



# Review Paper on Design and Development of Hydraulic Machining Fixture

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**Abstract:** Fixtures are used to hold the work piece during machining operations. It is also used during the time of inspection, welding and assembling process. This paper presents, design analysis and development of hydraulic fixture for real industrial fixture. Hydraulic fixture to reduce vibration and increase the product quality. In this research is analyzed by ANSYS we have found that the new fixture design will be better than existing model. Hydraulic fixtures are used to hold work pieces in place during machining operations. The process of making hydraulic fixtures involves several steps. First, the fixture is designed using analytical methods to determine the best way to hold the work piece in place and the most efficient way to machine it. Next, the fixture is modeled in 3-D using software such as Pro-E CREO or Solid works. The fixture is then assembled using the components designed in the previous step. After assembly, the fixture is analyzed using software such as ANSYS to ensure that it can withstand the forces generated during machining. Finally, the fixture is used to hold the work piece in place during machining operations. A **hydraulic fixture** is a specialized clamping system that utilizes high-pressure liquids (usually hydraulic oil) to power clamps and securely hold a work piece in place during machining, assembly, inspection, or other manufacturing operations. Unlike manually clamped fixtures, which rely on mechanical force, hydraulically clamped fixtures offer several advantages due to their fluid-based operation.

**Keywords:** Hydraulic fixture, Accuracy, Clamping.

## I. INTRODUCTION

The fixture is a device which is used to locate, hold & clamp the given component in a respective position also it is used to guide the tool with the help of jig plate & bushes. The value of the fixture design & manufacturing is nearly 10-20% of the manufacturing process. There are various types of fixtures according to their applications like machining fixture, Assembly fixture, Inspection fixture etc. The machining fixture is classified mainly two types dedicated fixture & modular fixture. If mass production is there the dedicated fixture is used. & its setup cannot change. When the production is of batch type the modular fixture used. Because it can accommodate the similar product in the batch as it is reconfigurable fixture. The use automation of fixture design is called as computer aided fixture design that results in the lower time required for the fixture design because the traditional method of fixture design of trial & error method is completely avoided. Many software's are used for the fixture design. . The current system uses manual clamping of fixtures for holding the work piece in the proper position while machining operations is being done on the part due to which rejection rate is high. These operations have to be done hundreds of times per day this may cause considerable fatigue to the operator, thereby reducing his efficiency. Also the time spent in this activity can seriously affect the production.

## II. OBJECTIVES

- To study different types of hydraulic machining fixture.
- To choose hydraulic machining fixture for specific application.
- To design and develop hydraulic machining fixture.
- To increase Productivity
- For Consistent Clamping Forces: Every cycle, parts are clamped with the same clamping force, eliminating variables and improving process stability.
- To Achieve Repeatable Clamp Location: Every cycle, parts are clamped in the same location eliminating the variability in part deflection from clamping forces.
- To Eliminates Human Error
- To Perform Faster: Load and unload times and more productivity when cycle times are operator dependent.



### III. FIXTURE DESIGN

The fixture consist of many elements like locating system, clamping system & supporting system. Each of them having different types of elements according to its suitability to the component they are selected. The most significant part in the fixture is the locators. The locator should be place such that it is easy to every time mount the given component & clamping system should be such that it exerts the force against the locator. Types of locators are Round & diamond pin, Floating locating pins, Bullet nose dowels, Bullet nose pins, Cone locator pins etc. & diamond pin locator is used two compensate the gap between two locating surface. Type of clamping are strap clamp, hinged clamp, quick action clamps, power operated clamps etc. The clamping characteristic should be such that position of clamping force on the supported part of work piece. The strength of clamping force should be enough to fix the work piece. If more number of clamps are needed for respective fixture then power operated clamping is suitable to prevent the more time for loading & unloading of component & operator fatigue.

Mainly there are four steps for the fixture design setup planning, Fixture planning, Unit design, Verification. Before the actual fixture design process is started the input for all the step is component cad model & machining operation information. Setup planning shows that the component is oriented in a respective direction by taken into consideration of machining features on the component & when other group of machining feature is to be carry out then the position & orientation of the component is changed. In Fixture planning desirable requirement & characteristic of respective fixture & fixturing layout are find out. In unit design the various types of element is required for the fixture designing & has to be assemble the locating system, clamping system & supporting system. The conceptual unit design & detail unit design needs to be carry out.

