

DESIGN AND FABRICATION OF MECHANICAL FIXTURE FOR HMC MACHINE

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Abstract—Fixture is a device which secures a single object to a location in space relative to a specific reference plane and/or point by limiting at least four of its possible six degrees of movement in space (along the x, y and z axis and rotation about said axis). In existing set up the workpiece is manufactured on conventional machining operations, so the aim of this project is to replace with fixture for HMC machine to increase production rate of workpiece.

Index Terms—Fixture, Productivity, Improve Accuracy.

I. INTRODUCTION

The fixture is a special tool for holding a work piece in proper position during manufacturing operation. For supporting and clamping the work piece, device is provided. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process is eliminated by fixture. This increase productivity and reduce operation time [1]. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts. In existing design the fixture set up is done manually on conventional lathe and milling machines. So the aim of this project is to replace with mechanical fixture to save time for loading and unloading of component [3].

A fixture consists of a set of locators and clamps. Locators are used to determine the position and orientation of a workpiece, whereas clamps exert clamping forces so that the workpiece is pressed firmly against locators. Clamping has to be appropriately planned at the stage of machining fixture design. A fixture is a production tool that locates, holds, and supports the work securely so the required machining operations can be performed. A fixture should be securely fastened to the table of the machine upon which the work is done [4].

II. PROBLEM STATEMENT

In company, currently the operation on workpiece (32-A cylinder) is carried on conventional machineries. These are time consuming and sometimes non economical. In this process 8 workpieces were produced during the time span of 12 hours.

Conventional machines include:

- Simple drill machine
- Radial drill machine
- Milling machine
- Four axis VMC (Vertical Machining Centre)



Figure1 : Conventional Machining Operations

III. OBJECTIVE

The objective of mechanical fixture is to transfer the conventional machining operations to modern and high-tech machine i.e. HMC (MORI SEIKI NHX 6300 DCG-2).

- The name of job/workpiece is 32-A cylinder.
- Material used is cast iron.
- It is a pneumatic cylinder used in Atlas Copco.



Figure 2: 32-A-Cylinder (workpiece)

After analyzing operations performed on conventional machines, we came across a machine called HMC (MORI SEIKI NHX 6300 DCG-2). This machine was vacant and after studying we found that the machine is suitable for 32-A cylinder.

Hence operations that can be performed on HMC are as follows:

- Facing
- Boring
- Counter boring
- Drilling
- Grooving
- Chamfering
- Threading

Hence most of the operations performed on conventional machines could be easily replaced by designing the appropriate fixture for HMC.

IV. HORIZONTAL MACHINING CENTRE (HMC)

Name of Machine: MORI SEIKI NHX 6300 DCG-2

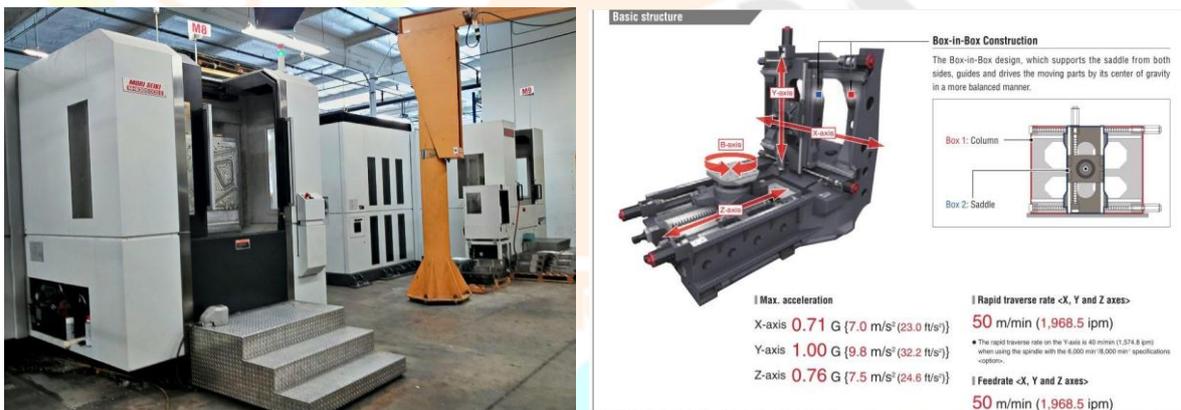


Figure 3: Actual machine and its internal structure.

