

Design & Development of Welding and Checking Fixture for Tractor Hood Assembly

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ABSTRACT

A fixture is mainly a work holding or support device used in the manufacturing industry. Fixture is used to securely locate position in specific location or orientation and support the work. Ensuring that all parts produced using the fixture will maintain conformity and interchangeability. Locating and supporting areas must usually be large and very sturdy in order to accommodate welding operation; strong clamps are also a requirement. The body of a hood consists of various plates that have to be welded to each other with a specific tolerance and weld quality. The material used in the manufacture of different parts of the body of a hood assembly is mild steel which is one of the most commonly used materials in the field of fabrication. All the welding processes are carried out by welding to ensure quality of the weld is as per the requirement. The fixture is designed and manufactured and it is checked for dimension conformance based on the CMM report. After testing and validation it is moved to production for regular production.

Keywords: Datum, work holding, CMM inspection, welding spots.

INTRODUCTION

A fixture is a device which holds and locates the workpiece during an inspection or for manufacturing operations. In construction, a fixture comprises of a different standard or specially designed work holding devices, which are clamped on the machine table to hold the work in position. It consists of locators, clamps, supports, and fixture body. Fixtures are essential elements of production processes as they are required in most of the automated manufacturing, inspection, and assembly operations. Welding fixtures are available in different size, shapes, materials and mechanisms based on their need of operations. The precision of the fixture play a major role in the manufacturing component. Welding a curved surface over another curved surface is very challenging so is positioning the components. Fixtures must correctly locate a work piece in a given orientation with respect to a welding torch or measuring device, or with respect to another component. Whenever any component is in space it will have 6 degrees of freedom and for correct location of that component it is required to restrict those 6 degrees of freedom. These degrees of freedom can be restricted by 3-2-1 location system. Such location must be invariant in the sense that the devices must clamp and secure the workpiece in that location for the particular processing operation.

Problem Identification:

The study and development is carried out to weld the different components of tractor hood assembly in correct position in minimum time and cost. While making joints, lots of problems encountered such as inaccuracy, misalignment etc. these problems cause rejection of finished jobs productivity losses more time consuming etc. Checking fixtures are specially designed for repeatability, accuracy, and reliability along with the strong focus on the operator ergonomics. In welding, weld metal and adjacent base metal expands during heating and restrains in cooling process. They are restrained because weld area is a part of large piece of metal. In practice, heating is not uniform across the cross section of a part. There is always restraint, because the parts are not heated or heated to a lesser amount tend to restrain the portion of the same piece is heated to a higher temperature. This differential or no uniform heating and partial restraint causes thermal distortion and warpage in welding.

METHODOLOGY

Methodology followed for tractor hood assembly fixture is as below.

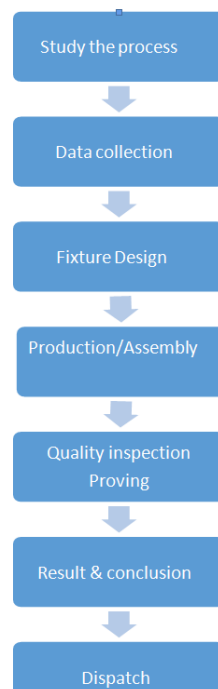


Fig. method used for manufacturing Fixture

The method of approach for Design hood assembly is depicted in the above figure.

Component for which Fixture is to be designed:

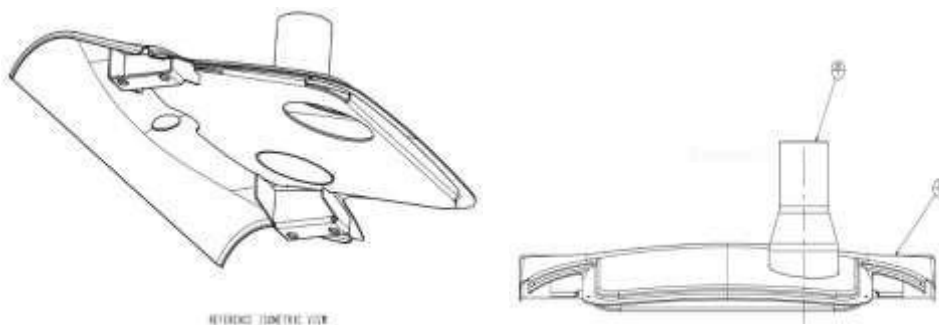
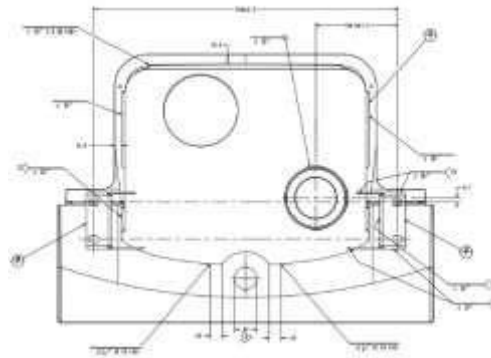