### IV. LITERATURE REVIEW

- **Design and Manufacturing of 5 Cylinder Hydraulic Fixture for Machining Case on VMC EZ5 authors 1.Niraj J. Sanghani, 2. Nirav P. Maniar, 3.Hardik Khunt and 4.Pankit Kondhiya**

In this case paper, the research includes design, analytical analysis and manufacturing of a hydraulic fixture with unique concept of rotary table for machining five operations on various faces of component in one setup on VMC EZ5. The innovative use of rotary table eliminates the needs of multiple setup of fixture and thus results in huge cost saving. Fixture is not only designed but manufactured also, and it sets the classical example of design for manufacturing.

- **Design and analysis of hydraulic fixture for hydraulic lift housing authors M M Jegan, B Pitchia Krishnan, Manoj Kumar Shanmugam, P Infant Kebin Raj, K T Bose.**

A review in this research, the found that implementation of this project eliminates the need of human operator for clamping of manifolds.

- **Design and Development of Hydraulic Fixture for Basak Cylinder Head Machining authors Mr. Nagaraj Anand Shet, Mr. Prasad U Raikar**

We get knowledge the present day slants in industry are towards receiving the pressure driven methods, since it Saves time produces Accuracy and provides Flexibility. Designing of hydraulic Clamping Fixture Was Considered to be lengthy And Complicated Procedure. In this project the same methodology is adopted for designing analyzing the designed hydraulic fixture.

- **Design and analysis of hydraulic fixture for hydraulic lift housing M M Jegan<sup>1</sup>, B Pitchia Krishnan<sup>2</sup>, Manoj Kumar Shanmugam<sup>3</sup>, P Infant Kebin Raj<sup>2</sup> and K T Bose<sup>1</sup>**

Fixture is a device used to locate, clamp and support a work piece during machining, assembly or inspection. The most important criteria's for fixturing are work piece stability, position accuracy and work piece deformation. A good fixture design is one that minimizes work piece geometric error [6-9]. A clamping system that uses high-pressure liquids to power clamps and hold a work piece in place. Hydraulically clamped fixtures have many advantages over manually clamped fixtures. In most cases, these benefits reduce costs for manufacturers allowing them to justify the initial investment for a hydraulic clamping system [11 - 15]

- **Kiran Valandi, M. Vijaykumar, Kishore Kumar S, Development, Fabrication and Analysis of Fixture, International journal of science technology management and research; 2014, Vol.3, Issue 4**

A fixture is designed, built to hold, support and locate every component to ensure that each is drilled or machined with accuracy and manufactured individually. A fixture can be designed for the particular job using production tools which make the standard machine tool more versatile to work as specialized machine tools. They are normally used in small scale production by semi-skilled operators. This dissertation work aims at designing a fixture used for performing machining operations at certain angle (102.5 degree) on the Crank case used in commercial vehicles The design of the fixture is simple, the loading and unloading of component is very easy



## V. ADVANTAGES OF HYDRAULIC FIXTURE

1. **Significant Clamping Force:** Hydraulic fixtures provide robust clamping force, ensuring secure positioning and stability of work pieces during machining and assembly processes.
2. **Reliable Clamping:** Unlike manual fixtures, hydraulic fixtures maintain consistent clamping pressure, minimizing the risk of work piece movement or misalignment during production.
3. **Smooth Operation:** The hydraulic control system allows for precise and smooth movement of fixture components. This enhances overall efficiency and reduces wear and tear.
4. **User Convenience:** Operators can easily adjust hydraulic fixtures to accommodate different work piece sizes and shapes. This flexibility improves productivity and reduces setup time.
5. **Widely Used:** Hydraulic fixtures find applications in CNC machine tools, machining centers, and automated production lines. Their versatility makes them indispensable in modern manufacturing.

## VI. CONCLUSION

- It reduces the cycle time. It gives an economically feasible design. Also ensures accurate & efficient clamping of parts. The suggested system helps in achieving sophisticated, precise, reliable, safe as well as accurate production methods. The clamping systems are designed such that they withstand the huge retention forces applied from the machining operations onto the work piece
- The fixture will not only provides the repeatability and high productivity, but also offers a solution, which reduces work piece distortion due to clamping and machining forces.

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