DESIGN OF FIXTURE FOR WELDING ASSEMBLY OF SWITCH BOARD

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ABSTRACT

Fixtures is the component or assembly that holds a part undergoing machining, must be designed to fit the shape of that part and the type of machining being done. The parts to be welded are placed in proper position in fixture and tightened. Welding fixture holds and supports the work piece, prevents distortion in work piece during welding process and withstands high welding stresses. Design of welding fixture involves several parts which broadly include body, locating elements, clamping element and positioning elements. Welding fixture may be modular or permanent fixture, modular fixture is just like permanent fixture with some key changes like it has specially designed tooling plate, block with standard grid pattern and modular elements with great flexibility to arrange them with high accuracy. Top and Base assembly is to be welded on fixture using spot welding process. The relative arrangement of different elements on base plate of fixture is vital part of design. The welding fixture will serve in reducing production time, maintain consistent quality, maximize efficiency, and reduce operator error and makes possible mass production of similar parts in very less time.

Keyword- *welding fixture, flexibility, Top & Base assembly*

1. INTRODUCTION

Fixtures The device that locates and holds the work piece during its machining process. Fixture design has large impact on the product quality manufacturing lead time and the cost. The obvious place for fixture is the mass production, where large quantity output offers simple opportunities for recovery of the necessary investment. However, the advantage in use of fixtures are so great and so varied that these devices have also naturally found their way into production of parts in limited quantity as well as into manufacturing processes outside of machine shop, and even outside of machine cutting industries. It is a special tool use for locating and firmly holding a work piece in the proper position during the manufacturing operation.as a general rule, it is provided with devices for supporting and clamping the work piece. It is fixed to the machine bed by clamping in such a position that the work is in correct relation to the machine tool elements. These are the devices which accelerate the production particularly with 100% interchanging parts.

1.1.Basic Elements Of Welding Fixture

 Locators: A locator is usually a fixed component of a fixture. It is used to establish and maintain the position of a part in the fixture by constraining the movement of the part.

 Clamps: The main purpose of clamping is to securely hold the work piece against the locators throughout the work cycle.

 Fixture body: Fixture body or tool body, is the major structural element of the fixture. It maintains the relationship between the fixtures elements namely locator, clamps, supports and the machine tool on which the work is to be processed.

 Supports: A support is a fixed or adjustable element of a Fixture. When severe part displacement is expected under the action of imposed clamping and processing.

1.2. Problem Definition

Presently there are no fixtures for the top and base assembly of switch Board, because of this dimensions vary every time so which leads to high 3m's (money, men, machine) and increases manufacturing lead time and extremely unsafe. So, it is necessary to develop a fixture to reduce the cycle time of a top and base assembly.

1.3. Introduction to Top and Base Assembly

We have designed the welding fixture of the Top and Base Assembly of the switch board. Before this we should have some basic information of the Top and Base Assembly like its parts, of which material it is to be made, etc. It consists of 6 parts viz. Gusset plates, Filler piece –plain angle, Mid channel (z-shape), End and front channel (c-shape), Foundation plate, Connectors. All the parts are made of M.S. the Parts that are used in top and base assembly are as C- Channels ,Z-Channel, Gusset plates.

1.4. Design Methodology

The design of the welding fixture for top and base assembly is carried out as per the flow chart given in fig . In this flow chart, the initial step starts with the material information, machine Specifications, geometric dimensions and tolerances required to be achieved on the component, and different parts, sub-assembly and their drawings which are made using the software creo-parametric 2.0. Before the design of the welding fixture the fixture requirements have to be considered.