Fig4.1 2D Drawing of part



Specification of the component

Material	Mild Carbon Steel A36
Density	7800 Kg/m
Weight	55 kg
Tensile Strength	400-500Mpa
Compressive Strength	200Mpa

he different components need to be welded together are,

- Plate
- Exhaust Tube
- Main fixed hood
- Brackets

Part lists for Fixtures

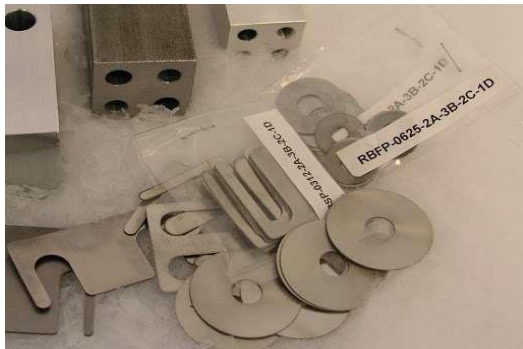
1. Base Structure
2. Base plates
3. Stands
4. Shims
5. Support Blocks
6. Profile Blocks
7. Fix pins, Dowel pins



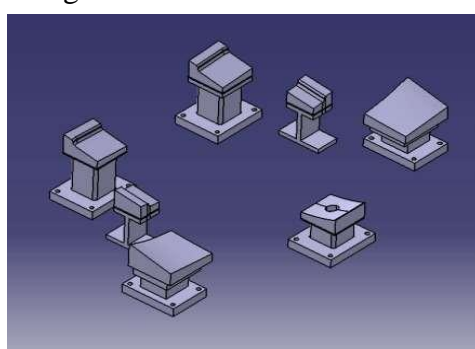
Base Structure



Height Stand



Shims



Profile blocks

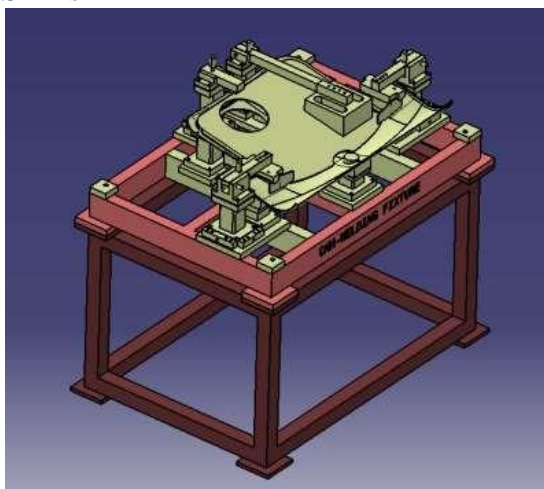
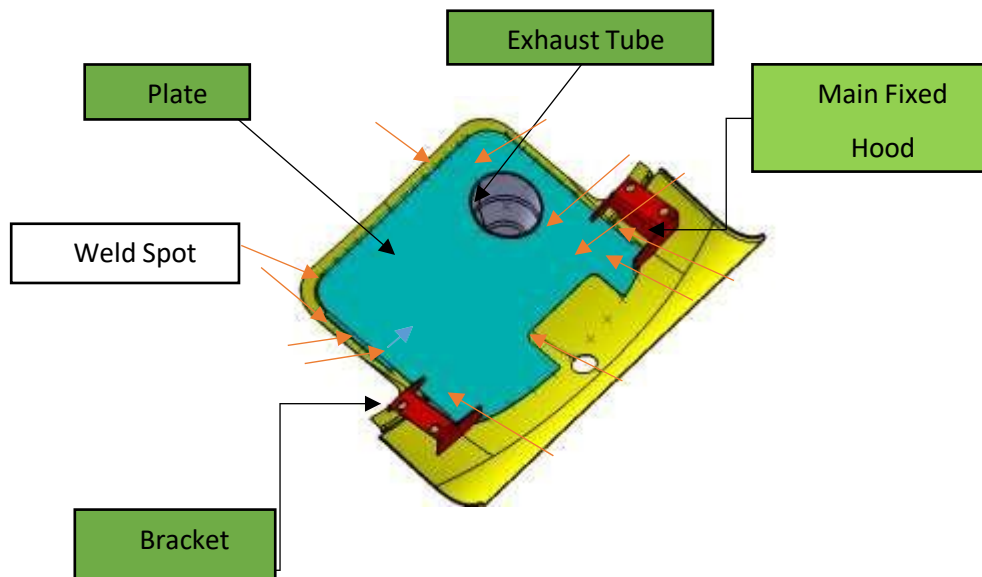


