

Fixture Design

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Abstract— In automobile industry, automobile welding fixture is a component which is important to auxiliary welding. The automobile body is welded by multiple complex sheet metal parts and other auxiliary work pieces. In this process, supporting role of welding fixture is an important role. In manufacturing of car, Truck, welding fixture was designed and analyzed briefly. The design of fixture demands extensive use of heuristic knowledge, which is also coupled. For instance, when define the machining operations of manufacturing parts in assembling of fixture solution should be kept in mind and vice versa. Fixture designers have a skill and experience for several years, in achieving proper fixture designs. In the Automobile Industry, BIW (Body In White) is the common terminology used to mention the car sheet metal welded structure (body shell). Sub-assemblies like Floor body, Body side, Left Hand Side/ Right Hand Side, Front End, Roof etc. gets welded together by various metal joining process e.g. resistance spot welding. The welding fixtures are holding devices of assemblies of Car body they have different operations (reverting, welding, and stud) of geometric of car body structure.

Keyword- Assembling Fixture, software in design of fixture solid work, NX, Rob cad for simulation of tools.

I. INTRODUCTION

The function of fixture is a holding device of work piece in proper aligns during manufacturing of product. Fixture is supporting, clamping the work piece, its checking, positioning, individual marking and non-uniform quality in manufacturing of product is eliminated by fixture. This increase productivity and reduce operation time. Fixture is basically uses in the industry to increasing production because of feature and advantages. To locate and immobilize workpieces for machining, inspection, assembly and other operations fixtures are used. The tool is uses in during of inspection of panel assemble. Fixture is not guide, but is always fixed to production line, various type of machining operation of product is suite on fixture.

The car body is made up of more than of hundreds of stamped sheet metal components which are joined together by spot welding process, accurate production of the car body is essential if the automated assembly line is to fit within the required tolerance, therefore we use the welding fixture. We can use a different type of units and they have different function in welding fixture design, based on clamping plan, location plan, and simulation.

II. PROCESS PLANNING FIXTURE DESIGN –

2.1- Input data design Includes -

- Panel assembling sheet
- Reference data for study
- Welding Points
- X-gun, C-gun
- Cycle time study
- Process sheet

2.2-Concept design-

Design Includes: -

- Standard part
- Manufacturing parts
- Purchasing part
- Function of fixture according to product
- Follow the guide line of customer

2.3-Manufacturing Drawing and Bill of Material-

2D design Includes:-

- Manufacturing part drawings
- Bill of Materials of fixture
- Fixture line diagram
- Flame -Cut drawings

III. PROCEDURE TO DESIGN BIW PANEL

The car body is manufactured in segments like Front door, Tail gate, floor - Join and form **Under body, Chassis, Side doors- closures** etc. All these parts are then welded together to form a complete body structure- **Body of car**. At the end of the framing line, the body receives the doors, bonnet, tailgate, which have been built separately.

Step of Fixture design-

You should know the basic process of assembling line Fixture, Weld equipment's for BIW design and below detail for Fixture concept design

3.1, Reference data study

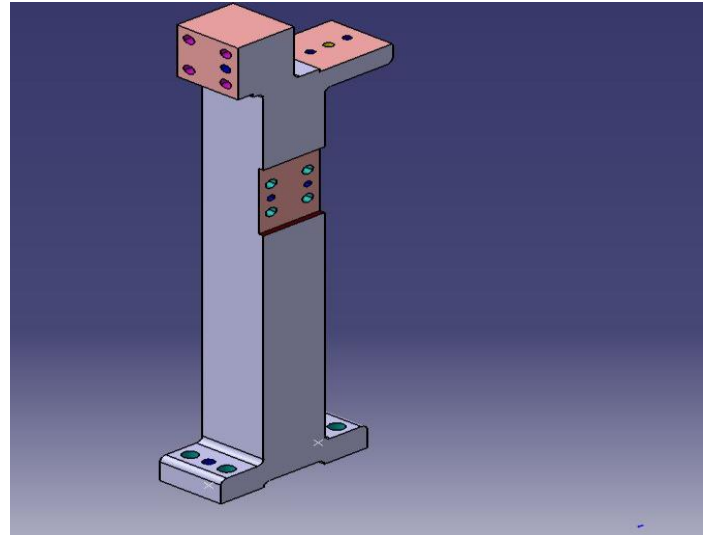
- 3.2, Uses of basic concept of fixture
- 3.3, Uses of standard components
- 3.4, Clamping Point and Supporting point arrangement
- 3.5, Locating Point of Pin
- 3.6, X, Y, & Z co-ordinates of locating points/Clamping points
- 3.7, Loading & Unloading Process of panel.
- 3.8, Manufacturing drawing
- 3.9, Fixture design: - Input Data

