namely top cover, bottom cover and bottom pad which ultimately reduces the cost of moulding by 20 lacs as one mould fulfills the need of 3 moulds. Therefore it helps us to reduce the overall cost of the product.

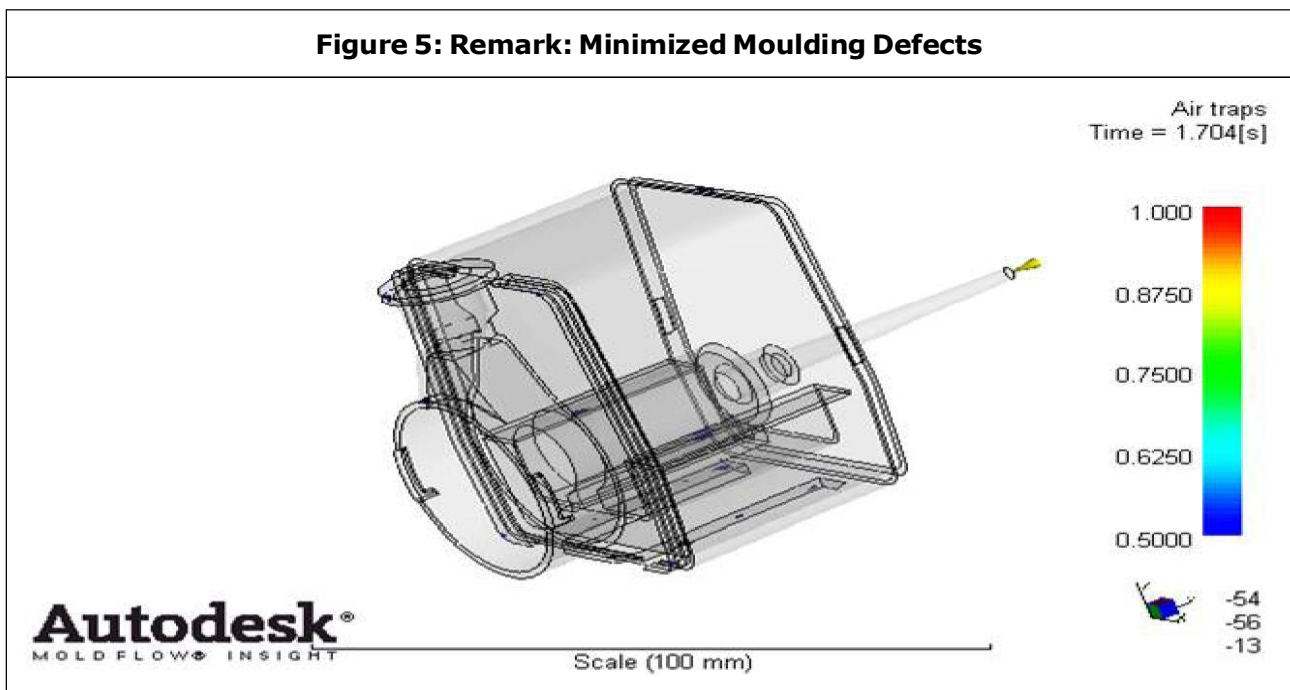


Figure 6: Dual Domain Mesh

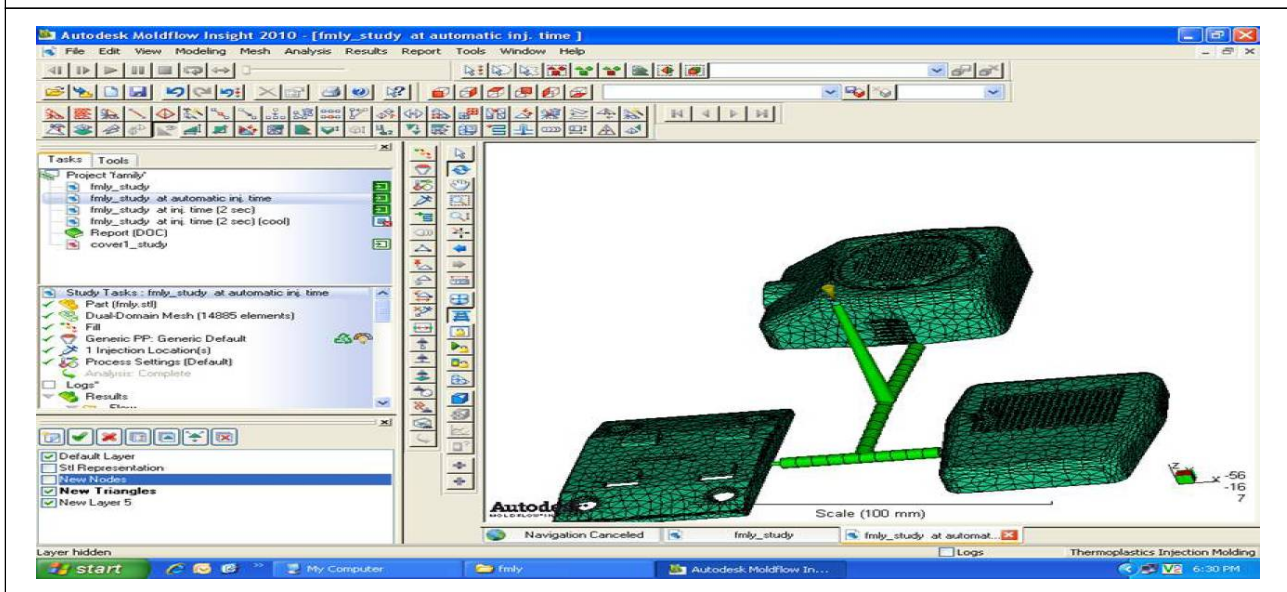
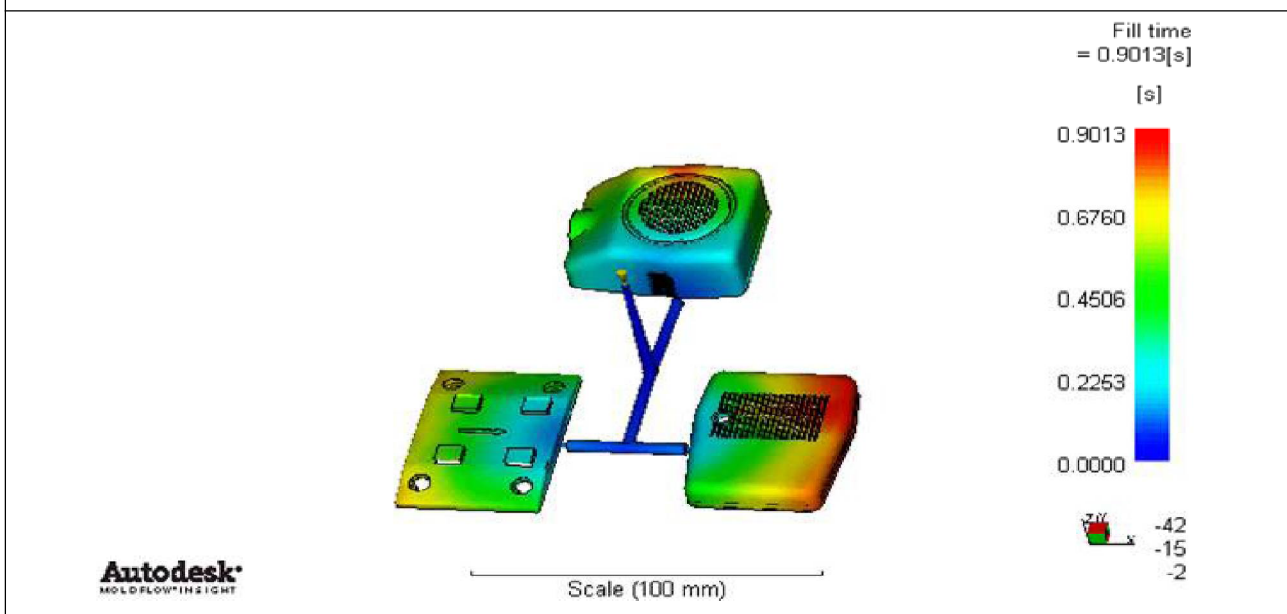


Figure 7: Fill Time for Family Mould: 0.9013 sec



Moulding Defects Image

Remark: Venting required

Component Stress Analysis on "ANSYS 13.0"

"ANSYS 13.0" perhaps one of the most widely used software while working on solving real world problems. For calculating various

stresses, strain, principal stress and their planes, fatigue stress and the life of the component are the major concerns on which we have worked with this software.

