FEA Analysis of Components in Leak Testing Machine

Ramprasad Shetti[#], Mayur Appaiah*

[*]*Asst. Professor*

[#, *] *Department of Industrial Engineering & Management,*

B.M.S. College of Engineering, VTU PG Extension Centre, Bangalore-560019, Karnataka, India

***Abstract*- This paper is regarding the design of the leak testing machine which can test 4 filters at a time which is connected to the Cylinder activation. After the machine is designed various issues are addressed which occurred during testing of the machine.**

***Keywords* -Leak Testing, Prototyping, Activation, Linear motion, Clamping.**

I. INRODUCTION

Leak test machine is predominantly used by the filter manufacturing industries for end of line leakage testing of multiple filters to be tested at a given time, It checks for common defects in leak tests they are voids, pores, weld failure and goodness of fit. FEA tools were used to predict the maximum loads during service condition

The Leak testing machines consists of the below parts

1. Hinge mechanism
2. Plunger
3. Rod Guide
4. Floating Plug,
5. Bushing
6. Frame
7. Tank
8. Cover
9. Installation Board.
10. Control Panel box

The leak Testing machine schematic is as shown in Fig 1. The compressed air enters into the set up and it should not show the bubble for 20 sec

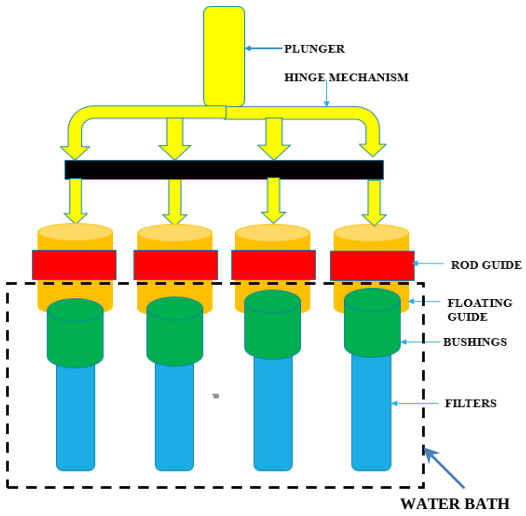

Fig 1: Single Station Leak testing machine

A. CFD analysis done on the pipe:

The CFD analysis on the pipe showed uniform flow, no supersonic flow was observed, The graph is as shown below,

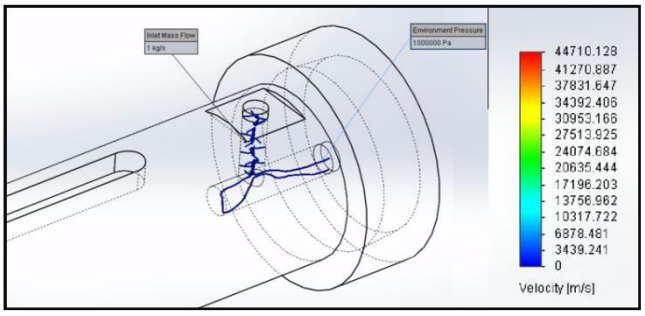

Fig 2: CFD analysis of the pipe

Load analysis on the system was done and was analyzed for the above mechanism, all the load is getting transferred to the bushings and as result proper clamping of the filter with the bushing do not take place.

Initially the team had decided to go for a brass bushing, but brass has is slippery in nature due to its sticky characteristics.

Also below analysis was done on bushing changing the material of the bushing.

