IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 5, May 2022

DOI: 10.17148/IJIREEICE.2022.10526

Design And Fabrication Of Jig For Tig Welding

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Abstract: Jigs are special purpose tools which are used to facilitate production like machining, assembling and inspection operations. The purpose of this jig is to hold the specimen of the welding specimen which is the sheet metal. The fabrication purpose is to improve the quality of welding by making the better jig compare to the older jig. The students use this jig to hold the specimen and welding it by using the MIG welding at the welding machine. The problems are the specimen is bending after welding because affect by thermal stress. The older clamp cannot hold the specimen properly. This jig must be suitable to place on the existed table. The main objective of this study is to design and fabricate jig for butt welding. Also the objective is the jig need to suitable for hold sheet metal. Four designs were drew and compared in terms of durability, cost, size and weight, easy to use and clamping force. The best design is chosen and fabrication according to the measurement. After testing the product, the clamp has improves the clamping force and the specimen is not bending and affect by the thermal stress.

I. INTRODUCTION

Glatt is a market leader in life science systems for the refinement and processing of powders. With the introduction of our technology for powder synthesis, we have been expanding our expertise since 2015 to include innovative particle design as an upstream process. As a result, we are now able to offer you integrated solutions throughout the entire value chain – from primary particle manufacturing to refining, and right up to finished tablets. With 15 branches and subsidiaries worldwide, we support customers in pharmaceuticals, food and feed processing and fine chemicals through our innovative process solutions. Do you have a product idea? We can assist you along the entire process chain. From the development of the process to the construction of your entire plant.

Nowadays a major trend in material research is to make products more functional, powerful and reliable. Another concern is towards optimum usage of material resources and its impact on the environment. Several situations arise in industrial practices which call for joining of dissimilar metals. The materials used are location dependent in same structure for effective and economical utilization of the special properties of each material.

Although fusion and non-fusion techniques of joining have been effectively used for manufacturing components, a comprehensive scientific understanding of the joining process is lacking.

Maraging steels (250) are a class of very low carbon high alloy steels exhibiting a unique combination of ultra-high strength, excellent fracture toughness and good weld ability. The alloy gains its strength from the precipitation hardening of its iron-nickel martensitic microstructure.

As a consequence, it possesses a com-bination of strength and toughness superior to other high strength steels by employing a relatively simple heat treatment. Mo stainless steel is used in applications where a combi-nation of tensile strength, fracture toughness, resistance to general corrosion and stress corrosion cracking is essential. The good me-chemical behaviour of Mo stainless steel is commonly attributed uniform precipitation of b-Ni Al ordered phase in the martensitic matrix [6e8]. The important feature of these two steels is that they exhibit good weldability and they attain their strength after respective ageing treatments. These steels are therefore important candidate materials for critical applications such as rocket motor casings, high pressure bottles, sub-marine hulls, bridge layer tanks, petrochemical equipment.

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II. LITERATURE SERVEY

Zeng Pan, Donghong Ding, Bintao Wu, Dominic Cuiuri, Huijun Li, John Norrish Transactions on intelligent welding manufacturing, 3-24, 2018

Tig -welding based additive manufacturing techniques are attracting interest from the manufacturing industry because of their potential to fabricate large metal components with low cost and short production lead time. This paper introduces wire arc additive manufacturing (WAAM) techniques, reviews mechanical properties of additively manufactured metallic components, summarises the development in process planning, sensing and control of WAAM, and finally provides recommendations for future.

Akhilesh Kumar Singh, Vaidya Dey, Ram Naresh Rai
Materials Today: Proceedings 4 (2), 1252-1259, 2017

Tungsten Inert Gas (TIG) welding is also known as Gas Tungsten Arc Welding (GTAW) process which is an arc based welding process that uses the arc between a non-consumable tungsten electrode and a work piece with the help of a shielding gas [1-6]. The TIG welding is used to produce high quality welds and is one of the most popular technologies for welding in manufacturing industries [7-12]. The main disadvantage of TIG welding process is low weld penetration.

Rati Saluja et al. (2012), Automatic and mechanical welding frameworks could utilize viably, when ideal process parameters for accomplishing the ideal quality and relative impacts of information parameters on yield parameters can be gotten [17]. Reaction surface strategy (RSM) procedure is Applied to decide and describe the circumstances and logical results connection between obvious mean reactions and Input control factors impacting the reactions. This Paper manages the use of Factorial plan approach for streamlining four submerged curve parameters viz. Welding current, bend voltage, welding pace and cathode stand out by creating numerical model for sound quality globule width, dot entrance and weld fortification on butt joint.