Calling IGES File in ANSYS 13.0 and Selecting the Part Which Bears the Load Result Evaluation

Figure 8: Air Traps Image

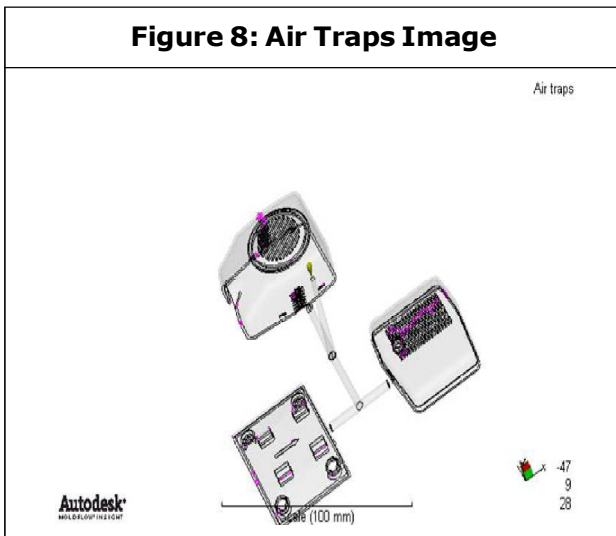


Figure 9: Weld Line Images

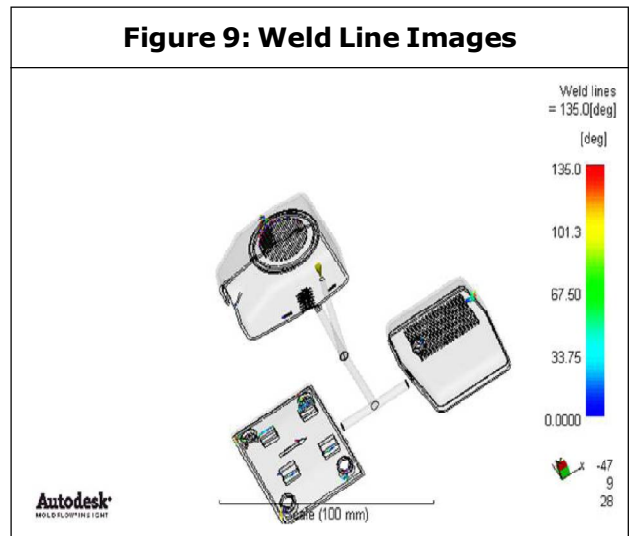


Figure 10: Applying Force (6N Approx)

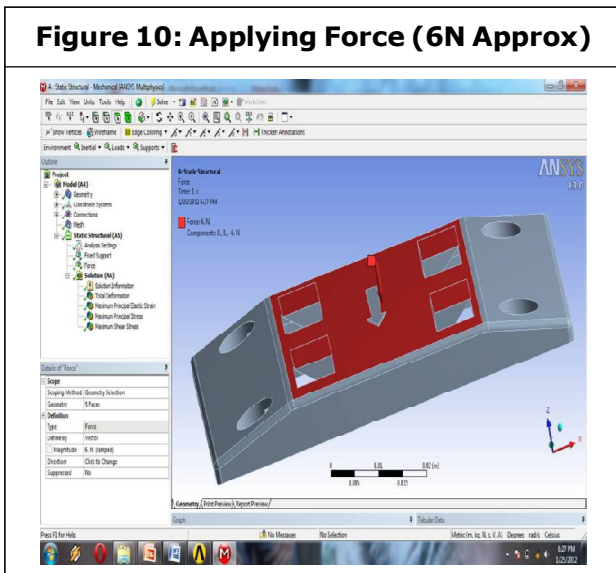


Figure 12: Total Deformation: 3.5428e-6 m (Maximum)

