

# A Critical Review on Bellow Part Removal Fixture

Sanchita Rahane<sup>1</sup>, Shwetlana Kawde<sup>2</sup>, Sneha Bhalekar<sup>3</sup>, Priyanka Badge<sup>4</sup>

<sup>1,2,3,4</sup>Student, Department of Mechanical Engineering PCET-Nutan Maharashtra Institute of Engineering and Technology, Talegaon Dabhade, Tal-Maval, Dist-Pune.

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**Abstract** – Fixture is a device used for holding a component firmly in a machine to constrain its degree of motion. Fixtures are essential elements of machining system for material removal process and being part of the precision path and forced flux between process and machine tool. Fixture are also made for assembly and inspection work. In the manufacturing industry, fixtures have a direct impact on product manufacturing quality, productivity and cost. Best feature of fixture to reduce the production cycle time. The relevance of fixture regarding productivity, efficiency and quality is mostly not considered properly. Bellow is a pliable element of the expansion joint with number of convolution to permit the physical changes in dimensional resulting from various mechanical forces, vibrations, thermal expansions. Tubular bellow are one of the most efficient energy absorbing elements for engineering system.

**Key Words:** Bellow, Fixture, Productivity, Cycle time, Cost

## 1. INTRODUCTION

The bellows is the flexible element of the expansion joint. An expansion joint or movement joint. Bellows are designed to absorb various dimensional changes both in lateral, longitudinal, angular direction resulting from various mechanical forces, vibration, shocks or any thermal expansion or compression of the pipelines. After being a flexible element of expansion joint the bellow should be pliable enough to accommodate the dimensional changes and strong enough to withstand various stress components on the bellow. A fixture is a work holding or support device used in manufacturing industry. Fixture is used to securely locate and support the work. Fixture is a special process device which is assembled and fixed in the process of machining. Its performance directly affects the quality of products. Fixtures are also used for casting and forging which are rough and irregular in shape. In order to maintain the workpiece stability during a machining process, an operational fixture has to satisfy several requirements to fully perform its functions as a workholding device.

Essential features of fixture:

To reduce the production cost

It should increase the productivity

To reduce the production cycle time

The design should assure the perfect safety of the operator.

## 2. Literature Review

**Prof. Mr. Uday C. Agashe, Mr. Adwait Ranpise, Mr. Mayur Mahajan, Mr. Anil Shrirame (2018)**

During manufacturing of Mechanical components, different types of holding and guiding tools are used. These holding and guiding devices are called as 'Jig and Fixture'. A fixture is a device used for holding a component firmly in a machine to constrain its degree of motion. A jig is a device that performs both functions i) holding the component ii) guiding the tool. Earlier, simple mechanical fixtures were used to clamp a component by means of kinematic linkages. The forces developed due to linkages were unevenly distributed over the component so that there was a chance to disturbing the component profile. These problems were arisen many times and as the component shape changes fixture design also changes. To overcome these problems various types of fixtures are introduced for specific operations (like for welding & drilling, for inspection, for assembly, for milling etc.) and in this way modification in the fixture is done.

**Hans-Christian Möhring, Petra Wiederkehr (2016)**

Intelligent fixtures enable the identification of critical process conditions, a compensation of error influences and the minimization of defective parts. At first, this contribution presents a study in which the influence of the clamping setup and of the workpiece characteristics at various steps of the machining process is analyzed. Experimental and theoretical results regarding the dynamic process behavior reveal the relevance of these influences with respect to machining performance and workpiece quality. Secondly, the European research project INTEFIX is introduced. Representative approaches of intelligent fixtures, reducing workpiece vibrations and distortions, and improving workpiece alignment, are described and prototypes are shown. In a third part, two examples of intelligent fixtures are presented and discussed more in detail. The first example concerns a fixture for the identification and active mitigation of chatter in milling of thin walled workpieces. The second example is related to the compensation of workpiece distortions which occur in machining of large thin walled structural parts.

**Tuhin Halder, Ankush K. Biradar, Dr. S. Ram Reddy (2017)**

Expansion bellows are designed to absorb various dimensional changes both in lateral, longitudinal and angular directions resulting from various mechanical forces, vibrations, shocks or any thermal expansion or compression of the pipelines. After being a flexible element of expansion joint the bellow should be pliable enough to accommodate the dimensional changes and strong enough to withstand induces various stress components on the bellow components. Similarly the bellow should have enough endurance to serve the purpose of certain system requirements. The design of bellow with various concerns including flexibility, strength and endurance make the design, manufacturing and testing processes of Expansion bellow quite unique.

**Brijesh M. Patel, B.D.Patel, V.M.Prajapati (2013)**

The flexible element of an expansion joints consisting of one or more convolutions with no more than five plies and the end tangent with length to diameter ratio not more than three. Any device containing one or more bellows used to absorb dimensional changes such as caused by thermal expansion or contraction of pipe line, duct or vessel or heat exchangers. Tubular bellows are one of the most efficient energy-absorbing elements for engineering system. Metal bellows have wide application in aerospace, micro electromechanical system, chemical plants, power system, heat exchangers, automotive vehicle parts, piping system, petrochemical plant, refineries, power stations, district heating installations, HVAC systems etc and wherever piping systems or ducts are subjected to movement through the effects of temperature, pressure or external forces etc. In this present Review the author have been found out the development of bellows, Forming Technology, analysis of movement test, buckling, Mechanical behavior, Design concept, Effective parameters and Analysis of the bellow by using commercial available software.