- 1) Panel Data of fixture
- 2) Sequence of assembly of panel data
- 3) Clamping Plan
- 4) Sections height of fixture from base plate
- 5) Cycle time
- 6) Base Plate

The many panels to be assembled to uses spot welding, where the panel is to be clamped, supported and located, through the units, what is the cycle time, what is the sequence of loading & unloading is derived out of the above data

IV. ASSEMBLY OF FIXTURE

In this process to different type units are mounting at base plate of fixture, such as clamp unit, locating unit , sliding unit , dump unit they have different mechanism in fixture. The orientation units of the fixture depend on shape of product also decided based on the weld spot points. The spots point at panel - Roof, floor panel assembly is located with respect to the body line of car.



. Figure: 4.2 machining of Riser

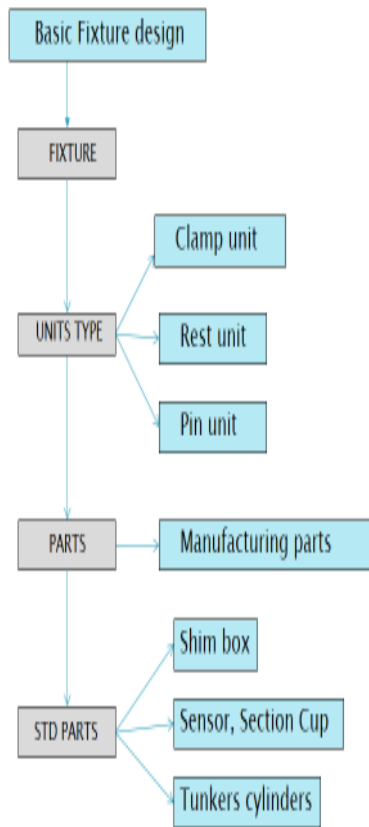


Figure: 4.1 Fixture assembling process

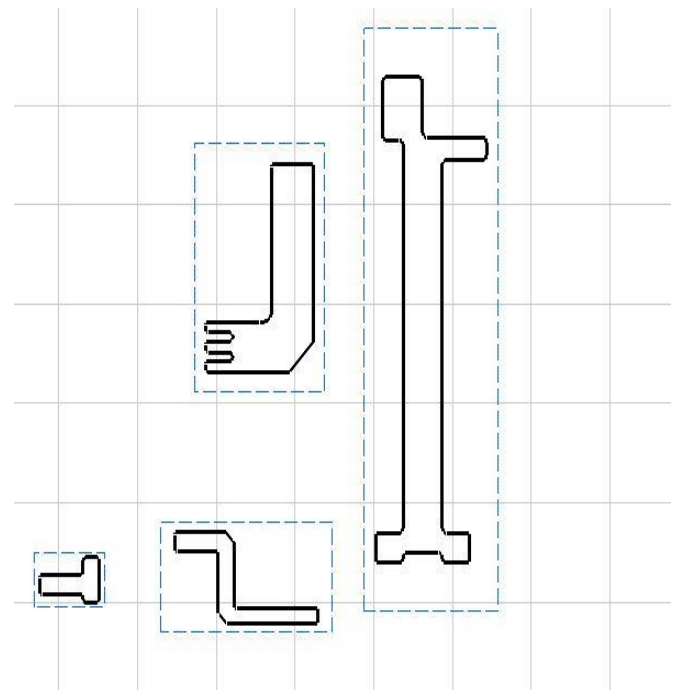


Figure: 4.3 Flame cut of drawing

V. CLAMP UNIT AND REST UNIT

The clamps are hold the panel through clamp arm and manufacturing part and prevent the part from distortion while carrying out the welding on panel. A single clamping unit consists of the following parts:1. Locator: Locator is a movable part through the mechanism of cylinder which is used to hold the panel from top against the Back-up and they are usually mounted on the clamp arm.