1.5. Some of the requirements of fixture are stated below:

- Physical: The fixture must be physically capable of accommodating the work piece geometry and weight. The fixture must allow access to the work piece features to be machined.
- Tolerance: The fixture locating tolerance should be sufficient to satisfy part design tolerances.
- Constraining: The fixture shall ensure work piece stability (i.e., ensure that work piece force and moment equilibrium are maintained). The fixture shall ensure that the fixture/work piece stiffness is sufficient to prevent deformation from occurring that could result in design tolerances not being achieved.
- Affordability: The fixture cost shall not exceed desired levels. The fixture assembly/disassembly times shall not exceed desired levels. The fixture operation time shall not exceed desired levels.
- Collision prevention: The fixture shall not cause tool path– fixture collisions to occur. The fixture shall cause work piece–fixture collisions to occur (other than at the designated locating and clamping positions).The fixture shall not cause fixture–fixture collisions to occur (other than at the designated fixture component connection points).
- Usability: The fixture weight shall not exceed desired levels. The fixture shall not cause surface damage at the work piece/fixture interface. The fixture shall provide tool guidance to designated work piece features. The fixture shall ensure error- proofing (i.e. the fixture should prevent incorrect insertion of the work piece into the fixture). The fixture shall facilitate chip shedding (i.e., the fixture should provide a means for allowing machined chips to flow away from the work piece and fixture).