Fig. Final Assembly of Welding Fixture

In this study, the flexibility of proposed work and fixture are investigated by considering two different weld assemblies. Main hood and plate of a tractor hood assembly welded as shown in Figure. The previously welded hood assembly is then welded with the LH and RH bracket as shown in Figure. The fixture designed must be compatible for both the assemblies to be spot welded.



Weld spots for each weld assembly are highlighted in Figure and Weld points are shown where welding will be carried out on the automobile sheet metal components. The foremost step taken before starting the design of welding fixture is to arrive at the spot weld locations. The location and orientation of other critical units of the fixture including clamps, locators etc., are decided based on the weld spot distribution. Principal Locating Points (PLP) are the points at which the panels are to be located onto the fixture. The welding fixture is designed with locator units to aid the operator to load the panels onto the fixture at the right location and orientation. The locator unit consists mainly of locating pin, L block, Spacers and/or shims, spacer. Minimum two locators units are provided to locate the car parts properly onto the fixture. Clamps hold the part firmly and prevent the part from distortion while carrying out the spot welding operation.

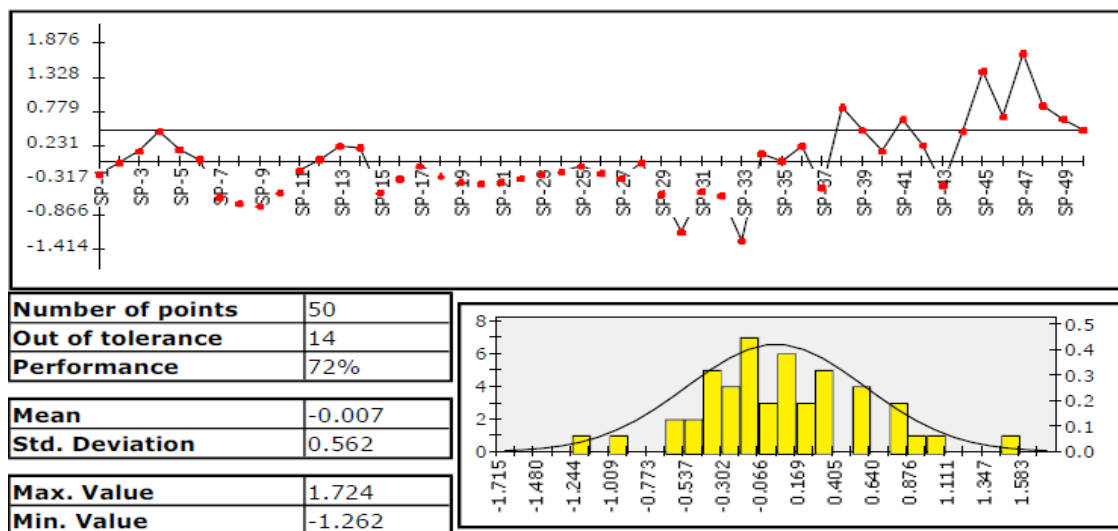
Quality Inspection: After all parts get assembled once again the quality check is done by checking all the dimensions and positions using CMM machine.



Fig. ROMER CMM ARM 7325

At first centering the fixture in CMM using three circle as the reference points. . The tabular column shows the output of the CMM. The result contains tolerances in plus or minus, Actual measurement, deviation out-tolerances. The same procedure has been carried out for location of profile block and the locations. Besides, the distance has also been checked in X axis. We will check all distance on X, Y, Z axis. Then report is generated in power inspect software.

CMM Report:



Result

The designed fixture is manufactured and assembled as per 3D data and validated with CMM inspection. Internal trial and testing was done based on CMM report available. Actual welding of components was done and checked for quality on CMM and report has validated that the fixture is fulfilling the requirements and ready to use on production line.

Tractor Hood Assembly Welding & Checking fixture photos:



Hood Assembly images after welding and testing:



FUTURE SCOPE:

After successful welding of batch of hood assemblies it is observed that though we are holding the components at correct positions on the fixture, some deviations are there due to welding temperature. Some work needs to be done on reducing the war page of the components after welding.

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