B. Von mises stress considering brass as the material

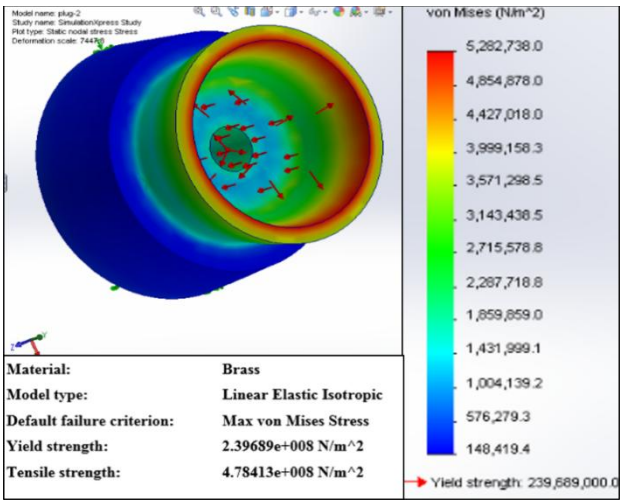

Fig. 3: Von Mises Stress plot for brass material

C. Von mises strength considering steel as the material

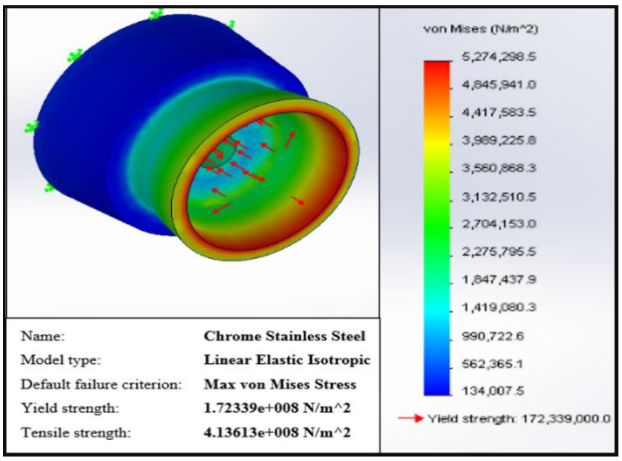

Fig. 4: Von Mises Stress plot for steel material

Von mises stress results for brass and the steel material were similar and also the factor of safety plot showed the same results when FEA analysis was done.

