

Review on 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 modify the old fixture for the machining of the different stator case frames of different sizes. This old fixture is time consuming process and requires more material handling. 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 machine 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.

Key words: Jig, Fixture, Weld Ability, Sensitization, Fusion, Stamping Plate, Stator Core

I. INTRODUCTION

A fixture is a device used for locating, holding and supporting a work piece during manufacturing operation. Fixtures are essential for 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 welding process. Such location must be important for that the devices must have to clamp and safe 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. Fixtures are widely used in mass production to ensure the easy setup and achieving the correct accuracy. Fixtures vary in design from relatively simple tools to expensive complicated devices. Fixtures also help to simplify metalworking operations performed on different 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. A fixture is a device for locating, holding and supporting a work piece during machining operation. Welding 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, welding and boring operations. These work holding devices are collectively known as jigs and fixtures.

A. The 3-2-1 Principle of Jig Fixture Design

The jig and fixture are tools used for holding the work piece in a correct location for mass production . Various types of fixture (like drilling fixture, milling fixture, and welding fixtures) are used in industry . The 3-2-1 method is the fundamental principle for all types of fixture design. Most of time is spent in deciding how to locate the work piece in the fixture. A free body having the twelve degrees of freedom i.e. six translational (+x,-x,+y,-y,+z,-z) & six rotational(clockwise and anticlockwise around x,y,z). So there is need to fix all 12 degrees of freedom except three translational degrees of freedom (-x, -y, -z) in order to locate the work piece in the fixture. So, 9 degrees of freedom are needed to fix. According to 3-2-1 principal, reset the work piece on three non – collinear points of the bottom surface (xy) and fix the (+z, clockwise around x and y, and anticlockwise around x and y) degrees of freedom. Then rest the work piece at two point of side surface (xz) and fix the (+y and anticlockwise rotation around z) degrees of freedom. The third step is rest the work piece at one point of the adjacent surface (yz) and then fix the (+x and clockwise rotation around z) degrees of freedom. So 9 DOF are fixed according to 3-2-1 principle of fixture design.

B. Welding-

Welding is a fabrication process that joins materials, like plastics or metals, by fusion of other material or metal at the place of joint. A fused material used having low temperature and good strength or bond forming ability. There is various application of welding and welding is a permanent type of joint having very good strength. Different types of welding are used for different material and according to their application. Different energy sources are used for the welding, including a gas flame, electric arc, a laser electron beam, and ultrasound. We have to take some precaution during this welding process like to avoid burns, electric shock, and vision damage, inhalation of poisonous gases and fumes, and exposure to intense ultraviolet radiation.

Types of welding-

- 1) Oxy fuel welding- it is also known as oxyacetylene welding or oxy welding uses fuel gases and oxygen to weld and cut the metals.
- 2) shielded metal arc welding (SMAW)-also called as stick welding or electric welding uses an electrode that is coated in flux to protect the weld puddle .
- 3) Gas tungsten arc welding (GTAW) - It is also called as TIG (tungsten, inert gas) uses a non-consumable tungsten electrode to produce the weld. The weld area is

protected from the atmospheric contamination by inert shielding gas such as argon and helium.

- 4) Gas metal arc welding (GMAW)-This welding is commonly termed as MIG(metal , inert gas) uses a wire feeding gun that feed the wire at an adjustable speed and flows an d argon or helium such inert gases are used to avoid the atmospheric contamination such as oxidation

C. Clamping-

A process in which the work piece is hold with zero movement in any direction for machining purpose called as clamping process. Different types of devices used for the clamping process like jig, fixture, c clamp, nut and bolt, bench vice. The purpose of clamping is to exert the pressure to press the work piece against the locating surface and hold it there in position to the cutting forces. Most commonly clamping devices are clamping screws, hook bolt clamp, bridge clamp, heel clamp, c-clamp etc.

Degree of freedom- the no of independent co-ordinate require to define the position an motion of the element in the space.

