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“Design and Development of Stator Stamping Welding Fixture”

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Abstract: Fixture is used for locating, holding and supporting a work piece machining like welding of stator case frames. Fixture reduces material handling time and increase the productivity. It is required to change the fixture for the machining of the different stator case frames of different sizes in this project. The old fixture available is time consuming process and requires more material handling time. It will leads to the problem of misalignment & inaccuracy. And also there is no provision for avoiding the misalignment & inaccuracy in operation. Inaccuracy will increase the rejection of frames. If it is need to rework the rejected frames, then it becomes essential to design the special purpose machine. This new fixture will increases the machining cost of stator case frames. So this fixture useful for machining more than one stator case frames with less work setup time & reduced material handling also. The fixture consists of different spigots which are provided on spigot plate to accommodate different stator case frames. Thus there is no need to change the fixture for every stator case frame of different size. As the single fixture is used for different stator case frames, the manufacturing cost of fixture is reduced. The productivity is increased and required manpower for manufacturing is reduced.

Keywords: jig, fixture, weld ability, sensitization, fusion, stamping plate, stator core.

I. INTRODUCTION

Fixtures are essential elements of production processes and they are required in most of the automated manufacturing, inspection, and assembly operations. Fixtures must correctly locate a work piece in a given orientation with respect to a cutting tool or measuring device, or with respect to another component, as for instance in assembly or welding. Such location must be invariant in the sense that the devices must have to clamp and secure the work piece in that location for the particular processing operation. Fixtures are normally designed for a definite operation to process a specific work piece and are designed and manufactured individually. Fixtures are widely used in large batch production to ensure the easy setup and achieving the desired accuracy. Fixtures vary in design from relatively simple tools to expensive complicated devices. Fixtures also help to simplify metalworking operations performed on special equipment. It can be used in a variety of machine tools such as Lathe, Milling, Grinding, etc., though the milling fixtures are the most widely used in view of the complex requirements for the milling operation. Fixture design has received considerable attention in recent years. However, little attention has been focused on the optimum fixture layout design. A fixture is a device for locating, holding and supporting a work piece during manufacturing operation. Fixtures are essential elements of production processes as they are required in most of the automated manufacturing, inspection, and assembly operations. Fixtures must correctly locate a work piece in a given orientation with respect to a cutting tool. Fixture is used for machining of stator case frames. There are many standard work holding devices such as jaw chucks, drill chucks, collets, etc. which are widely used in workshops and are usually kept in stock for general applications. Fixtures are normally designed for a definite operation to process a specific Work piece and are designed and manufactured individually. Jigs are similar to fixtures, but they not only locate and hold the part but also guide the cutting tools in drilling and boring operations. These work holding devices are collectively known as jigs and fixtures.

A. Elements of stator stamping welding fixture

- 1) Clamping plate
- 2) Supporting plate
- 3) Radius pad
- 4) Expandable pad
- 5) Skew key

- 6) Spacer
- 7) Lock nut ,C-Washer
- 8) Hydraulic power pack

B. Important Term used

- 1) *Stamping Plate*; It is single plate which are used to make a complete core having thickness 1mm or less than 1mm and made up of cobalt iron or nickel iron.



Fig. Stamping Plate

- 2) *Stator Core*: It is a set of no of stamping plate welded to each other with different core length as per requirement of magnetic field.



Fig. Stator core

C. Design

- 1) *Clamping plate* : A clamp is a force-actuating mechanism of a fixture. The forces exerted by the clamps hold a part securely in the fixture against all other external forces.

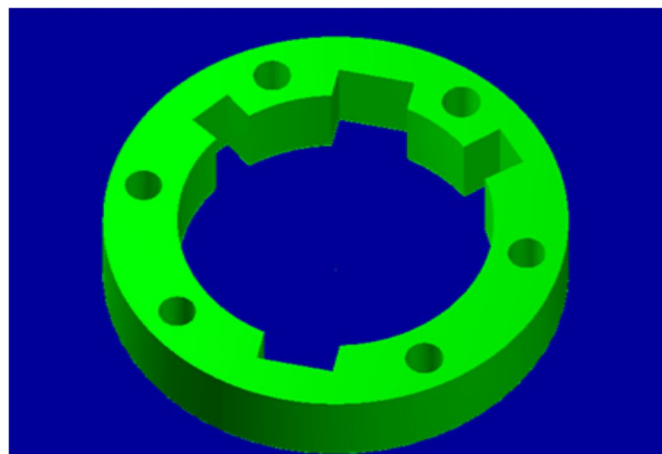


Fig. Clamping plate

The inner diameter of clamping plate is equivalent with the outer diameter with small clearances.

- 2) *Supporting Plate*: Support is a fixed or adjustable element of a fixture. Supports added and placed below the work piece so as to prevent or constrain deformation. Supporting plate having same structure like a clamping plate.
- 3) *Radius Pad* : Radius pad make a complete contact with the inner side of stamping because the outer radius of radius pad and inner radius of stamping is same. The inner side of stamping plate comes in contact with the radius pad because the inner diameter of stamping plate and outer diameter.
- 4) *Skew Key*: A locator is usually a fixed component of a fixture. It is used to establish and maintain the position of a part in the fixture by constraining the movement of the part. To provide direction to clamp stator plate before welding process. The material i.e.EN8 Steel (201-255BHN) used for the skew key is very hard and friction resisting avoiding wear.