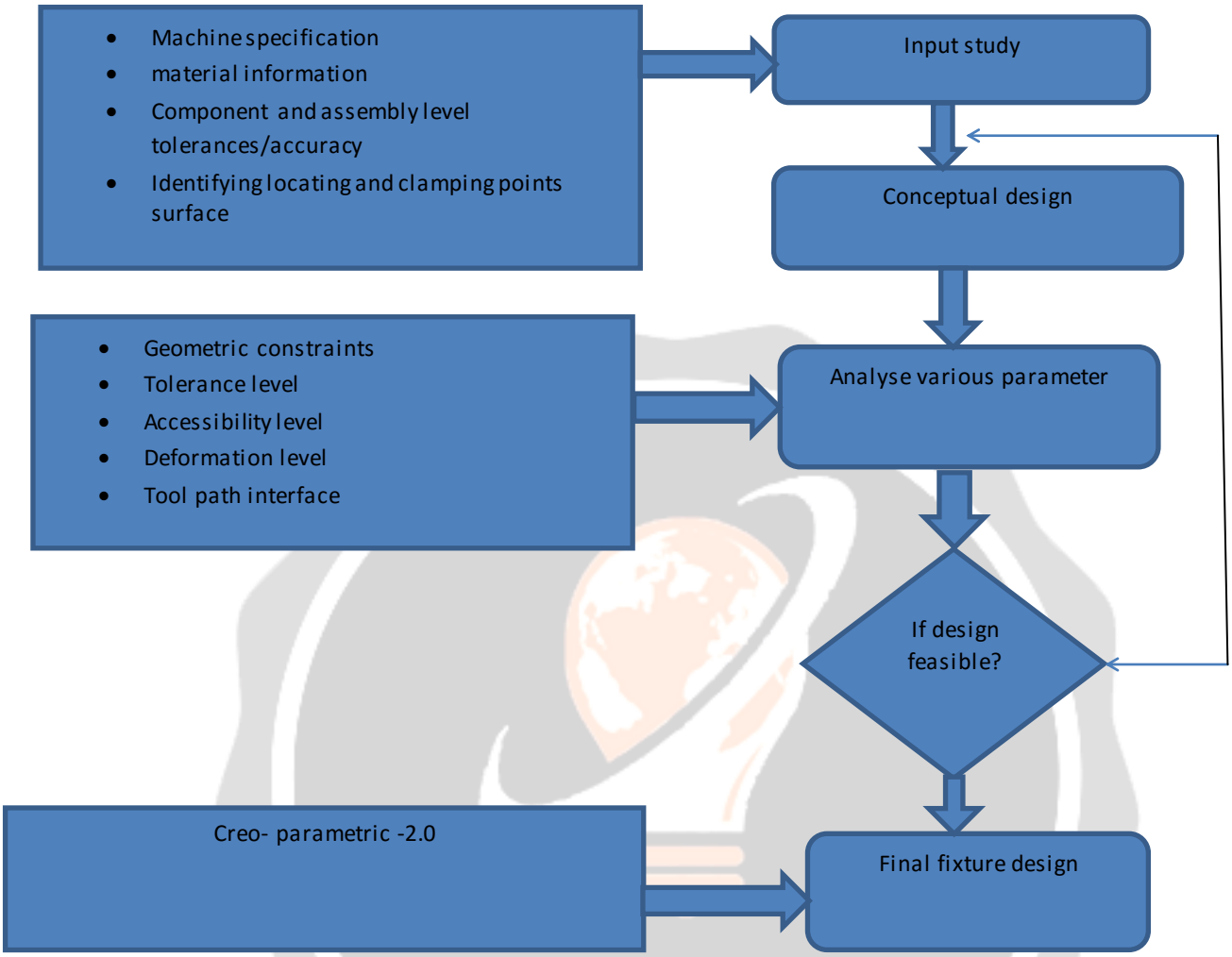


Chart 1-Flow chart to design the fixture

1.6.Objectives

The main objective of this assembly of fixture are as follows:

- Productivity: Fixtures eliminate individual marking positioning and frequent checking. This reduces operation time and increases productivity.
- Skill reduction: Fixtures simplify locating and clamping of the work pieces. Tool guiding elements ensure quick and correct positing of the tool with respect to the work piece. There is no need of skillful setting of the work piece or tool.
  Any average person can be trained to use fixtures. The replacement of a skilled labour with unskilled labour can effect substantial saving in labour cost.
- Interchangeability: Fixtures facilitate uniform quality in manufacturing. There is no need for selective assembly. Any parts of the machine would fit properly in assembly and similar components are interchangeable.

- Cost reduction: Higher production, reduction in scrap, easy assembly and saving in labour cost result in substantial reduction in the cost of work piece produced with fixtures.

1.7. Fixture Design Criteria

The following design criteria must be observed during the procedure of fixture design:

Design Specifications, Factory standards, Ease of use and safety and Economy.

2. DESIGN CONSIDERATION IN FIXTURES

• The main frame of fixture must be strong enough so that deflection of the fixture is as minimum as possible. This deflection of fixture is caused because of forces of cutting, clamping of the workpiece or clamping to the machine table. The main frame of the fixture should have the mass to prevent vibration and chatter.

• Frames may be built from simple sections so that frames may be fastened with screws or welded whenever necessary. Those parts of the frame that remain permanently with the fixture may be welded. Those parts that need frequent changing may be held with the screws. In the situation, where the body of fixture has complex shape, it may be cast from good grade of cast iron.

• Clamping should be fast enough and require least amount of effort.

• Clamps should be arranged so that they are readily available and may be easily removed.

• Clamps should be supported with springs so that clamps are held against the bolt head wherever possible.

• If the clamp is to swing off the work, it should be permitted to swing as far as it is necessary for removal of the workpiece.

• All locator's clamps should be easily visible to the operator and easily accessible for cleaning, positioning or tightening.

• Provision should be made for easy disposal of chip so that storage of chips doesn't interfere with the operation and that their removal during the operation doesn't interfere with the cutting process.

• All clamps and support points that need to be adjusted with a wrench should be of same size. All clamps and adjustable support points should be capable of being operated from the fronts of the fixture.

• Work piece should be stable when it is placed in fixture. If the work piece is rough, three fixed support points should be used. If work piece is smooth, more than three fixed support points may be used. Support point should be placed as farthest as possible from each other.