II. LITERATURE SURVEY

Prof. A.D. Kachare, Prof. G.M.Dahane et.al. (2012) The machining on number of stator case frames without changing the fixture is possible. It reduces work in progress, material handling time, work piece setup time and non-productive time. A research has been done in the past to solve the problems. In the paper of 'modular fixture machining process' a model of modular fixture setup relative to cutting forces is proposed, planned and assembled. Positioning is discussed and the best solution is offered. Tool movements influence the final quality of work piece, and fixture influences tool movements. An example is presented as a possible solution. Modular elements make jigs and fixtures elements interchangeable and reusable, their design then becomes a task of selecting and assembling the proper elements together. Primary criterion used for grouping the manufacturing features to form setups is usually tool approach direction. For load/unload, for pin placements etc. tool carries the main forces that later form the final shape of the work-piece. The paper of 'machining fixture using Genetic Algorithm' presents that the deformation of the work piece may cause due to dimensional problems in machining. Supports and locators are used in order to reduce the error caused by elastic deformation of the work piece

Prof.S.N.Shinde Prof. Siddharth Kshirsagar et.al.(2014) It is important that the design satisfies all of the functional requirements. Design parameters which were outlined at the start of the project .By using this fixture the accuracy of machining increases. It leads to a belief that if applied will create an even better machine than we have designed. The process of conducting operations related to welding fixtures and positioners helps in gaining a deeper understanding as well as effective project process. The prototype construction proves fruitful in analysing the process for its potential as a finished product. In today's market all large manufacturers are automating as much of their production line as possible. Automated processes have been in high demand extensively in past two decades but

there is still room for improvement. Welding fixtures closes the gap in the engineering of automated fixture mechanism. From finding a resource for research material to design updates of the part causes the task of accurately prototyping the real design difficult. It is important that the design satisfies all of the functional requirements and design parameters which were outlined at the start of the project. In order to meet the requirements of the fixture customization is done by making the clamping system very practical for various sizes and geometries.

Prof. Nilesh Chanewar, Prof. Vinayak sonawane et.al(2017) Welding is very delicate joining process which requires very high skill for fine work.

Welding the various parts in manufacturing is very common and popular form of permanent metal joining process. This is widely used in the manufacturing and reworking industries. There are many types of welding available like Arc welding and gas welding to weld different thickness of metal.He found that the methods available for circular welding are very limited and costlier in case of atomization. The explosion welding process is known to be an efficient procedure to join two very different work pieces together. The welding is done by explosives that push the work pieces together. They are then joined rapidly and vigorously. The explosions are contained in typical shapes.

Naveen A M, V A Girish et.al.(2014) have examined the effect of welding fixture to prevent the weld distortion, which are very much taken into consideration while designing the welding fixture. The correct relationship and alignment between the components to be assembled must be maintained in the welding fixture. To do this, a fixture is designed and built to hold, support and locate work piece to ensure that each component is joined within the specified limits. The direct impact of fixture on the product manufacturing quality, productivity and cost.

M. Vishala, P. Sampath Rao et.al.(2014) The main purpose, objective and also the necessity of a fixture have been clearly presented in the introduction of this project. A series or bunch or numerous weld fixtures together work in an automated industry in providing the better gripping as well as the location of the part that are being manufactured. In this project, we have modelled a weld fixture by using PRO-E software which is one of the software used for modelling components in most of the design based industries. While the modelling of the components the material selection is carried out simultaneously based on the design considerations related to loads, etc.

III. CONCLUSIONS

- 1) The machining on Different length 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.
- 2) By using this fixture the misalignment occurring during mounting of stator case frame is effectively avoided, hence the accuracy of machining increases.
- 3) Due to using hydraulic power pack reduce assembly time and pressure can be control as per requirement.
- 4) Design and Analysis of Welding Fixture for Automotive Component conclude 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.

ACKNOWLEDGMENT

The following individuals provided the much needed support, in every aspect of the project and their assistance is gratefully acknowledged, Prof Kalase R.S. (project guide) , Prof Kalhapure A.(project co-ordinator). Special thanks to Mr A. Kulakarni & Mr. K.P. Singh, Production Head, Crompton Greaves (Stamping Division M6 Unit) Ahmednagar for their timely guidance and support.

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