2. Plate: Any Shaped Plate used to mount the locator to clamp arm, besides allowing adjustment for locator in two directions shimming.

3. Shim: The function of shim is adjustable in any direction such as X, Y, Z direction through the locator on units .
4. Sheet metal parts: It allows the connected to sensor. The sensor is located to perpendicular of panel.
5. Riser: The geometrical shape of riser block is according to flame cut and maintain the height of unit to the clamp point on panel. The cylinder is mounted on machining face of riser through the screw.

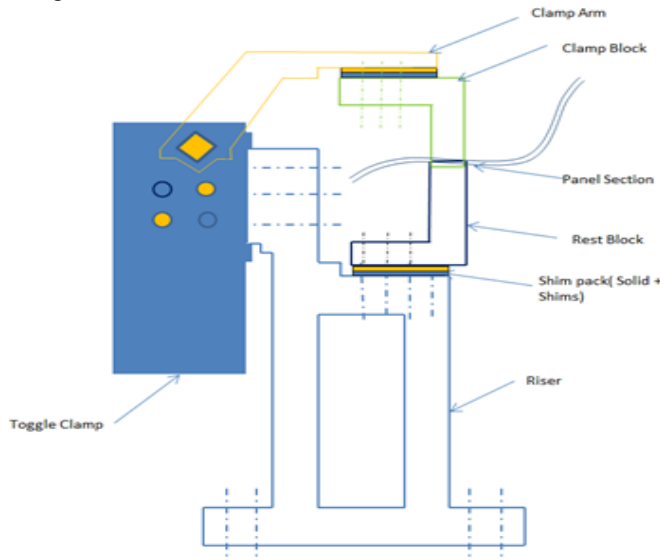


Figure: 5.1 Clamp Unit and rest unit

1. PLP (Principle Location Points) is given by customer.
2. Shimming is depending on the angle between of cross section of panel and locator General rule if the section is inclined more than 15deg or clamping surface is 3D profile then 2 direction shimming are provided otherwise one direction shimming.
3. Process engineer have decided to gun shape stick to X, C type of gun. Do the proper study of gun and weld point.
4. Panel section is passing through the PLP either in opening condition or closing condition .Panel section through X, Y or Z direction passing through PLP. Section will help in finalizing the shape of clamp and rest locator. The panel touch to face of locator is machining and Harding face.
6. Finalization of a base plate plane – consider following things before deciding the base plate.
Height of maximum and minimum weld spot from the floor. No gun arm should touch the base plate. Operator ergonomic while accessing all the spots.
7. Construction of Rest and Clamp Locator:
If standard Mylar has to be used (Few companies make standard height and length of steel blank with few holes and dowels for clamping) then select the proper blank size as per the requirement; consider 5 mm above the panel.
8. Select the clamping cylinder as per the pivot point distance from the PLP. You may choose various cylinder 45°, 60°, 90°, 30 degree opening as per the requirement

(distance of clamp arm from the PLP and no of clamping mounted on each cylinder). Once clamp and rest block is build, start construction of mounting plate or fabrication structure as per the company standard to make the connection with the base plate. shimming is 5mm solid +5mm shim pack, In few companies 3mm shims are used. Make connection plate between rise and Mylar. Material can be 16CrMnO5, C45, Teflon, Aluminum or S-Grun as per the customer requirement. Generally S-Grun mylars are made of more thickness.

VI. CONCLUSION

Fixture is very important of automotive industries. Its increases productivity and accuracy of product according to process sheet automatic and robotic manufacturing plants. Using this concept; improve in quality of product, enhance efficiency of plant, reduce in rework and scrap cost. Utilization of same components when there will be change in product. Thus, from the presented work it can be concluded that, for better design, use of standard components is advisable so that tooling requirement of assembly is less. Fixture line, machining cost is reduces through the shape of machining part. The fine machining is not more than 5 mm, also machining minimize through the flame cut, laser cut, use in manufacturing parts. The thickness of manufacturing part 3, 5, 6, 8, 10, 12, 15, 20,25mm is selected as per standard of sheet.

An ideal fixture should not only provide the machining repeatability and high productivity, it should also offer a solution which reduces workpiece distortion due to clamping and machining forces. The remaining sections of this book provide an in-depth analysis of this topic, which has not been addressed in depth previously.

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