

Static analysis of Shaft (EN24) of Foot Mounting Motor using FEA

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Abstract-*This paper is about static analysis of foot mounted motor which is also known as (EN24)type motor by using FEA software ANSYS 14.5 and modeling is done with help of CATIA V5 R20. This is the special problem which is observed by Laxmi Hydraulics Pvt. Ltd Solapur, Maharashtra, India. They have reported frequent failures of this type of Shaft. .*

Key Words:Static analysis, Foot Mounting Motor, CATIA V5, FEA

1. INTRODUCTION

In industry there are various requirement of motion for which we are using prime movers like Motor or Engines. Motors are widely used as prime movers as it gives uniform motion and control of speed and direction is easy as compared to engines. There are few types of motors which are classified on basis of mounting methods. These are as follows:

Types of motor

B3- Foot mounting motor

B 5- Flange mounting

B 14-Face mounting

B 34-Foot cum face mounting

B 35-Foot cum flange mounting

B3 type is a motor in which foot is bolted to wall on which whole motor is mounted. So that entire weight of a motor is going to act on foot. This is the case which is somewhat similar with cantilever beam of motor shaft. This type of motor is used at elevation places like overhead cranes, overhead machines etc. the R & D department of Laxmi Hydraulics departments has given the dimensions of foot of B3 motor.



Figure 1:Foot mounting B3 type motor

2. FEA ANALYSIS OF FOOT (B3) TYPE MOTOR

Analysis can be defined as the process of breaking a complex topic into finite i.e. smaller parts for better understanding of it. The technique has been applied in the study of mathematics and logic since before Aristotle (384–322 B.C.), though analysis as a formal concept is a relatively recent development.

Basically in mechanical engineering the word analysis which comprises two phases out of which one is modeling and another is analysis. In this paper the analysis is carried out with help of ANSYS 15 and Modeling is done with CATIA V5 R20.

2.1 MODELING OF B5 FOOT

Actual dimensions obtained by the firm are as follows:

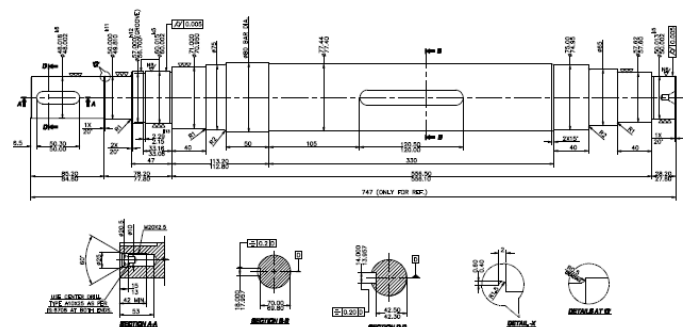


Figure 2:Actual dimensions of shaft of foot type motor

The modeling is done with CATIA V5 R20. All the dimensions are taken as per given by the firm.

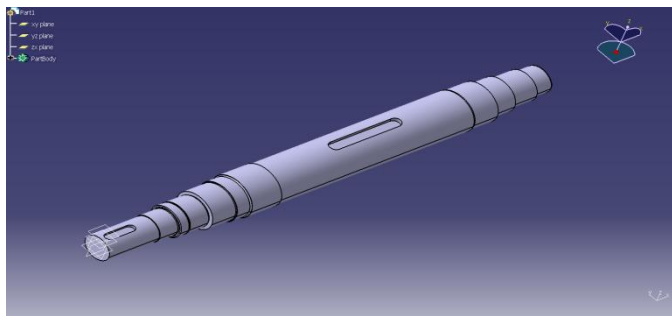


Figure 3: CATIA model of shaft of foot type motor

For analysis though the analysis tool is available in CATIA but ANSYS software gives more accurate and correct prediction about the failure of flange. The first phase is modeling the joint using CAD software.

The model geometry was generated using CATIA software and then imported as a neutral file in ANSYS

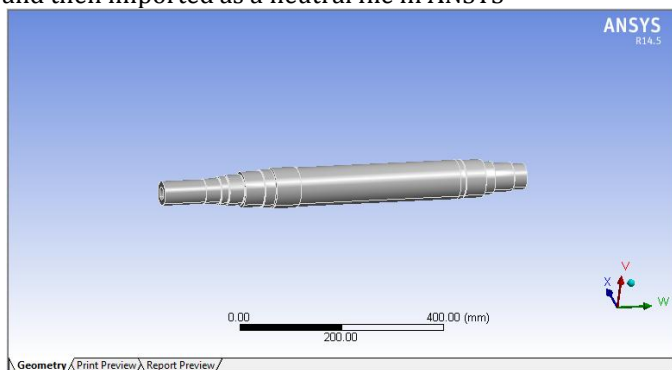


Figure 4: CATIA model of shaft of foot type motor in ANSYS

2.2 MESHING

Next, the prepared geometric structure is reproduced by finite elements. The finite elements are connected by nodes that make up the complete finite element mesh.

Each element type contains information on its degree of freedom set (e.g. translational, rotational, and thermal), its material properties and its spatial orientation 3D-element type's solid brick 8 node. The mesh was controlled in order to obtain a fine and good quality mapped mesh. The shaft has 36426 nodes and 21642 elements.

