



Research Paper

REDUCE HUMAN ERROR FOR DESIGNING THE FIXTURE USING POKA YOKE

A Punjab Singh^{1*}, A B Nagarajan¹, R Ramkumar¹

*Corresponding Author: **A Punjab Singh**, ✉ apunjabsingh@gmail.com

In this paper implemented a creative idea for mistake proofing in the fixture for piston and connecting rod sub assembly. In this paper to reduce the human errors on engine assembly through mistake proofing concept. We focused on the complete engine assembly operation and the tools used. And mainly generate complete knowledge about the total engine assembling operations. To enhance the tooling section and maintenance of the organization. The main objective of this paper reduce the customer complaint and also standardize the way of sub assembly of piston and connecting rod through implementation of mistake proofing based assembly fixture.

Keywords: Connecting rod, Fixture, Poka Yoke, Piston, Stroke

INTRODUCTION

The main aim of the task is to design a fixture for piston con-rod sub-assembly fitment in the engine assembly line. The various purposes of selecting this particular task are eliminate the human fatigue, to avoid inverted assemble of piston and connecting rod, to make the assembler conscious when human is doing the assembly wrong, to make this fitment more simpler and easier, to achieve quality & perfect

engine performance and to do the assembling work much faster to reduce the assembling time.

FIXTURE

Fixture is a work holding device which only

holds and positions the work piece. It does not guide the tool. Sometimes there is a provision in the fixture for setting the tool with respect to the work piece.

Fixtures are most often clamped to the machine table. Fixtures are widely used in turning, milling, grinding, shaping, planing, boring operations.

FUNCTION OF FIXTURE

The main functions of fixture is locating and clamping are the two activities to ensures the desired quality in production related operations like machining welding inspection and assembly. When few parts are to be produced many operations can be performed by clamping the work piece to the machine

¹ Asst.Professor, Department of Mechanical Engineering, Sir issac Newton college of Engineering and Technology, Nagapattinam, India

table without using a specialized and dedicated work holding device. When no of parts produced increased significantly, much of the time spent on locating and clamping. Those times are non-productive times, which will increase the manufacturing lead time. Fixture is a used for locating and holding the work piece during the machining and positioning parts relative to each other during assembly.

The following are the main function of the fixture.

- To locate and position the work piece relative to the tool.
- To clamp the work piece during machining and assembly.

OBJECTIVES OF FIXTURE

- To reduce the customer complaint and also standardize the way of sub assembly of piston and connecting rod through implementation of mistake proofing based assembly fixture.
- To improve the quality of the product.
- To reduce the machining lead time and control the cost estimation.
- To increase the performance of the engine and also reduces the noise

EXISTING WORK

Mistake Proofing Concept on Piston

The engine assembly is the heart part of this organization. Hopely this paper had a good scope in the engine assembling shop and tool management section of the organization. This paper will lend numerous benefits to the organization side and company side Some of the major valuable and economic benefits that could be achieved by the organization.

It consists of following tasks:

Task1 include the following functions:

- Tool cost can be reduced enormously.
- Machining time can be conserved to a great extent.
- Labor cost can be reduced moderately.
- Tool material can be saved to a large extent.
- Easy to handle tools in the engine assembly line.
- Idle tools can be easily isolated from the shop floor.
- 5'S concept can be perfectly practiced.
- Tool wastage can be avoided and Tools can be easily handled.
- Appropriate tools can be exactly provided to the actual operation.
- Engine assembling operation can be made simpler.
- Searching of the tool by the worker can be avoided.

Task2 include the following functions:

- Human errors can be avoided at any situation.
- Rework/Rejection can be eliminated.
- First time fitment quality ensured.
- Ease to handle assembling parts.
- Reduced human fatigue.

FOUR STROKE ENGINE DRAW BACKS OF THE CURRENT METHOD

Assembling of Piston and connecting rod based one O-marking provided in the piston. There is a manual dependent process, where operator refers the O mark every time to assemble the connecting rod.

Great possibility of human error which leads to misalignment of piston & con-rod sub-assembly into the cylinder block. Inverting of piston is the vital problem. Misalignment of piston With respect to connecting rod will lead to,

- Low performance of engine due to profile mismatch between crankshaft and connecting rod.
- Oil hole mismatch between crankshaft and connecting rod leads to more friction and leads to low performance of the engine.

PROPOSED METHOD

To eliminate all the above said drawbacks of misalignment of piston con-rod sub-assembly, we have to implement the POKA-YOKE method in our proposed work.

PISTON CON-ROD SUB-ASSEMBLY FITMENT

Poka Yoke is a quality management concept developed by a Matsushita manufacturing engineer named Shigeo Shingo to prevent human errors from occurring in the production line. Poka yoke (pronounced "poh-kahyoh-kay") comes from two Japanese words "yokeru" which means "to avoid", and "poka" which means "inadvertent errors. Poka yoke is sometimes referred to in English by some people as "fool-proofing". However, this doesn't sound politically correct if applied to employees, so the English equivalent used by Shingo was "error avoidance." Other variants like "mistake proofing" or "fail-safe operation" have likewise become popular.

