ISSN 2395-695X (Print)
ISSN 2395-695X (Online)
International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)
Vol. 2, Special Issue 15, March 2016

A DESIGN AND FABRICATION OF FIXTURE FOR STATOR CORE MACHINE

[1] P.Arivuselvan
P.G Scholar, M.E.
Department of Mechanical Engineering
Mahath amma institute of Engg and Technology,
Pudukkottai,Tamilnadu
arivuselvan98@gmail.com

***Abstract*– In this new millennium where reduction of pollution is essential, renewable source of energy has become viable alternative for the tradition fossil based fuel energy. One source of renewable energy is the wind energy. Here wind energy which is potential energy is converted to kinetic energy with the help of wind turbines. The manufacturing of wind turbines is a very complex process. Two clamping Elements (Four Jaws and Mandrel) should be used in order to complete Machining and Dialing process. Positioning accuracy will differ from component to component. Clamping Method is difficult. Initial settings should be set every time a work piece is loaded**

***Index term*–** *Milling, Drilling Fixtures, Tolerances*

I.INTRODUCTION

A fixture is a work-holding or support device used in the industry. Fixtures are used to securely locate (position in a specific location or orientation) and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchangeability. Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part, reducing the requirement for skilled labour by simplifying how work pieces are mounted, and increasing conformity across a production run[1].

A fixture's primary purpose is to create a secure mounting point for a workpiece, allowing for support during operation and increased accuracy, precision, reliability, and interchangeability in the finished parts. It also serves to reduce working time by allowing quick set-up, and by smoothing the transition from part to part. It frequently reduces the complexity of a process, allowing for unskilled workers to perform it and effectively transferring the skill of the to the unskilled worker[2]. Fixtures also allow for a higher degree of operator safety by reducing the concentration and effort required to hold a piece steady.

Economically speaking the most valuable function of a fixture is to reduce labour costs. Without a fixture, operating a machine or process may require two or more operators; using a fixture can eliminate one of the operators by securing the workpiece[10][6].

Milling Fixtures Milling operations tend to involve large, straight cuts that produce lots of chips and involve varying force. Locating and supporting areas must usually be large and very sturdy in order to accommodate milling operations; strong clamps are also a requirement. Due to the vibration of the machine, positive stops are preferred over friction for securing the workpiece. For high-volume automated processes, milling fixtures usually involve hydraulic or pneumatic clamps [7].

Because drills tend to apply force in only one direction, support components for drilling fixtures may be simpler. If the drill is aligned pointing down, the same support components may compensate for the forces of both the drill and gravity at once. However, though monodirectional, the force applied by drills tends to be concentrated on a very small area. Drilling fixtures must be designed carefully to prevent the workpiece from bending under the force of the drill [8].

II. RELATED WORKS

Collect all relevant data and assemble it for evaluation. The main sources of information are the part print, process sheets, and machine specifications. Make sure that part documents and records are current. For example, verify that the shop print is the current revision, and the processing information is up-to-date. Check with the design department for pending part revisions.

An important part of the evaluation process is note taking. Complete, accurate notes allow designers to record important information. With these notes, they should be able to fill in all items on the "Checklist for Design Considerations." All ideas, thoughts, observations, and any other data about the part or fixture are then available for later reference. It is always better to have too many ideas about a particular design than too few.

Four categories of design considerations need to be taken into account at this time namely workpiece specifications, operation variables, availability of equipment, and personnel. These categories, while separately covered here, are actually interdependent. Each is an integral part of the evaluation phase and must be thoroughly thought out before beginning the fixture design.

Workpiece specifications usually are the most important factors and have the largest influence on the fixture's final design. Typically, these considerations include the size and shape of the part, the accuracy required the properties of the part material, the locating and clamping surfaces, and the size of the run. Availability of equipment required to machine, assemble, and inspect a part often determines whether the fixture is designed for a single part or multiple parts. A process engineer sometimes selects the equipment to machine parts before the tooling designer begins the design. The tooling designer should verify what equipment will be used for each operation.

A vertical milling machine, for example, is well suited for some drilling operations. But for operations that require a drill jig, a drill press is the most cost-effective machine tool. Typically, equipment criteria include the following factors: types and sizes of machines, inspection equipment, scheduling, cutting tools, and plant facilities.

