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# Design And Development In Self Centering Vice For Friction Welding Machine

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***Abstract***

*This paper deals with the designing a self-Centering vice for Friction Welding Machine. Friction welding is a solid-state welding process that generates heat through mechanical friction between work pieces in relative motion to one another, with the addition of a lateral force called "upset" to plastically displace and fuse the materials. The self- centering vice is use for holding a non-rotating job during a welding operation. In industry vice used has some limitations like stroke of vice and slippage between job and holding tool. As Stroke of Vice is limited which results into increase in tooling cost of bowl for various dimensions. The stroke of the vice is increased by increasing bore length of cylinder block which results into cylinder block come closer than previous clamping position. Analysis is conducted for bore length of cylinder block.*

*Keyword- Self centering vice, friction welding technology, hydraulics, Ansys, Finite element analysis.*

## I. INTRODUCTION

In conventional friction welding, relative rotation between a pair of workpieces is caused while the work pieces are urged together. Typically, thereafter once sufficient heat is built at the interface between the workpieces, relative rotation is stopped and the workpieces are urged together under forging force which may be same as or greater than the original urging force.

Self-centering vises is used with horizontal or vertical machinery and are especially beneficial for milling, drilling and finishing applications that require high levels of accuracy. Benefits of self centering vises include quick fixturing, increased accuracy, and improved efficiency.

A self-centering vice is a holding device that automatically adjusts the workpiece to center. It is one of the most important components for friction welding machine. It is used to clamp a non-rotating object during a welding process. In friction welding process the two parts which have to be weld together should be align in common axis and here self centering mechanism of vice plays an important role. which improves machining precision and reputability of job.



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A self centering operation is done with rack and pinion mechanism. The clamping of non-rotating workpiece is done by two- cylinder blocks which are hydraulically operated.At the beginning of friction welding operation clamping force of vice should be greater than welding torque otherwise slippage of job will occur which disturb a welding process. Now self centering vice used in a friction welding machine have some limitations which decreases machine efficiency, in this project we are going to modify a self-centering vice.

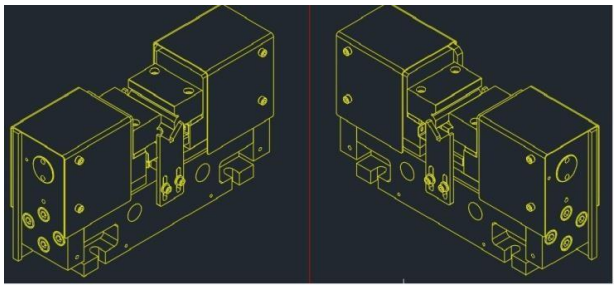

Fig. 1 AutoCAD 3D Model of Self Centering Vice.

## II. CYLINDER BLOCK

In self centering vice, clamping operation is done by the cylinder block and bowl. The bowl is connected to the cylinder block and sliding movement of block is produces with the help of force exerted by hydraulic pressure and slide over a guide plate. Piston is fitted in bore of the cylinder block with the help of retainer plate and most important thing here piston is remains stationary and only cylinder block is moving along with bowl.

This fixed position of piston raised a limitation in stroke of the vice. Because of this in a industry for a different welding diameters, different size of bowl are used which increases tooling cost. To overcome this problem its necessary to increase a bore a length and analyze it for particular loading condition. The FEA results are shown in following fig.

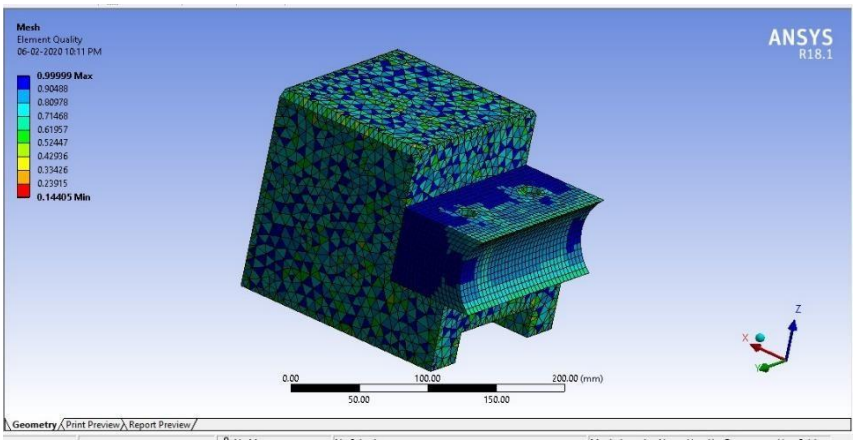


Fig.2 Hexagonal fine meshing used in Ansys.