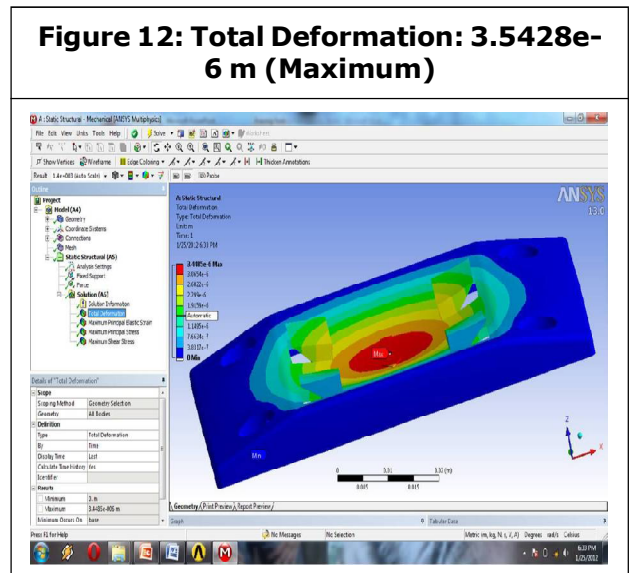


Figure 11: Providing Fixed Support

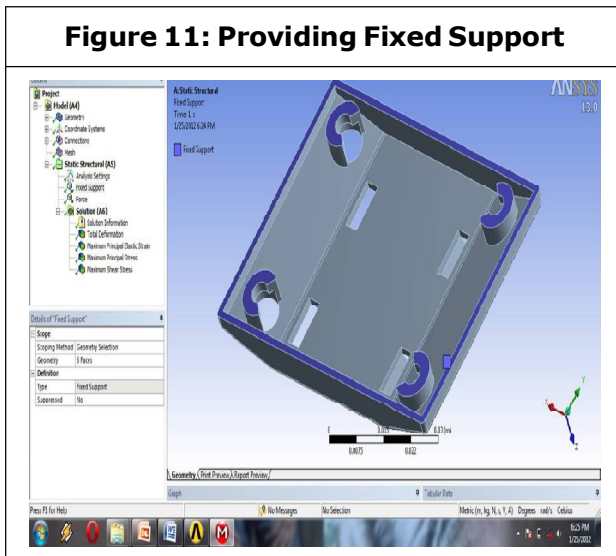
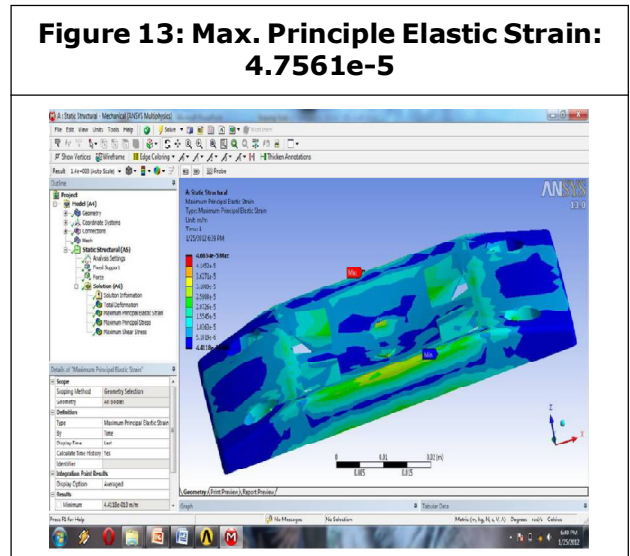


Figure 13: Max. Principle Elastic Strain: 4.7561e-5



CONCLUSION

- We have finally design a central body which is free from various moulding defects like air traps and weld lines which ultimately provide better strength and fatigue life to the body.
- We also got succeed in minimizing the fill time of the Top cover, Bottom cover and Bottom pad without any increment in the moulding defects which leads better productivity and hence more products/ shift.
- We successfully designed a family mould which minimizes the cost of moulding by 20 lacs and ultimately saves 20 lacs of the company.
- The fatigue life of the bottom pad by using ANSYS 13.0 has been done successfully by which the various stress level can be tested. 🌀

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