Personnel considerations deal with the end user, or operator, of the equipment. Fixture designers should put themselves in the machine operator's shoes and consider all the operational scenarios they can. Designers should consider not only correct usage of the fixture, but also possible incorrect usage. They must ask if there is any way for the operator to get hurt while operating this equipment. Additional factors usually considered in this category are operator fatigue, efficiency, economy of motion, and the speed of the operation. The designer also must know and understand the general aspects of design safety and all appropriate government and company safety rules and codes.

III. SYSTEM ARCHITECTURE

In analyzing fixture costs, the emphasis is on comparing one method to another, rather than finding exact costs. Estimates are acceptable. Sometimes these methods compare both proposed and existing fixtures, so that, where possible, actual production data can be used instead of estimates.

To evaluate the cost of any workholding alternative, first estimate the initial cost of the fixture. To make this estimate, draw an accurate sketch of the fixture. Number and list each part and component of the fixture individually. Here it is important to have an orderly method for outlining this information

The next step is calculating the cost of material and labour for each tooling element. Once again it is important to have an orderly system for listing the data. First list the cost of each component, then itemize the operations needed to mount, machine, and assemble that component. Once those steps are listed, estimate the time required for each operation for each component, and then multiply by the labour rate. This amount should then be added to the cost of the components and of the design to find the estimated cost of the fixture.

The total cost to manufacture a part is the sum of per-piece run cost, setup cost, and tooling cost. Expressed as a formula:

$$\text{Cost per part} = \text{Run cost} + \frac{\text{Setup cost}}{\text{Lot cost}} + \frac{\text{Tooling Cost}}{\text{Tooling quantity over toolig life time}}$$

These variables are described below with sample values from three tooling options: a modular fixture, a permanent fixture, and a hydraulically powered permanent fixture.

IV. CIRCUIT DESIGN

A. Workpiece

There are two ends in the workpiece.**1.**Drive End.2.Non Drive End.Between the Drive End and Non Drive end, there are totally 20 seperate layers.There are 2 laser cut layer of 2.5 mm thickness just below and above the compression plate at the Drive end and the Non-Drive end respectively.Each Layer consists of Laminated sheets of thickness 0.5 mm.I sections of length 9.05 mm is placed between the 20 layers. Hence the workpiece (Stator Core) consists of 1368 (72 x19) I sections. The first and the last layer consist of 98 sheets. The remaining layers consist of 70 sheets.Hence totally the Stator Core consists of 1456 sheet.Then a load of 305 kn is applied at the Drive End. This load is applied to ensure that there is no air gap between the layers of sheets.When the load is being applied, Stiffness bar is spot welded. There are two types of stiffness bar used.There are totally 8 stiffness bars spot welded vertically.There are totally 3 stiffness bars spot welded vertically. The distance between each horizontal stiffness bar is 116.25 mm

B. Existing Fixture

The current fixture is used in a Vertical Turret Lathe .The combination of Faceplate and the four jaws form the Fixture.The Fixture has the ability to rotate in various speeds for Machining and Dialling.Several T-Guide ways are provided for Clamping Jaws, Screw-jacks, etc. This Fixture has the ability to hold circular work- pieces of various dimensions.

C.Machining Process

Machining Process is done only on the outside of the Stator Core.Stator Core is made to rotate with help of a Fixture.To get the required dimension on the compression plate, Machining is done on both Drive- End and Non Drive-End.

Dialling Process

Dialling is done on the outside and the inside of the Stator Core. The Dial is mounted on the Tool Head of the VTL Machine.Stator Core is made to rotate with help of a Fixture. Dialling is done throughout the Stator Core to check the perpendicularity. Outer Dialling is carried out by clamping the Stator Core with help of Mandrel (Internal Clamping). Inner Dialling is carried out by clamping the Stator Core with help of the four Jaws (External Clamping).

V. MEASUREMENT AND RESULT

Materials for Fixture

5.1 Aluminium

Physically,chemically and mechanically aluminium is a metal like steel, brass, copper, zinc, lead or titanium. It can be melted, cast, formed and machined much like these metals and it conducts electric current. In fact often the same equipment and fabrication methods are used as for steel.

Aluminium is a very light metal with a specific weight of 2.7 g/cm^3, about a third that of steel. For example, the use of aluminium in vehicles reduces dead-weight and energy consumption while increasing load capacity. Its strength can be adapted to the application required by modifying the composition.

