Proceedings of National Level E-Conference on "Science & Technology"
Organized by Shahajirao Patil Vikas Pratishthan's
S. B. PATIL College of Engineering Indapur, Maharashtra, India
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT]
ISSN No.: 2394-3696, Website: ijiert.org, Held on 15th and 16th June 2020.

DESIGN ANALYSIS AND OPTIMIZATION OF CENTRIFUGAL BLOWER

Prof. Kshirsagar S.R* MaheshShinde[1] ShubhamNandgude[2] DipakSalunkhe[3] PoojaMagar[4]

*Associate Professor, [1,2,3,4]Student of

S. B. Patil College of Engineering, Indapur , Pune-413106, Maharashtra, India sanjay_shreyas@gmail.com*, shindemahesh1011@gmail.com[1], shubhamnandgude729@gmail.com[2],salunkhed12@gmail.com[3],poojamagar8390@gmail.com[4]

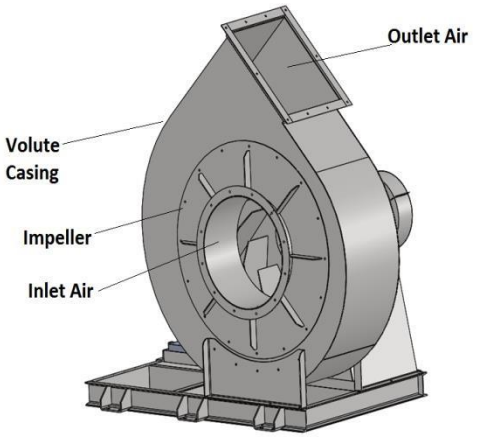
Abstract-

Blower is used to deliver the air or gas with an appreciable rise in pressure again the flow resistance. It is an important role in various industries for air-conditioning systems, furnaces and dust or fume extraction systems Based on the input data the design calculations has been carried out and modelled using SOLIDWORKS. The clean-up and meshing are carried out in CFD Analysis The Main Aim Behind these Project for increase energy efficiency & constant air flow delivery that enable them generate energy of up to 84% efficiency. Done the CFD investigation for getting improved parameter blend utilizing prepare. This will provide optimised design of centrifugal blower This paper gives the solution to above problems by optimization of centrifugal blower impeller by static and modal analysis using FEA for the material MS.

Keywords- Blower, FEA Analysis, Optimization, Solidworks, Rotor, Backward-Curved Blade, Analysis Of Impeller

1. INTRODUCTION

A centrifugal blower is a mechanical device used for moving air or other gases.The terms "blower" and "squirrel cage blower" (because it looks like a hamster wheel) are much of time utilized .These blowers increase the speed of air stream with the rotating impellers. Centrifugal blowers are measure utilized in totally different industrial applications, that square measure skill ful of as long as restrained to hard-hitting rise and flow rates blower will increase we referred



Fig[1]. Main Assembly of Centrifugal Blower

Centrifugal blowers square measure primarily 2 main components, namely, the casing and also the blade. The blade is commonly thought of AN integral a part of the suction motor since its housings and also the motor square measure assembled as a unit.The blade, driven by the blower shaft adds the rate element to the fluid by centrifugally casting the fluid off from the blade vane tips. The key plan here is that the energy created is K.E.the quantity of energy given to the fluid corresponds to the rate at the sting or vane tip Addison (1995) established that the quicker the blade revolves or the larger the blade is, the upper are the rate of the fluid at the vane tip.

2. LITERATURE REVIEW

The performance of the fan obtained by totally different fan laws. thus ton of stress is given to know the essential theory of fans, their sorts and their operating. the choice of vital parameters is incredibly essential and determinative the performance of the fans [5].

The basic equations in the main continuity equation, momentum equations and energy equations have to be compelled to be thought of whereas following the procedure fluid dynamics approach. whereas considering any sensible downside the most effective turbulence model and order of accuracy has to be selected permanently results [6].

When finishing up the planning optimization of centrifugal fans, centrifugal blower wherever the mass flow variation is controlled by mobile ante rotor and not by speed variation of the electrical motor [7]. For vibration analysis of blower have to be compelled to understand the parameters that cause vibration and additionally the tactic to live vibration with correct setup arrangements [8]. because of vibration the lifetime of bearing of blower is reduced. The lifetime of bearing will be improved by carrying corrective actions on blower & modifying its accessories like journeyman block to forestall bearing failure [9].

To improve the in operation stability of a centrifugal blower, separate cavities area unit introduced simply upstream of the vane associate degreed optimized for any improve the in operation stability we have a tendency to referred optimisation of vibrations in an exceedingly centrifugal blower to boost in operation stability by Panax quin quefolius Bum Ma Kwang YongKim
[1] They did experimental study on noise reduction and performance of an industrial centrifugal blower .they compare noise characteristic of FC blades and before Christ blades. And then, some totally different volute geometric configurations we have a tendency tore disbursed and also the performance associate degreed noise of the FC blades centrifugal blower will be increase we referred Experimental study on the noise reduction of an industrial forward-curved blades centrifugal blower by ki Datong MaoYijun LiuXiaoliang Yuan Minjian [3].