Prof. Yasunova T.A - Influence of tool shape on friction stir welded joint of aluminum and steel with circular weld line is used to achieve the circular weld line was performed, and effect of welding tool shape was investigated for improving the weldabileeffect

Proff sharma H. - Experimental Analysis of Friction Stir Welding of Dissimilar Alloys AA6061 and Mg AZ31 .Using Circular Butt Joint Geometry is used stir welding of size and shape parts has to be weld very common are CIRCULAR and straight welds. To eliminate this common problems our circular welding jig and fixture assembly which works on the simple mechanism of gear train which transmit power from manual handle to rotating motion to workpiece and reciprocating motion to our tool in this case the electrode will consume on workpiece and fine circular weld done on worlpicirc.

Prof. Anbarasan I. -Design and fabrication of jig for hollow cylindrical component in drilling machine concluded that the project design and fabrication of a jig and fixture holding and indexing of the circular job is made easy.

III. PROBLEM STATEMENTS

1. After visiting Glatt Systems Pvt.Ltd. there is traditional type of tig welding process were performed.
2. For welding the drum using tig welding process manpower of 2 or more workers are required in which one is for operation and another is for handling the job.
3. Therefore more time as well as money of industry spend.
4. For handling the tig welding one person is required for holding the welding gun so it is very harmful for this person .
5. So the life of workers are in danger .
6. By using traditional type tig welding one person is required for holding the gun so the welding of drum is not so much precise due to long time work.

IV. MATERIAL AND METHOD

The design of jigs and fixtures is dependent on numerous factors which are analysed to achieve optimum output. Jigs should be made of rigid light materials to facilitate secure handling, as it has to be rotated severally to enable holes to be moved from different angles. It is recommended that four feet should be provided for jigs that are not bolted on the machine tool, to enable the jig to wobble if not well positioned on the table and thereby alert the operator. Jigs provide procedures for proper location of the work-piece concerning the cutting tool, tightly clamp and rigidly support the work-piece during machining, and also guide the tool position and fasten the jig on the machine tool.

To achieve their expected objectives, jigs consist of many elements:

- Frame or body and base which has features for clamping

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- The accuracy and availability of indexing systems or plates
- The extent of automation, capacity, and type of machine tool where jigs and fixtures will be employed
- Bushes and tool guiding frames for jigs
- The availability of locating devices in the machine for blank orientation and suitable positioning

Auxiliary elements :

- The strength of the machine tool under consideration
- The precision level of the expected product
- Fastening parts
- The available safety mechanisms in the machine tool.
- The study of the fluctuation level of the machine tool.

The factors below are to be reflected upon during design, production, and assembly of jigs and fixtures due to the targeted increase in throughput, quality of products, interchangeability, and more accuracy.Guiding of tools for slim cutting tools like drills

IMPORTANT CONSIDERATIONS WHILE DESIGNING JIGS :

(a) Study of workpiece and finished component size and geometry.
(b) Type and capacity of the machine, its extent of automation.
(c) Provision of locating devices in the machine.
(d) Available clamping arrangements in the machine.
(e) Available indexing devices, their accuracy.
(f) Evaluation of variability in the performance results of the machine.
Rigidity and of the machine tool under consideration

THE SIGNIFICANT FEATURES OF JIGS AND FIXTURES ARE:

The body: The body is the most outstanding element of jigs and fixtures. It is constructed by welding of different slabs and metals. After the fabrication, it is often heat-treated for stress reduction as its main objective is to accommodate and support the job.

Clamping devices: The clamping devices must be straightforward and easy to operate, without sacrificing efficiency and effectiveness. Apart from holding the work-piece firmly in place, the clamping devices are capable of withholding the strain of the cutting tool during operations. The need for clamping the work-piece on the jig or fixture is to apply pressure and press it against the locating components, thereby fastening it in the right position for the cutting tools.

Locating devices: The pin is the most popular device applied for the location of workpiece in jigs and fixtures. The pin's shank is press-fitted or driven into a jig or fixture. The locating width of the pin is made bigger than the shank to stop it from being pressed into the jig or fixture body because of the weight of the cutting tools or work-piece. It is made with hardened steel.

