

Design and Fabrication of Welding Fixture for a Single Doorframe



Engineering

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ABSTRACT

Mass production aims at high productivity to reduce unit cost and interchangeability to facilitate easy assembly. This necessitates production devices to increase the rate of manufacture and inspection devices to speed up the inspection procedure. Production devices are generally work holders with / without tool guiding / setting arrangement. These are called jigs & fixtures. The advantages of welding fixtures in production are that increase in productivity, inter-changeability, operator fatigue reduction and cost reduction. Fixtures hold the work pieces securely in correct position with respect to the welding / machine / cutter during operation. The effect of the clamping element – an integral part of the fixture gets a gets importance while implementing it in an operation. Welding fixture that can serve better technically as well as economically will make a significant difference in production processes.

1. Introduction

The successful machining of any mass production depends upon the interchangeability to facilitate easy assembling & reduction of unit cost. So there is a necessary of special purpose tools which are used to facilitate production operations like machining, assembling, inspection, etc.

1.1 Jigs:

It is a work holding device in which the component is clamped in a specific location so that the cutting tools are guided to perform one or more operations. They are so designed to facilitate loading & unloading of components with ease. The other features of a jig are that it can hold, support, locate & provide a firm grip on the work piece.

1.2 Fixtures:

A fixture is a device used for holding the work piece during machining operations or during welding process. It does not have provision to guide the tool as that of a jig. But it is always fastened to a machine table in a fixed position. Most of the machining operations can be performed by clamping the work piece directly on to the machine table without using a fixture, when only a few parts are to be machined. But when the number of parts is large enough to justify the cost of fixture, it is generally used for holding and locating the work piece. The aspect of clamping is given more emphasis in fixture's design, as the clamping force should be able to withstand the cutting force. The fixture deploys setting blocks to locate the cutter properly in relation to the fixture or the components. It is not always required to have blocks as in the case of turning or welding fixtures. The fixture should be clamped to the table of the machine upon which the work is to be done.

2. Locating and clamping devices:

The successful running of mass production depends upon the interchangeability to facilitate easy assembly and reduction of unit cost. So there is a necessity of special purpose tools, which are used to facilitate production operations like machining, assembling, inspection etc. Fixtures are designed to hold support and locate the work piece to ensure that each part is machined within the specified tolerance. Use of fixture is the simpler, easier, faster and more profitable method of manufacturing different components under mass production.

2.1 Locating methods:

There are different locating methods available with respect to surface of the work piece

- i. Locating from plane surface
- ii. Locating from circular surface
- iii. Locating from irregular surface

As for our project have used Locating from plane surface method.

2.2 Locating from Plane Surface:

- a. Pressure pads used for locating welds should have angle lead for easy entry and this length should be short to prevent jamming of work piece.
- b. Long locators for fragile work piece should be relieved at the centre & blocks should be positioned in such a way that variation in work piece will not affect the operation.

- Fixed –locators
- Adjustable – locators

3. Essential features of fixtures:

3.1 Reduction of Idle Time:

The design of jigs or fixtures should be such that the process of loading and unloading the components takes the minimum possible time and enables on easy location and clamping should be such that idle time is reduced to minimum.

3.2 Replaceable parts or standardization:

The locating and supporting surfaces, as far as possible should be replaceable that is not permanently fastened. When worn out, new ones may replace them. Moreover, they should be standardized so that their interchangeable manufacture is possible.

3.3 Economic soundness:

The equipment to be used should be economically sound, i.e., the cost of its designing and manufacturing should be in proportion to the quantity and price of the producer.

3.4 Position of clamps:

The clamps should be so positioned that clamping occurs directly above the points supporting the workpiece so as to avoid distortion and springing of work, which otherwise will result in an inaccurate work. Moreover, the clamps should be strong enough to resist bending under clamping pressure.

3.5 Safety:

The design of fixture should be such that it should not constitute any danger to the operator.

4. Materials for fixtures:

4.1 Carbon Steel:

These can be used for standard cutting 1% carbon, 0.5% manganese and a less quantity of silicon. Collet steels can be oil/water hardened to 47RC.