**Cui Wenbo, Li Xinkai, Meng Chenggong, XIA Tenghui (2018)**

Based on the need for rapid welding of intelligent automotive sheet metal parts, a pneumatic clamp was developed for this process. The design of the fixture measuring mechanism, fixture base plate, clamping device and positioning mechanism was elaborated in detail. The simulation of the vulnerable

**3. DESIGN CONCERN PARAMETERS**

(a) 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.

(b) 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.

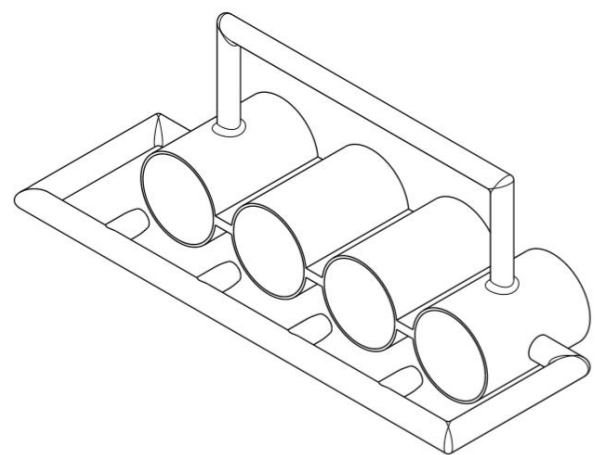
(c) Clamping should be fast enough and require least amount of effort.

(d) Workpiece should be stable when it is placed in fixture. If the workpiece is rough, three fixed support points should be used. If workpiece is smooth, more than three fixed support points may be used. Support point should be placed as farthest as possible from each other.

(e) The three support points should circumscribe the centre of gravity of the workpiece.

(f) 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.

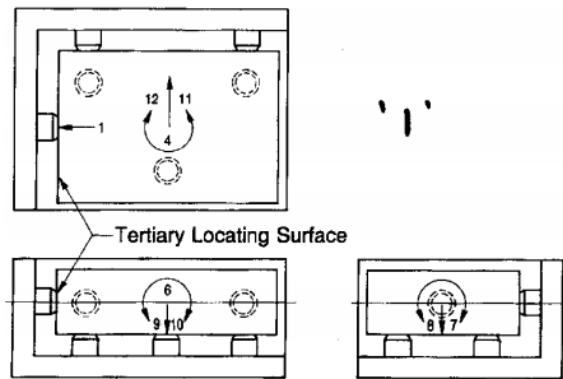
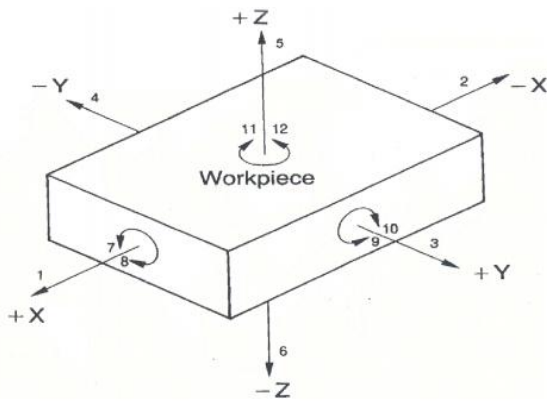
(g) Support points and other parts are designed in such a way that they may be easily replaced if they break.



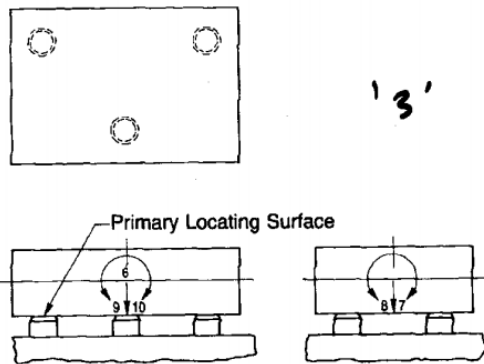
Isometric view  
Scale: 1:3

**Fig.1 Fixture Drawing**

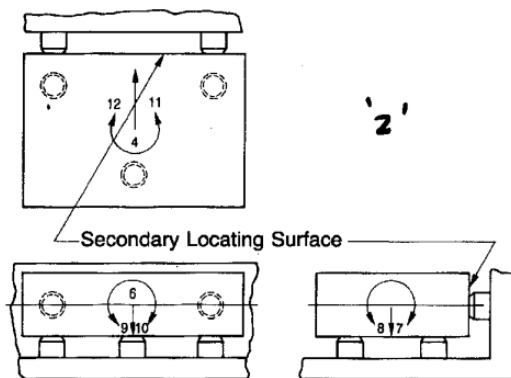
Many dedicated fixtures for prismatic parts are designed using the "3-2-1" locating principle.



The "3" in 3-2-1 refers to 3 locators (passive fixture elements) on the primary locating/datum surface.



The "2" in 3-2-1 refers to 2 locators on the secondary locating/datum surface.



The "1" in 3-2-1 refers to 1 locator on the tertiary locating/datum surface.

#### 4. CONCLUSION

Fixture is used for locating and holding the workpiece. Fixture is always fixed to machine or bench. Fixture is generally used for mass production. Fixture reduces operator's fatigue. The fixture also follows the principle of locating and clamping. The various types of fixture such as vise, milling, grinding, facing, turning, faceplate and boring fixture are explained with examples in this unit. The design of fixture depends upon the shape and size of workpiece. The fixture may be different for different workpieces.

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