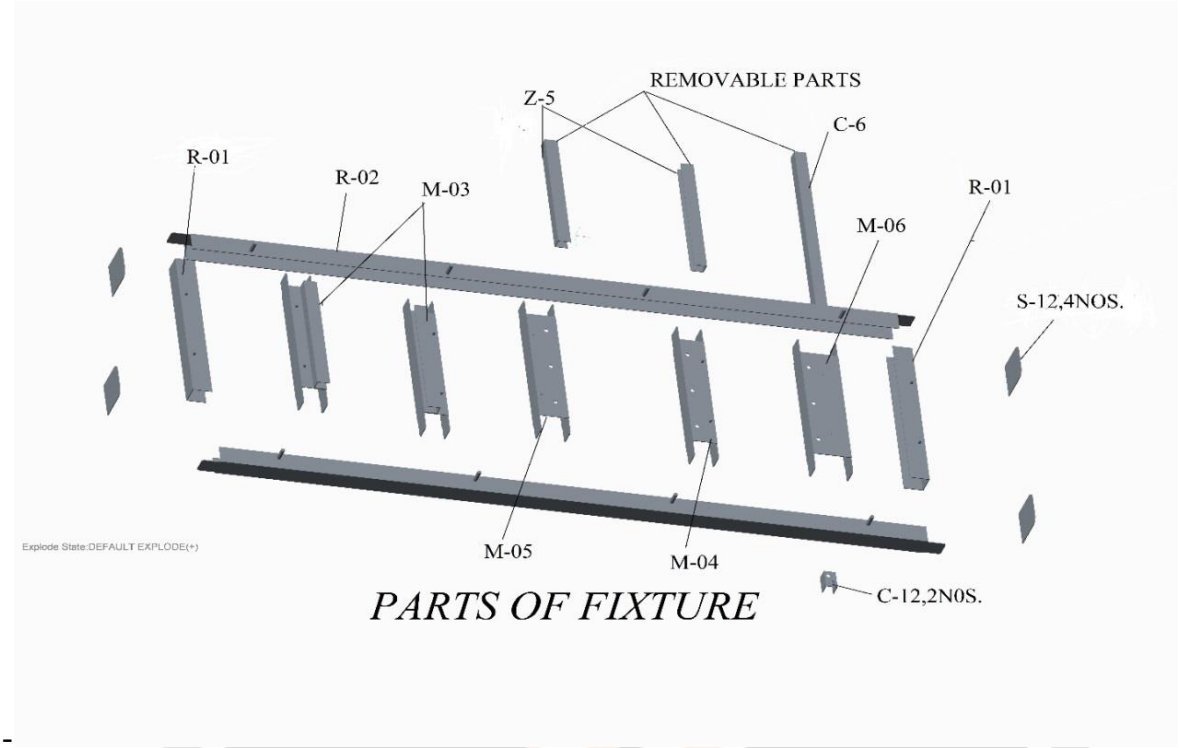
• The three support points should circumscribe the centre of gravity of the workpiece. The surface area of contact of support should be as small as possible without causing damage to the workpiece. This damage is due to the clamping or work forces.

3.SELECTION OF MATERIAL

Table no. 1 Comparison between Mild steel, Aluminum and Cast Iron

Contents	**Mild steel**	**Aluminum**	**Cast Iron**
Material cost	Low	Medium	High
Wear Resistance	Medium	Low	High
Thermal Expansion	Low	High	Medium
Resistivity coefficient ϵ (ohm-m)	15×10^{-8}	2.65×10^{-8}	100×10^{-8}
Density(kg/m^3)	7850	2.7	6800
Specific Heat(Btu/lb/f)	0.122	0.24	0.12
Melting Point(F)	2750	1220	2300
Hardness (BHN)	130	170-187	415
Temperature Coefficient (α_c)	6.66×10^{-3}	3.8×10^{-3}	-