Aluminium naturally generates a protective oxide coating and is highly corrosion resistant. Different types of surface treatment such as anodising, painting or lacquering can further improve this property. It is particularly useful for applications where protection and conservation are required.Aluminium is 100 percent recyclable with no downgrading of its qualities. The re-melting of aluminium requires little energy: only about 5 percent of the energy required to produce the primary metal initially is needed in the recycling process.

The main disadvantage of Aluminium is that it does not possess the strength of steel. More Aluminium should be used to equate the strength of an object to steel. This will make Aluminium more expensive. It is also very easy to scratch. Hence the wear rate is very high.

Mild Steel

Mild Steel is one of the most common of all metals and one of the least expensive steels used. It is to be found in almost every product created from metal.It is weldable, very durable (although it rusts), it is relatively hard and is easily annealed.

Having less than 2 % carbon it will magnetize well and being relatively inexpensive can be used in most projects requiring a lot of steel. However when it comes to load bearing, its structural strength is not usually sufficient to be used in structural beams and girders.

Most everyday items made of steel have some milder steel content. Anything from cookware, motorcycle frames through to motor car chassis, use this metal in their construction.

Because of its poor resistance to corrosion it must be protected by painting or otherwise sealed to prevent it from rusting. At worst a coat of oil or grease will help seal it from exposure, and help prevent rusting.

Being a softer metal it is easily welded. Its inherent properties allow electrical current to flow easily through it without upsetting its structural integrity. This is in contrast to other high carbon steels like stainless steel which require specialized welding techniques.

This mild variant of harder steel is thus far less brittle and can therefore give and flex in its application where a harder more brittle material would simply crack and break.There are many different bronze alloys, but typically modern bronze is 88% and 12% Bronze is much less brittle than iron, and when it oxidizes the oxidisation is only superficial. This is due to the copper carbonate layer protecting the underlying layer from corroding further.

These copper based alloys (bronze) melt at a lower temperature to steel or iron and are more easily produced from their constituent metals. They are generally about 10% heavier than steel, however alloys that use silicon or aluminium will be considerably less dense.

Bronzes are weaker and softer than steel. If you look at bronze springs for instance, they are less stiff and therefore store less energy even when of the same bulk. It resists corrosion and metal fatigue more effectively than steel and of course it is a better conductor of heat and electricity

S.no	Material	Density	Yield strength	Ultimate strength
1	Aluminium	2.7 gm/cm^3	276 MPa	310 MPa
2	Mild Steel	7.85 gm/cm^3	320 MPa	1080MPa
3	Stainless Steel	7.9 gm/cm^3	380 MPa	671 MPa
4	Bronze	7.7 gm/cm^3	310 Mpa	620 MPa
5	Titanium	4.5 gm/cm^3	1480Mpa	1860MPa

VI. CONCLUSION

In this papaer, the old fixture was analysed and the shortcomings of the Old Fixture was noted down. Then a Fixture was designed. The shortcoming of the newly designed Fixture was analysed and the design was improved. Then suitable materials, type of joint and the type of weld was decided. Then the Fixture was Fabricated and tested. The results of the test prove that the newly designed Fixture is better than the old Fixture. The inspection time is reduced and the Tolerances have decreased.

REFERENCES

1. Rajendran, V, and Marikani A, *Materials science* Tata McGraw Hill publications, 2004.
2. Begman, *Manufacturing Process*, John Wilely & Sons, VIII Edition, 2005.
3. Philip F.Ostwald and Jairo Munoz, *Manufacturing Processes and systems*, John Wiley & Sons, 9th Edition, 2002.
4. Dieter G.E., *Mechanical Metallurgy*, Mc Graw Hill Book Company, 1988.
5. Beer F. P. and Johnston R, *Mechanics of Materials*, McGraw-Hill Book Co, Third Edition, 2002.
6. Shigley J.E and Mischke C. R., *Mechanical Engineering Design*, Sixth Edition, Tata McGraw-Hill , 2003.
7. Jain R.K., *Engineering Metrology*, Khanna Publishers, 2005
8. Sinha.B.P., *Mechanical Estimating and Costing*, Tata McGraw-Hill, Publishing Co.,1995.
9. Joshi, P.H., *Jigs and Fixtures*, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
10. K. Venkataraman, *Design of Jigs Fixtures & Press Tools*, Tata McGraw Hill, New Delhi, 2005.
11. Design Data Hand Book, PSG College of Technology, Coimbatore.