Specifications of NHX 6300

- DDM (Direct Drive Motor) on the B-axis (option).
- Rapid traverse rate (X/Y/Z): 60 m/min.
- High-rigidity spindle with a large-diameter bearing.
- Ring type magazine (60 tools) offers high-speed indexing.
- The reduction in standby power.

V. DESIGN AND FABRICATION OF FIXTURE

Important considerations while designing jigs and fixtures. Designing of and fixtures depends upon so many factors. These factors are analyzed to get design inputs for and fixtures [3].

The list of such factors is mentioned below:

- a. Study of workpiece and finished component size and geometry.
- b. Type and capacity of the machine, its extent of automation.
- c. Provision of locating devices in the machine.
- d. Available clamping arrangements in the machine.
- e. Available indexing devices, their accuracy.
- f. Evaluation of variability in the performance results of the machine.
- g. Rigidity and of the machine tool under consideration.
- h. Study of ejecting devices, safety devices, etc.
- i. Required level of the accuracy in the work and quality to be produced

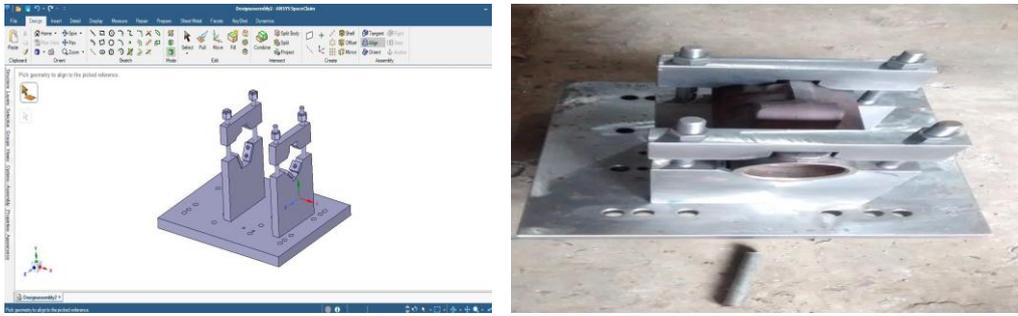


Figure 4: CAD Design and Actual Fixture.

- Graphical representation for increment in Production rate.

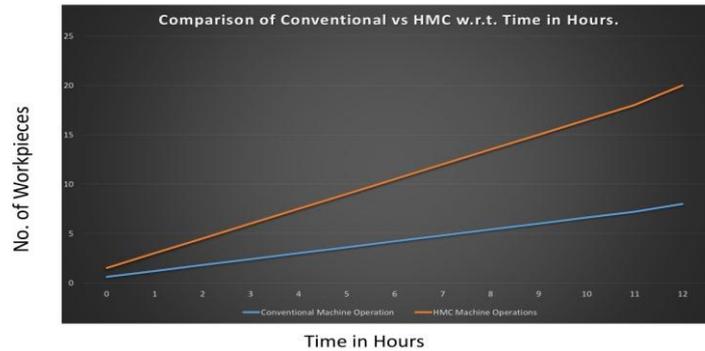


Figure 5: Comparison of conventional machining operation vs operation on HMC w.r.t. Time

ADVANTAGES

- High productivity.
- Time consumption less.
- High accuracy
- Corrosion resistant.
- Less or negligible errors.
- High surface finish.
- Low maintenance cost.
- Less wear of fixture material.
- Economical then conventional.
- No lubrication is required.

DISADVANTAGES

- High initial cost.
- Difficult in handling.
- Programming of the machine was difficult.
- Due to thick cutting chips, the safety glass of the machine broke.

CONCLUSIONS

- The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable.
- Hence we have completed the fixture and a successful trial has been done.
- The production rate of the workpiece (32-A cylinder) increased.
- Elimination of human errors.
- Reduction in cycle time of operations.

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