The process reveals that optimisation of the first pure mathematics of blower, at 1.5 times breadth of vane, 24° tongue angle and 100 percent reduction in volute outer radial locations, pressure head and flow uniformity will increase compared to alternative cases we have a tendency to referred optimisation of centrifugal blower volute by Beena D.BaloniYogeshPathak and S.A. Channiwala [4].

3. METHODOLOGY:

1. Getting parameters of old blower
2. Calculation of optimized parameters
3. Modelling parts of blower
4. Selection of material
5. Fabrication drawing
6. .Finite Element Analysis (FEA)
7. Bill of material
8. Costing

4. PROBLEM DEFINATION:

Concern industry manufactures blowers and supplies it to cement industry, it is found that they are facing many problems regarding centrifugal blower. They are using centrifugal blower for ventilation purpose, also they are using blower to also more power consumption of cement equipment, The present centrifugal blower is made up of from AISI 4340 steel (M.S) material here corrosion is a major problem.& also weight of the present blower is high, and strength of impeller is less & High pressure drop generated due to high back Pressure & also Corrosion in pipe lines, cylinder and other components & Increase in downtime

5. RESULTS & DISCUSSION

5.1 Material Selection:

For basic parts of blower we have used material AISI 4340 Steel (MS). Thus for Rotor we have used AISI 304 Steel due to which increase resistance against corrosion and durability of the structure

Material was Selected by ASHBY Chart. In which AISI 304 steel material was selected .in properties model type is linear elastic isotropic. For failure criterion we used Max-Van Misses Stress..

5.2 Material selection based on Ashby Charts

- **Four basic steps**

1) ***Translation:*** To express design requirements for the constraints & objectives
2) ***Screening:*** eliminate materials that can't do the work
3) ***Ranking***: find the materials that do the work best
4) ***Supporting information***: explore pedigrees of top-ranked candidates

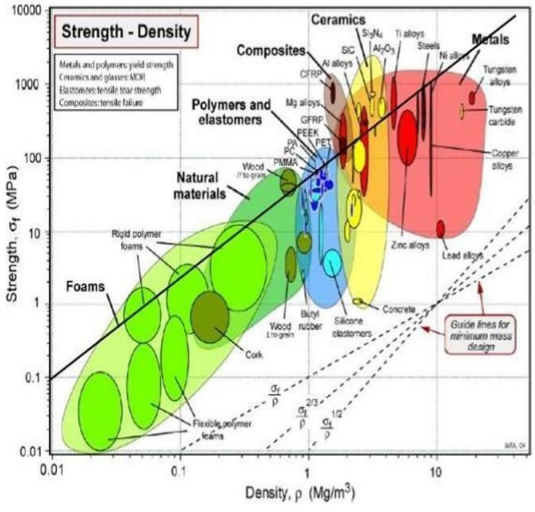


Fig2. Ashby Chart

5.3 Finite Element Analysis (FEA):

As we see there are three report of FEA analysis generated. rotor of the centrifugal blower was selected for optimization for different thickness of rotor are 5mm , 3mm, 8mm Respectively

In this we have done analysis type of static, Which has a solid mesh type. Here we used SI system of unit for measurement. In which Length or Displacement is in mm, Temperature is in Kelvin, angular velocity in Rad/sec, Pressure or Stress in N/m2.

ROTOR:-In these fea analysis of Rotor are rotor material is Same & only varied the thickness of rotor

1) Meshing Of Rotor

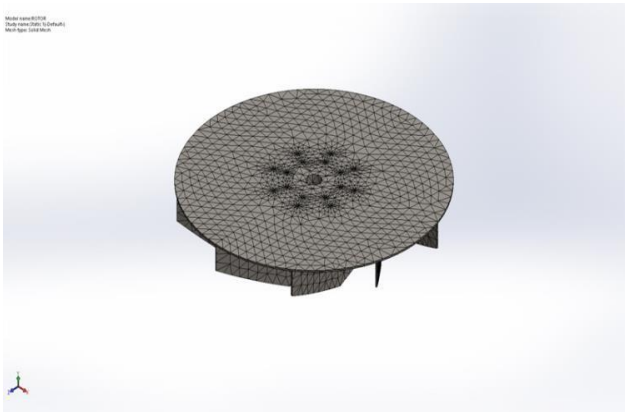


Fig3.Meshing Of the Rotor

No. of Nodes	No. of Elements	Element Size	Type of Meshing
31060	16839	46.3135 mm	Solid Mesh