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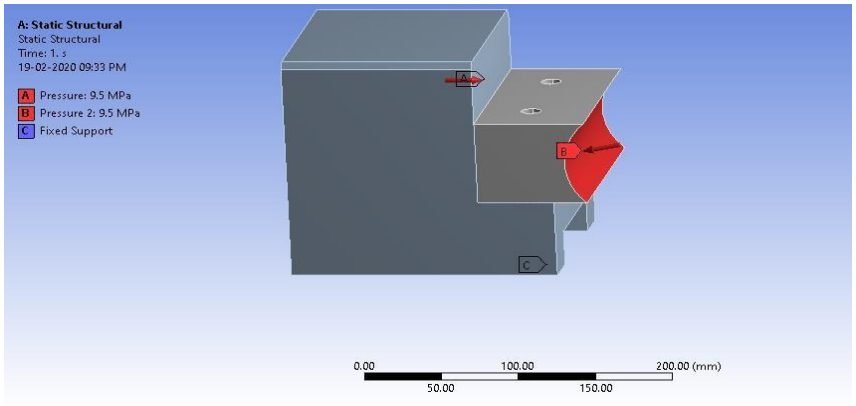


Fig.3 Load condition in a clamping position

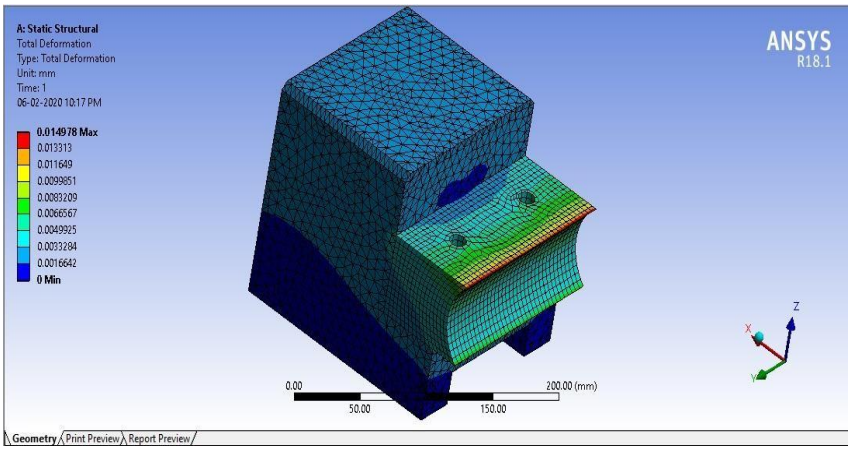


Fig.4 Total deformation for given load condition.

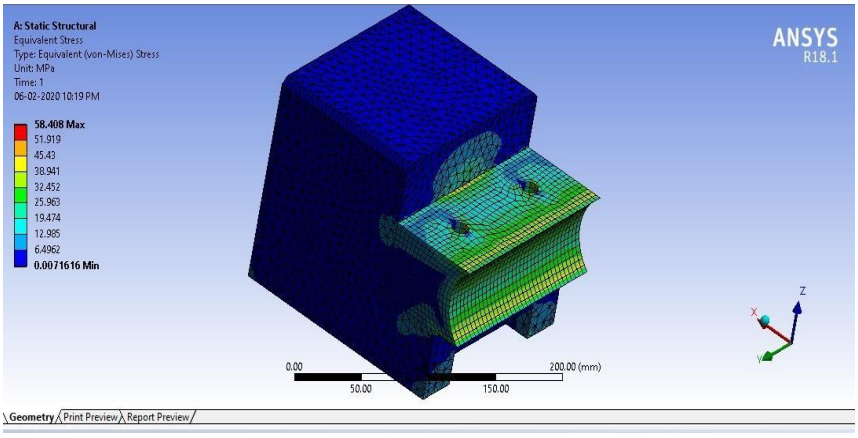


Fig.5 Overview of Equivalent stress.