Jig bushing or tool guide:Guiding parts like jig bushings and templates are used to locate the cutting tool relative to the component being machined. Jig bushes are applied in drilling and boring, which must be wear resistant, interchangeable, and precise. Bushes are mainly made of a reliable grade of tool steel to ensure hardening at a low temperature and also reduce the risk of fire crackling.

Flat Locator : Flat locators are used for location of flat machined surfaces of the component. Three different examples which can be served as a general principle of location are described here for flat locators. These examples are illustrated in Figure 4.3.

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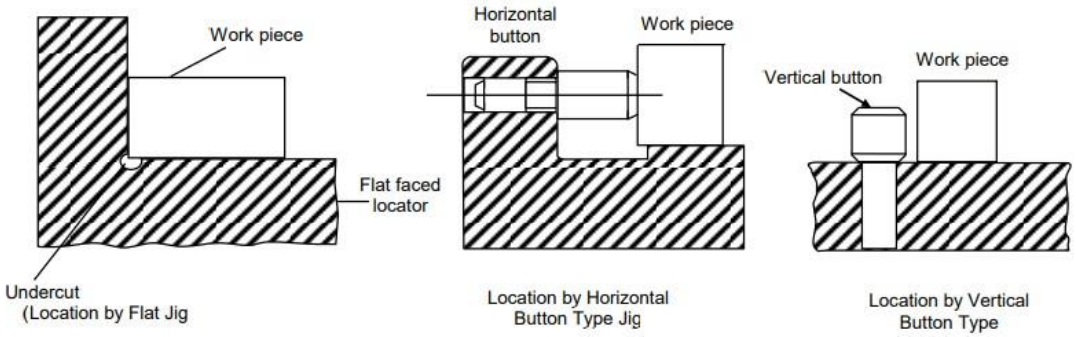
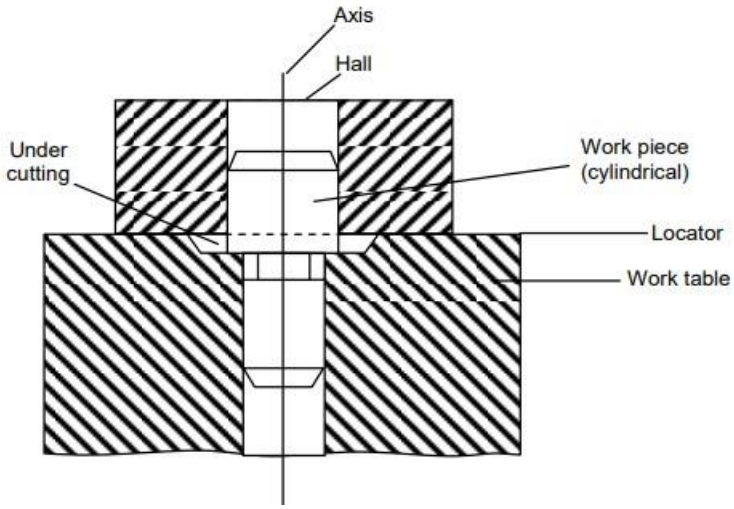


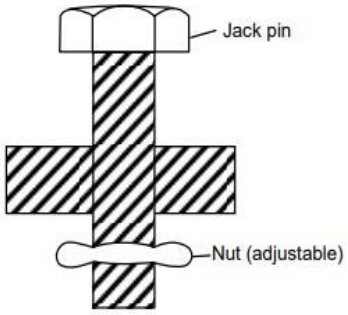
Fig.Method of locating using flat locators.

A flat surface locator can be used as shown in first figure. In this case an undercut is provided at the bottom where two perpendicular surfaces intersect each other. This is made for swarf clearance. The middle figure shows flat headed button type locator. There is no need to made undercut for swarf clearance. The button can be adjusted to decide very fine location of the workpiece. There can be a vertical button support as shown in third figure, which is a better arrangement due to its capacity to bear end load and there is a provision for swarf clearance.

Cylindrical Locators: A cylindrical locator is shown in Figure 4.4. It is used for locating components having drilled holes. The cylindrical component to be located is gripped by a cylindrical locator fitted to the jig‟s body and inserted in the drilled hole of the component.