Table1.1: Nodes & Elements

2. *Von Mises Stress*

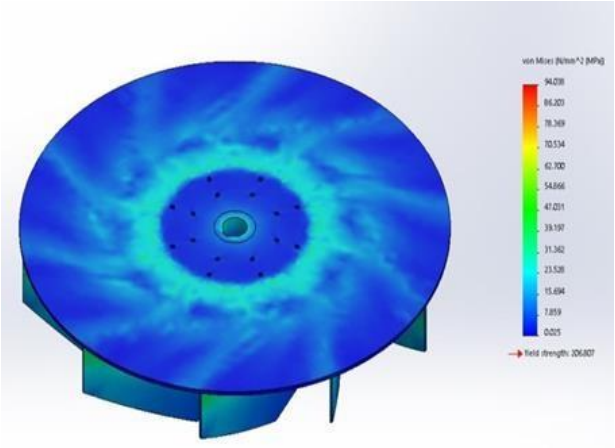


Fig4. Rotor :-Stress

After doing FEA for AISI 304 Steel (MS) material we found out minimum &maximum stress is 94.038N/mm & 0.025N/mm^2 respectively

3) Displacements

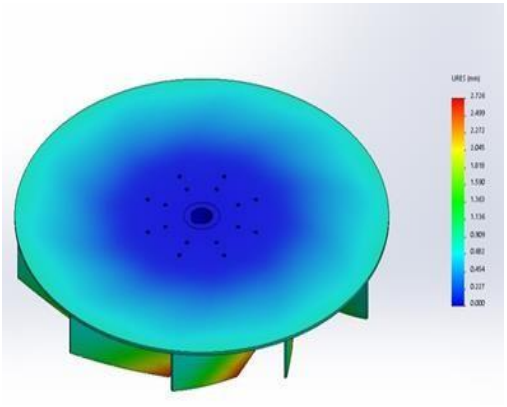


Fig 5. Rotor :-Displacement

After doing FEA for AISI 304 Steel material we found out minimum & maximum displacements is 0.0 00mm & 2.726 mm respectively

4) Factor Of Safety

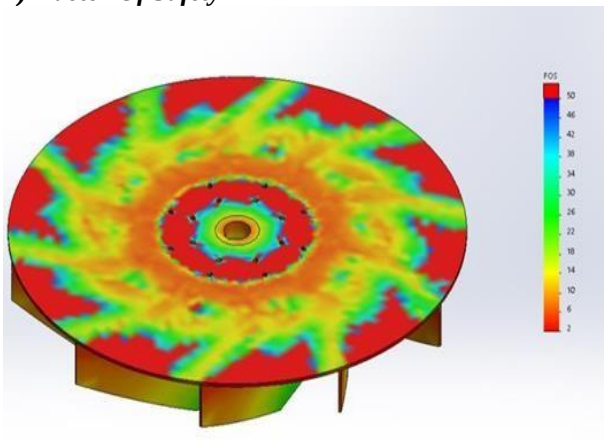


Fig6. Rotor :- Factor of Safety

After doing FEA for AISI 304 Steel (MS) material we found out minimum & maximum factor of Safety is 2 & 80 respectively

5). Analyze The Rotor Size Of Centrifugal Blower For Different Thickness

Sr. no	Rotor Thickness	Material	Von-Misses stress	Max Displace-ments	Max factor of safety
1.	3 mm	AISI 304	94.038N/mm	2.726 mm	8.38e+03
2.	5 mm	AISI 304	52.408N/mm^	1.519 mm	1.89e+04
3.	8 mm	AISI 304	21.814N/mm^2	0.633 mm	3.36e+04

Table 1.2 Result table

6. CONCLUSIONS :-

As we observed above result value we understand that property of Rotor of centrifugal blower improved without changing material properties.

1. According to stress theory 3mm Rotor size of material is highly sustainable So select the 3mm size of rotor for optimization

2. In displacement we observe that stress is directly proportional to displacement

3. As factor of safety is large of 3mm thickness of Rotor material than Safety of material Also increases

REFERENCES

[1] Mechatol Engineering Solutions pvt. Ltd.
[2] Bureau of Energy Efficiency, “Fans and Blowers”, 96
[3] Ma, Sang-Bum, and Kwang-Yong Kim. "Optimization of discrete cavities in a centrifugal compressor to enhance operating stability." Aerospace Science and Technology 68 (2017): 308-319.
[4] Baloni, Beena D., Yogesh Pathak, and S. A. Channiwala. "Centrifugal blower volute optimization based on Taguchi method." Computers & Fluids 112 (2015): 72-78.
[5] Yahya S M. 1998. Turbines Compressors and Fans. Tata Mc-Graw Hill Edition.
[6] Anderson J.D. 2012. Computational fluid dynamics. Tata Mc-Grew Hill Edition
[7] Bogdam Gherman, Cristina Silivestru and Marian Draghici, Aerodynamic geometry optimization of a centrifugal blower
[8] Asad Said Jama Al Zadjali and G.R Rameshkumar, Condition monitoring of centrifugal blower using vibration analysis
[9] B.A Kardile, Bearing life improvement of centrifugal blowers