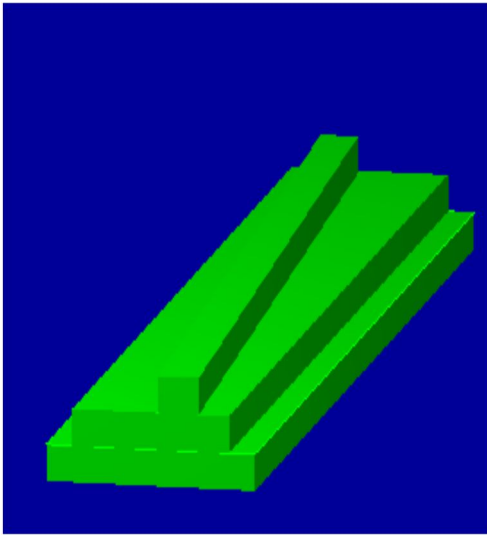


Fig. Radius pad

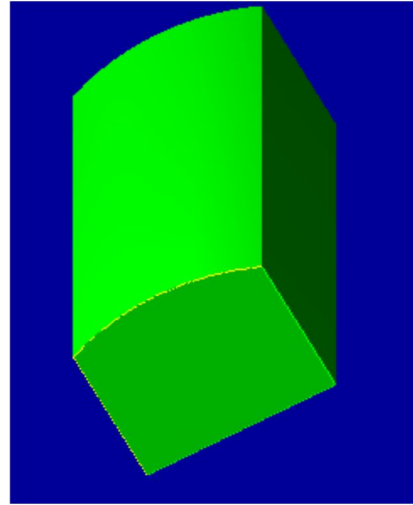


Fig.Skew key

- 5) *Spacer*: Spacer is used for arranging the different length of stator core and placed between the clamping plate and supporting plate.
- 6) *C – washer*: Used for engage the shaft of hydraulic power pack and clamping plate.it having C-shaped and it act a uniform pressure in all direction. C-washer can be quickly removed from the assembly at time of removing the welded core

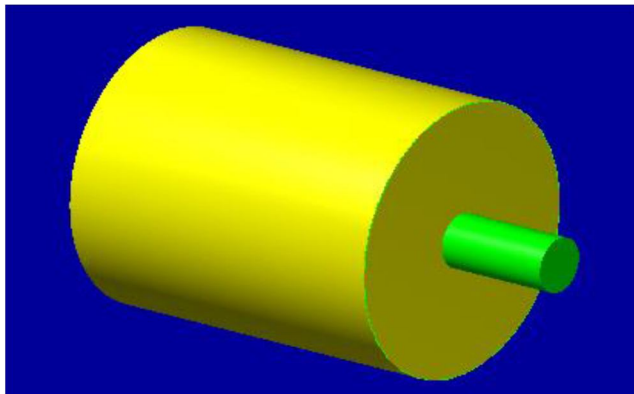


Fig. spacer

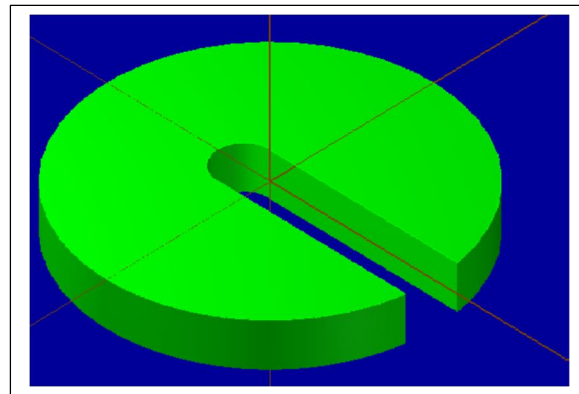


Fig. C- Washer

- 7) *Hydraulic power pack* : In this fixture hydraulic power pack play a very imortant role that it is used for clamping. The force exerted by hydraulic power is applied on the clamping plate upto the standard value 100bar for perfect clamping .the stmping plates are inserted in between the supporting plate and clamping plate through skew key and the pressure force created by the hydraulic power is applied on the clamping plate. Tank cosisting the working fluid i.e. oil and bye the use of motor this oil is pressurized for our application.



Fig. Hydraulic power pack

II. WORKING

Stator stamping welding fixture is used to weld the stator of motor i.e. set of stamping plate welded of core length 350mm, 445mm, 550mm. The high power motor used for long distance water transportation system, mining process, sugar factory and various applications where high power is required. When support plate is inserted in the mandrel then the stamping plate is inserted through the skew key. Once the set of required core length is formed then another support plate and clamping plate is mounted. Here second support is in contact with stator core to avoid deformation in core from applying direct pressure. When clamping plate is fitted after that a C-washer is inserted because of its easy removal. The lead screw through the mandrel acts as a tightener by using the application of hydraulic power pack. Because of this hydraulic power pack pressure up to 100 bar is applied on the clamping plate and core of zero spacing between the stamping plate is formed. This complete clamped stator core is then welded by CO₂ welding.

III. CONCLUSIONS

The machining on different lengths of stator without changing the fixture is possible, hence it reduces work in progress, material handling time, work piece setup time and non-productive time.

By using this fixture the misalignment occurring during mounting of stator case frame is effectively avoided, hence the accuracy of machining increases.

Due to using hydraulic power pack, assembly time is reduced and pressure can be controlled as per requirement.

Design and analysis of welding fixture for automotive component concludes that the complete fixture for welding of stator core assembly has been designed analytically as well as critical components of the fixture assembly are analysed for safety.

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