Jack Pin Locator : Jack pin locator is used for supporting rough workpieces from the button as shown in Figure. Height of the jack pin is adjustable to accommodate the workpieces having variation in their surface texture. So this is a suitable method to accommodate the components which are rough and un-machined.



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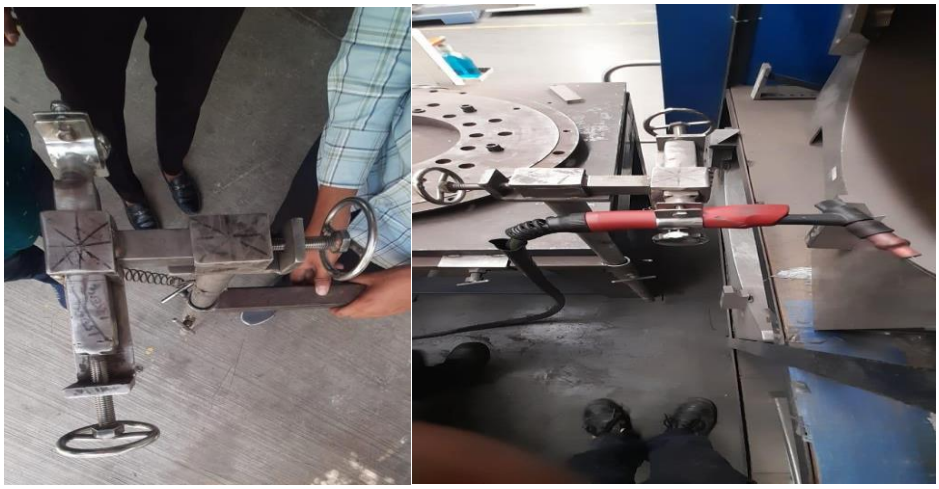
V. RESULT

Improvements and savings It is part of the verify phase in DFSS methodology. The critical analysis is carried out in 2 stages, one about the design and other about the overall process improvement using metrics like timing saved per parts and cost benefits. The standards used in this project for analyzing the design was VSM and SWO analysis . The same is used in giving one comparative analysis for the new jig implemented. The new work sequence for the new jig helps in reducing the setup time further adding to the overall efficiency of the machining process.



Advantages of Jigs

PRODUCTIVITY:

Expands the usefulness by dispensing with the singular stamping, situating and successive checking .The activity's time is additionally decreased because of speed up, feed and profundity of cut because of high clamping rigidity

INTERCHANGEABILITY AND QUALITY: Jigs and fixtures are facilitated to the production of article's in large quantities with high degree of accuracy, quality, and interchangeability at a competitive market of costing

SKILL REDUCTION: There is no need for skillful setting of work on tool. Jigs and fixtures makes conceivable to utilize incompetent or semi-Skilled machine administrator to make reserve funds in labor cost.

COST REDUCTION: Higher creation, decrease in piece, simple gathering and reserve funds in labor cost brings about extreme decrease in unit cost.The new operational procedure was implemented. This helps in reducing the setup time further adding to the overall efficiency of the machining process. The collection of cycle time in the new jig was done exactly like the previous one with a sample of 10 cycles after a few warm-up cycles.

Essential features of Jigs :

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REDUCTION OF IDLE TIME – Should enable easy clamping and unloading such that idle time is minimum CLEANLINESS OF MACHINING PROCESS – Design must be such that not much time is wasted in cleaning of scarfs, burrs, chips etc.

VI. FUTURE SCOPE

1. Maximizing production efficiency and productivity is a key concern for manufacturers.
2. Jigs are manufacturing aids used to increase the reliability, accuracy and quality of the manufacturing process whilst minimising production cycle times and improving worker safety
3. The future study should focus on providing this theoretical Knowledge in to practices to get the desired quality of weld.

VII. CONCLUSION

- We have learned many things during this project, especially in designing the jig and dealing with tig machine .This is because there are several steps that must be followed before conducting proper welding we need to be comfortable with the welding equipment attached to the jig.
- Jig is the tool guiding and work holding equipment designed for machining and assembling large number of parts .They are fabricated with heat treated steel that are corrosion and wear resistance.it can be produced good design to jig ensure that they fullfill their function economically is a vital to the success of the manufacturering system
- The objective of the study are achieves at the end of this project which is the data analysis are completely collected, the design the jig and fixture to ease work handling is successfully developed and finally all the analysis result is successfully done.

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