4.FRAME DESIGN



PARTS OF FIXTURE

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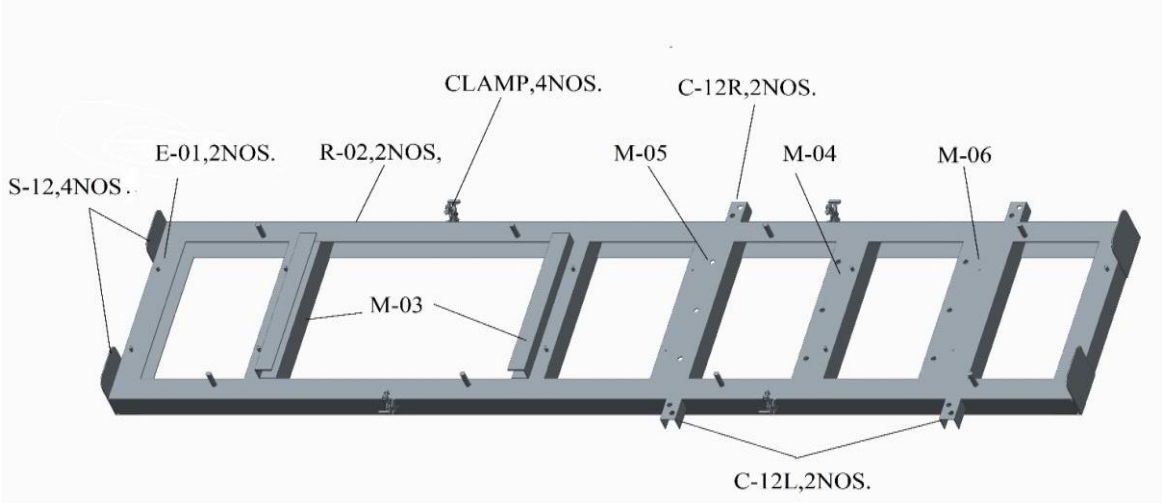
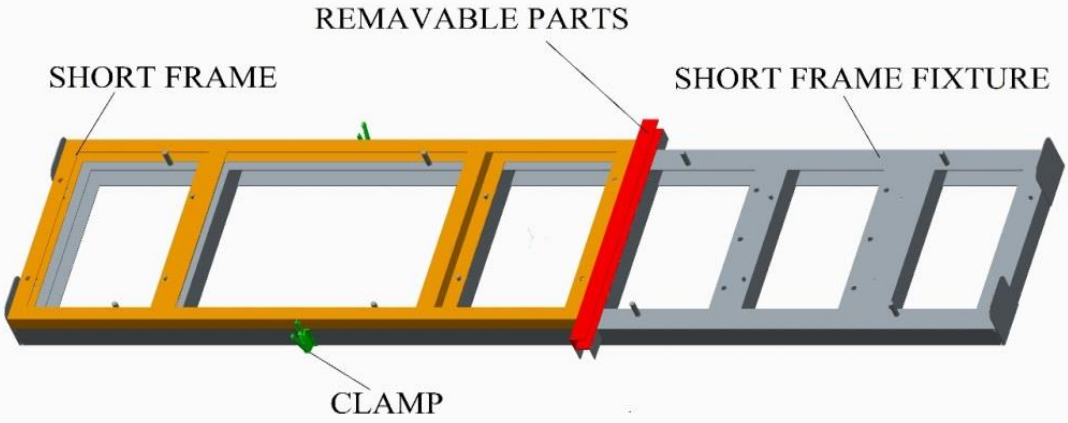
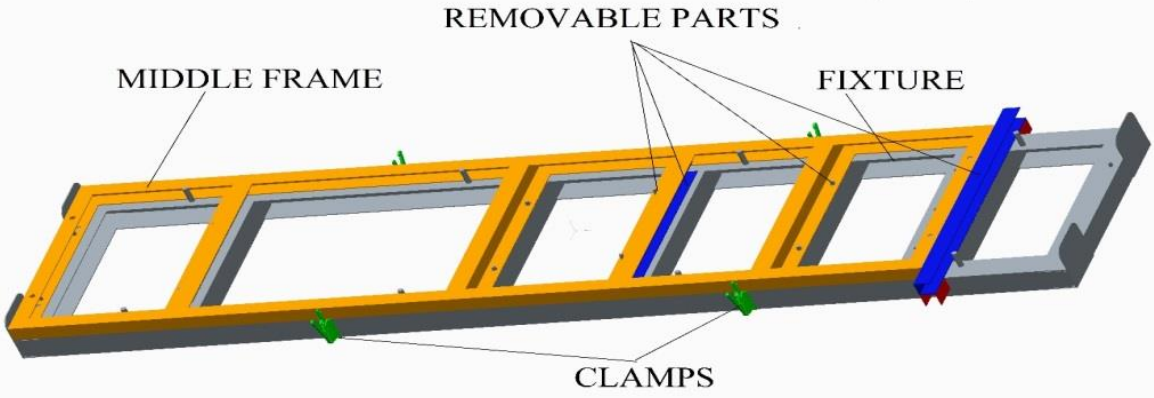