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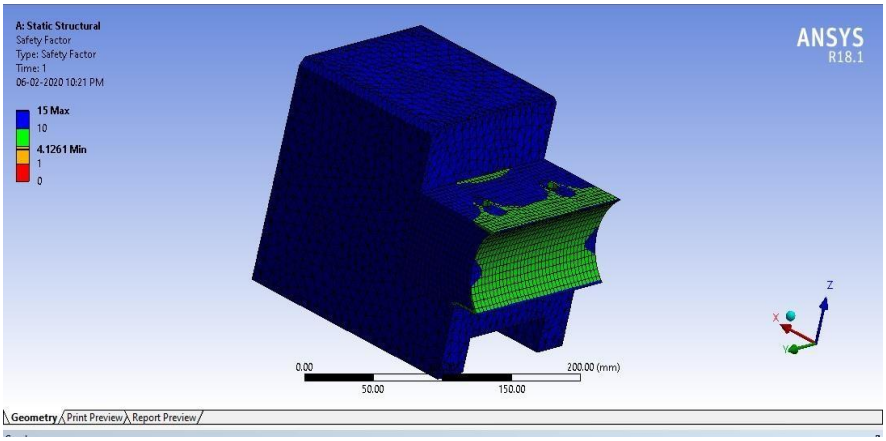


Fig. 6 Factor of safety at load condition.

At the beginning of a welding process the slippage is occurred between workpiece and bowl which affects weld quality. If Slippage is occurred over more period of time then welding process will not take place. The slippage produced in vice because of clamping force supplied by cylinder block is less than welding torque supplied by motor. Thus, If we have to avoid slippage then clamping force must be greater than welding torque.

In short, to avoid slippage then the ratio of clamping force to welding torque must be greater than 1. The following calculations are used to overcome this problem.

**Slippage calculation: -**

To avoid slippage issue in between handling tool & welding job following points should be consider: -

1) The ratio of Clamping force to welding torque must be greater than one.

$$\frac{\text{clamping force}}{\text{Welding torque}} > 1$$

2) Selecting of motor:

**Parameters of Work piece: -**

Material – EN24 Diameter – 30 mm

**Parameters of Hydraulic Vice: -**

1) Hydraulic Pressure = 90 bar,
2) Piston Diameter = 95 mm,



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**Step 1: - To** find clamping force

**I.** Cylinder Area = $\pi \times d^2$

$= \frac{\pi \times 95^2}{4}$

$= 7088.21 \times 10^{-6} m^2$

**II.** Force = Pressure × Area

$= 90 \times 10^5 \times 7088.21 \times 10^{-6}$

$= 63793 \times 2 = 127856$ N

**Step 2: -** To Find Welding torque: -

1) Require RPM for material EN24 to deform in plastic state =1500rpm (From Research paper)
2) Motor selected: MAD100C (from manual of Bosch Rexroth motor)
3) Peak power = 15.38KW

$\overline{Power} = \frac{2\pi NT}{60}$

T = 48956 N-m

**Step 3: -** Ratio of clamping force to welding torque

$\frac{\text{Clamping Force}}{\text{Welding torque}} = \frac{127856}{48956} = 2.611$

## III. CONCLUSION

The model analysis of cylinder block for given load condition is studied and model is analyzed by using Ansys 18.1. The component is studied for their quality indexing to insure a proper meshing of the component. Determination of bore length and material of cylinder block is done. The results are presented in above figures.



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**REFERENCES**

[1]. A. Ambroziak and M. Winnick, "Examination of coefficient of friction welding process of tubular steel", Archives of matallurgy and Material,2011:56(4), pp. 256-262.

[2]. Shinde Gurunath and Dabeer Prakash, "Experimental investigation in friction welding technology", International Conference on Science &Engineering for Sustainable Development ,2017, pp. 373-384.

[3]. Madhavan V. Alvise D.and Lepot I." Optimization of welding parameter for the continuous drive rotory friction welding process", International conference of the international institute of welding, chennai India,2011, pp. 110-112.

[4]. Ragunathan S., Balasubramanin V, Rao A.G. "Effect of welding processes on mechanical and microstructural characteristics of high strength low alloy naval grade steel joint", Tamilnadu, India,2015, pp. 308-317.

[5]. Samuthiram G., Vijaykumar P.," Evalution of mechanical properties of fraction welded joints of EN-24 steel cylinderical rods", International Journal of Mechanical Engineering and Robotics Research, 2014, pp. 431-438.

[6]. Bosch Rexroth AG "Rexroth Indradyn a Asynchronous Motors MAD/MAF", Dept. DC-IA/EDM3, Gremany,2011, pp. 85.



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