4.2 Cast Iron:

Used for odd shapes to some machining and laborious fabrication, CI usage requires a pattern for casting. Pattern cost should be compared with cost of machining and fabrication. Cast Iron contains more than 2% C. It can be with stand vibrations well and are very suitable for base and bodies of milling fixtures. Self-lubricating properties of Cast Iron make it suitable for machine slide and guide ways.

4.3 Mild Steel:

Used for odd shapes to some machining and laborious fabrication, MS usage requires a pattern for casting. Pattern cost should be compared with cost of machining and fabrication. Mild Steel contains more than 0.13% C. It can be with stand vibrations well. It is very suitable for base and bodies of welding fixtures. It also has a property of good machinability. In our project we have used mild steel (M.S.) for all the parts. As mild steel is cheaper when compared to other steels, it will reduce the cost of material.

5. Principles of welding fixtures:

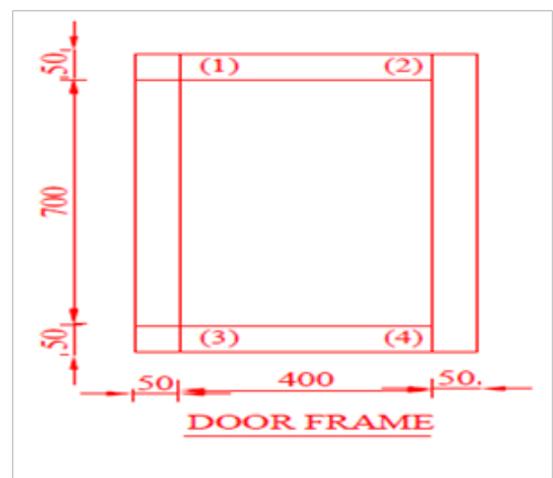
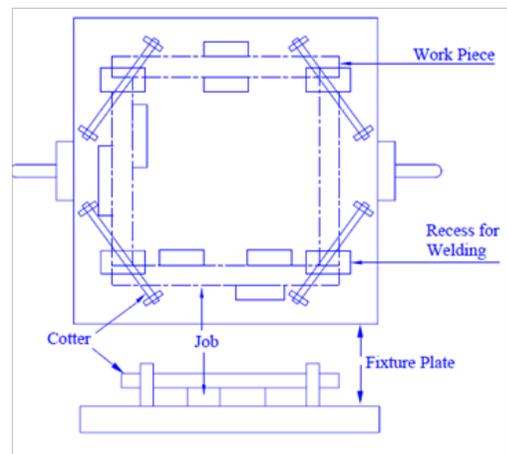
A few design principles applicable only to welding fixtures are given below.

- The heat produced during welding will result in the expansion of work piece. Due to this the proper location, clamping, locating, loading & unloading should not be affected.
- Welding spatter should not be allowed to fall on the threaded parts of the clamping elements.
- It should not be so designed that it does not get overhead due to continuous work.

- As far possible, the fixture should be designed that all welding in one setting.
- Clamps should be kept clear of welding zone or be shielded.
- The removal of work piece from the fixture should be as easiest as possible after welding.
- Location & clamping should not make the welding zone inaccessible.
- The base plate of the fixture is milled with grooves below the welding area to provide positive clearance between work piece & the base.
- There should be proper clearance between the work piece & locator to permit expansion.

6. Welding fixture for a single door frame:

- It is to be made of four strips are to be welded at four strips are to be welded at four places.
- A design of the welding fixtures for the door frame is shown in the next slide.
- On the fixture plate the four strips are kept in position in which they are to be welded.
- The strips get their correct position in which to be welded.
- The strips get their correct position on the fixture plate by means of rectangular pieces as shown.
- These pieces are welded on the fixture plate.
- The strips are kept tightened with the fixture by means of cotters.
- The fixture is kept in an inclined position on a stand to a suitable height.



7. Conclusion:

Having more gripping power in gripping arrester and pressure pads .It is mainly very useful to hold the lengthy door frame in particular position.It is slightly heavier but portable.It can be efficiently used .It is simple and rigid in construction.Manufacturing cost in lesser than other clamping devices. This fixture is mainly used in production field for clamping the cylindrical rod firmly and securely to perform operations such as shaping and various processes. This device find place in, It is used almost in all types if industries (Large,Small & medium scale workshops). This fixture is mainly used in manufacturing - oriented industries. This device is suitable to hold a single doorframe effectively.

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