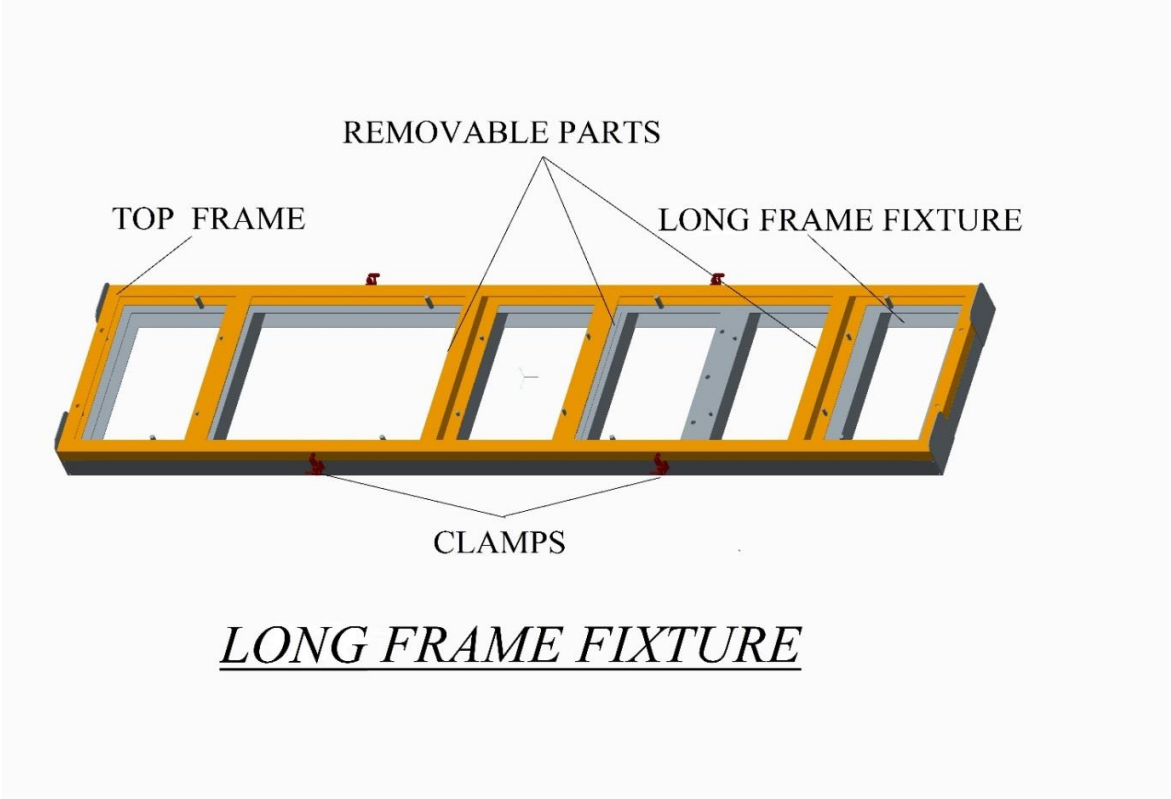
FIXTURE



SHORT FRAME FIXTURE



MIDDLE FRAME FIXTURE



LONG FRAME FIXTURE

5.CONCLUSION

With the advance researches in fixtures, we studied many developments and case studies about fixture design. We go through so many information sites and booklets. After searching the required specifications, we decided to design the suitable fixture. Also we tried to improve the accuracy of top and base frame welding, also we tried to minimize the work time and we tried to combined three different frames fixture in single fixture.

We learned so many new things in the guidance of our industrial guides and college teachers. We also got the knowledge about ergonomic aspects from junior engineers and workers. We are fully satisfied with our project work in the industry.

6.ACKNOWLEDGEMENT

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We perceive this opportunity as a big milestone in our career development. We will strive to use gained skills and knowledge in the best possible way and we will continue to work on their improvement.

7.REFERENCES

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