IMPORTANTANCES OF POKE YOKE

- The main objective of poka yoke is to achieve zero defects.

- In fact, it is just one of the many components of Shingo's Zero Quality Control (ZQC) system, the goal of which is to eliminate defective products.
- Poka yoke is more of a concept than a procedure. Thus, its implementation is governed by what people think they can do to prevent errors in their workplace, and not by a set of step-by-step instructions on how they should do their job.
- Poka yoke is implemented by using simple objects like fixtures, jigs, gadgets, warning devices, paper systems, and the like to prevent people from committing mistakes
- These objects, known as poka yoke devices, are usually used to stop the machine and alert the operator if something is about to go wrong.

Characteristics of Poka Yoke

- Useable by all workers
- Simple to install
- Does not require continuous attention from the operator
- Low-cost

Poka yoke is at its best when it prevents mistakes, not when it merely catches them. Since human errors usually stem from people who get distracted, tired, confused, or demotivated, a good poka yoke solution is one that requires no attention from the operator.

Such a poka yoke device will prevent the occurrence of mistake even if the operator loses focus in what operator is doing.

Usage

Poka-yoke can be used wherever something can go wrong or an error can be made. It is a

technique, a tool that can be applied to any type of process be it in manufacturing or the service industry.

Errors are many types:

1. Processing error: Process operation missed as per the operating procedure.
2. Setup error: Using the wrong tooling or setting machine adjustments incorrectly.
3. Missing part: Not all parts included in the assembly, welding, or other processes.
4. Improper part/item: Wrong part used in the process.
5. Operations error: Carrying out an operation incorrectly.
6. Measurement error: Errors in machine adjustment, test measurement or dimensions of a part coming in from a supplier.

Primary Methods Of Poka-Yoke

- Contact
- Counting
- Motion-Sequence

In this paper analyse the contact method for reducing the human error in very efficient manner.

WORKING PRINCIPLE

The basic principle of our poka-yoke tool is CONTACT METHOD which is described as “the technique of proving the mistakes done by the worker with the help of sensing nature when he physically approaches the component”.

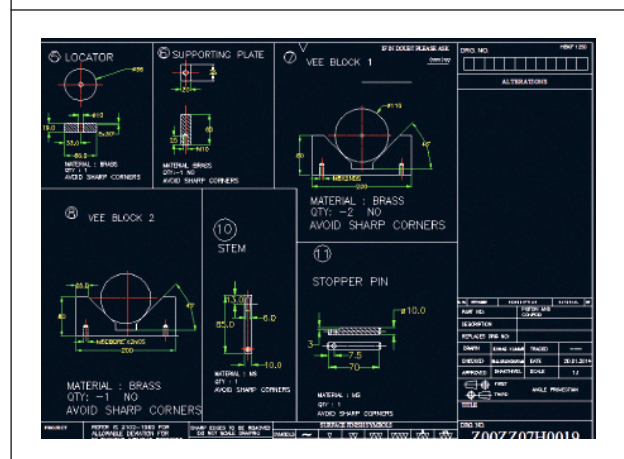
TECHNIQUES & PROCEDURE

Undergone detailed about the current method used to fit the piston con-rod assembly. Recorded the mistakes done by the

assembler. Analysed the cause and effects of the mistake done by the assembler. Analysed the drawbacks of the current method. Concentrated on the piston crown structure. Noted the assembling time on the operation and human fatigue.

Noted that fitment of piston con-rod sub-assembly into the cylinder in an inverted position due to carelessness of the assembler is the major problem. Understood the major effects of the above said mistake. Decided to implement poka-yoke concept. Analysed the detailed structure of connecting rod and piston.

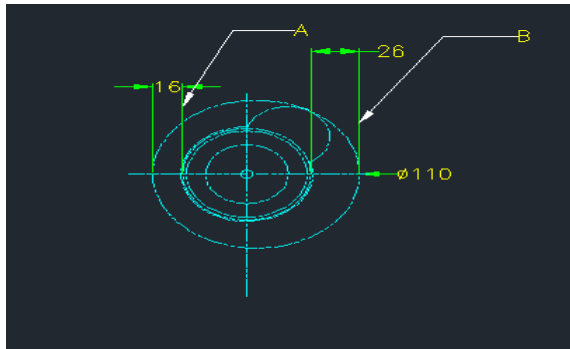
Figure 1: Procedure for Connecting Rod



POKA-YOKE MISTAKE PROOF CONCEPT

Decided to make use of the OFFSET DISTANCE between the piston axis and the combustion chamber axis. Designed the fixture for mistake.

Distances of A & B (16 & 26 respectively) have captured to bring Poka-yoke concept in the fixture. dimensions of A & B will vary with respect to the combustion chamber axis.

Figure 2: Contact Method

CONCLUSION

A good exposure for designing, assembling, manufacturing in association with time study, work study and team work in the automobile field particularly in the engine field has gained through this Poka-Yoke method. But during this paper work gained many information about the complete assembly of the Medium duty and heavy duty vehicles especially about the 4-stroke diesel engine. Definitely our paper propose more methods ro reduce the human errors in efficient manner and assure that this paper work will add value to us to our academics as well as in the future vision. Also we hope that our paper work will be more useful.

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