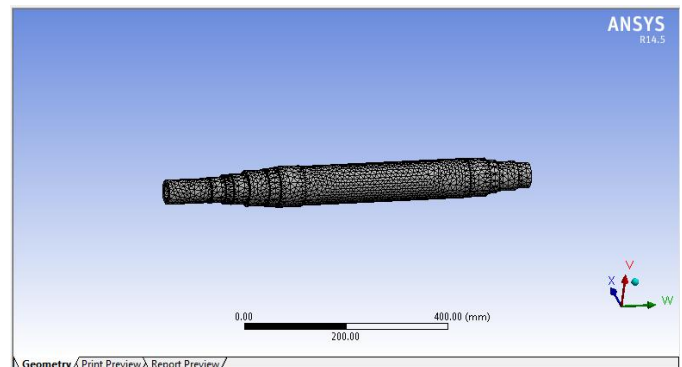


Figure 5: Meshing

2.3 LOAD APPLICATION

In order to solve the resulting system equation, boundary and loaded conditions are specified to make the equation solvable. In our model, shaft one end fixed and other end has different axial loads were applied. The Torque variation in range of 285 N-m to 287 N-m on user end of the shaft is applied.

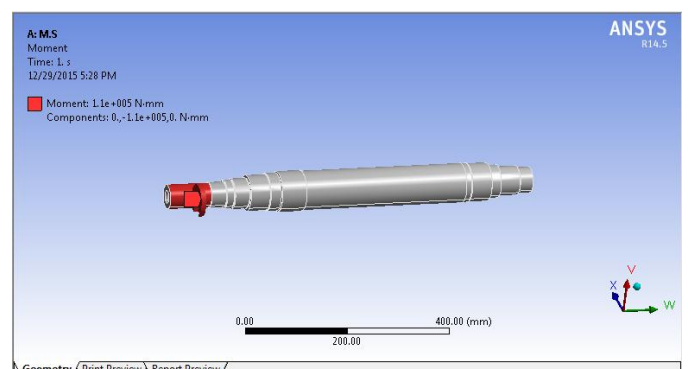


Figure 6: Load application (Torque)

3. RESULTS

As analysis finishes, the result as shown in fig is found

3.1 STRESS ANALYSIS

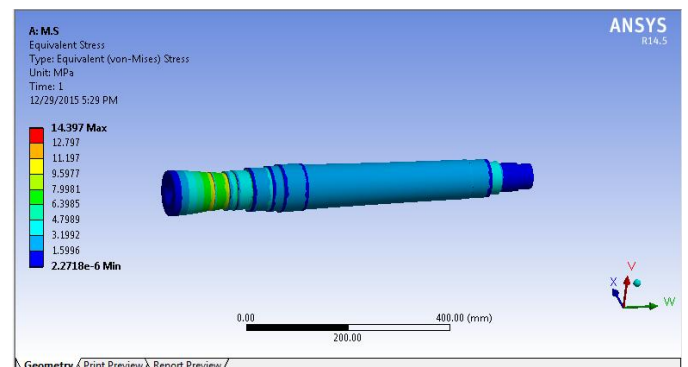


Figure 7: Stress distribution on the Shaft.

Fig shows the stress distribution on the flange. It indicates that the range of the stress is 0.00022 to 14.39Mpa. The maximum stresses are developed at the bearing recess region around 14.39 Mpa.

3.2 DEFORMATION

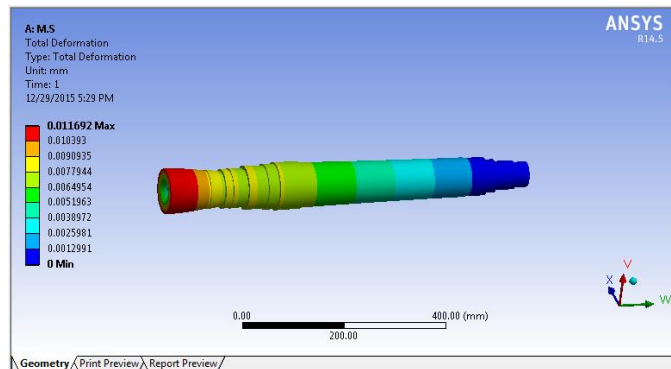


Figure 8: Deformation change.

Figure indicates the deformation of shaft because of the load. The maximum deformation is occurs at the region of the bearings recess (0.011 mm).

4. RESULTS

Table -1: Results

Sr. No.	Material	Equivalent stress (MPa)	Total Deformation (mm)	Load (N-m)
01	C.I. (F.G. 200)	14.39	0.011 mm	286

5.CONCLUSION

The equivalent stresses for C.I. EN24 motor shaft are as shown in a Table 5. The Maximum equivalent stress for the same is 14.39 Mpa , which is safe for the given material by considering allowable strength (160 Mpa) of the C.I. by taking factor of safety into account.

The total deformations for the same 0.011 mm which is less as compared to existing material.

6. REFERENCES

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