D. Factor of safety plot considering brass as the material

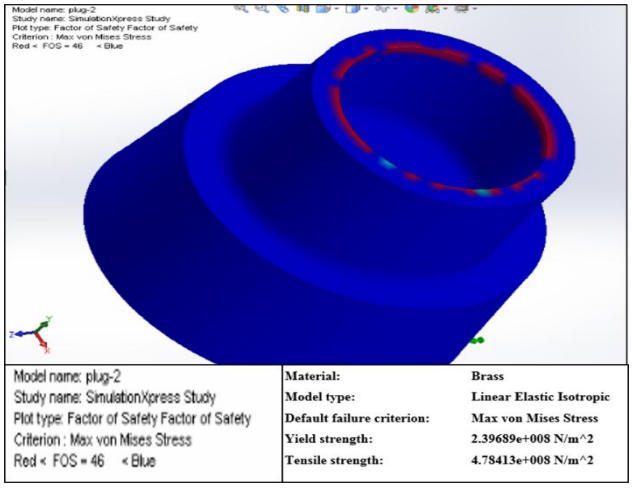

Fig. 5: Factor of safety plot for brass material

E. Factor of safety plot considering steel as the material

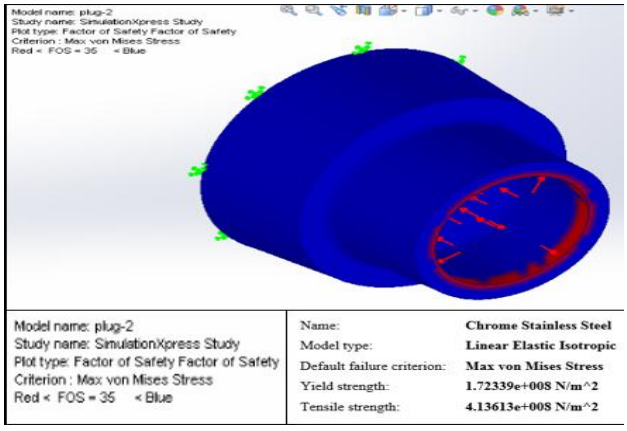

Fig. 6: Factor of safety plot for steel material

F. Static Displacement Analysis Made on Brass Bushing.

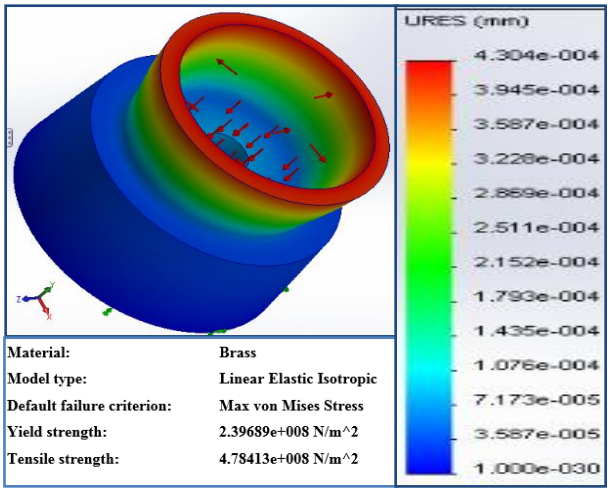

Fig 7: Static displacement analysis done on Brass bushing

G. Static Displacement Analysis Made on Steel Bushing.

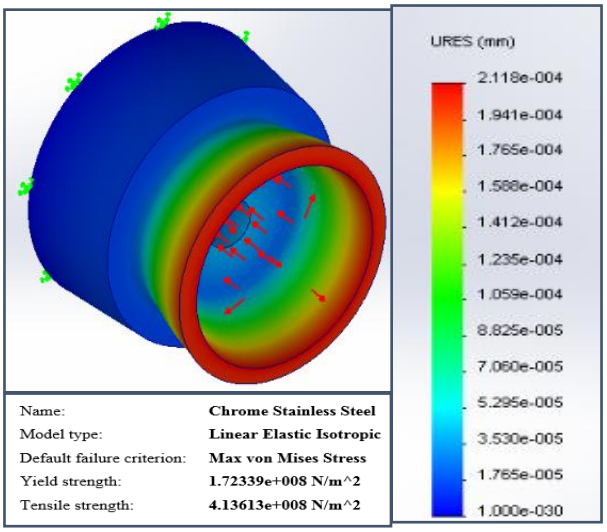

Fig 8: Static displacement analysis done on Steel bushing

By the analysis reports what we conclude is the strength of the brass is better than that of steel. But the Static Displacement of the steel is better than that of brass. And commercial point of view Steel Bushings are having lesser cost. Also steel bushings are easily available in market. So steel bushing was selected. Based on the above analysis new design of leak testing machine was proposed which calls for a 4 station cylinder setup which contributes to ease of assembly, reuse of the single station Cylinder. Also stainless steel parts are used for fabrication. The 4 station leak testing machine concept is as shown below

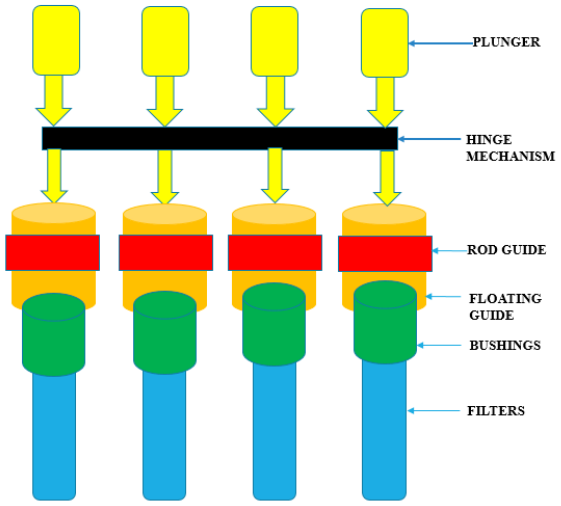

Fig 9: Four Station Leak testing machine

II. CONCLUSION

From the above discussions, the concept which had the 4 station set with the steel bushing was the final design for the leak testing machine.

CFD analysis done on the pipe showed the good results and FEA analysis done on the bushing helped to change the material of the bushing to steel.

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