IMPLEMENTATION OF POKA-YOKE TECHNIQUE IN A GEAR INDUSTRY – A CASE STUDY

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Abstract- Rejection of manufactured parts at various stages of manufacturing cannot be tolerated now days in production scenario due to tough competition worldwide. All manufacturing industries are moving in the direction of zero defect production. To implement this, the first and most important thing which is being done by the manufacturing industries is to prevent the error or completely eliminate the error with the application of some proven techniques. Poka yoke is one of the techniques and this paper focuses on an application of this technique on a drilling fixture of a drilling machine at a cell in gear manufacturing company. As a result of the application of poka yoke on a drilling fixture, possibility of drilling on the opposite face of a gear is eliminated completely.

Keywords: Poka Yoke, Quality management. Lean practice

I. INTRODUCTION
Poka -Yoke is a device that is used to either detect or prevent defects from occurring. The aim of Poka-Yoke is to eliminate defects in a product by preventing or correcting errors as early as possible. The essential idea of Poka-Yoke is to design your process so that mistakes are impossible or at least easily detected and corrected. Basic function of Poka- yoke has been shown in figure 1. Poka-Yoke (means mistake-proofing) technique was developed by Shingo in 1961. He is the person who is also responsible for the Toyota Production System (TPS) and Just-In-Time (JIT) production system. Poka Yoke uses devices on process equipment to prevent the special causes that result in defects, or to inexpensively inspect each item that is produced to determine whether it is acceptable or defective. A Poka-Yoke-designed manufacturing device is one of the bases of Shingo’s zero quality control concepts which mean that the defect rate in a production is zero. Poka-Yoke design can dramatically decrease the risk of producing defectives again [1]. Poka- yoke is a technique for avoiding simple human error in the workplace also known as mistake-proofing, goof proofing. Poka-Yoke is simply a system designed to prevent inadvertent errors made by workers performing a process [2]. The aim of Poka-Yoke method is to eliminate or minimize human errors in manufacturing processes and management as a result of mental and physical human imperfections [3].

II. SCOPE OF THE CASE STUDY AND OUTLINE OF THE PROCESS
This case study has been done on a drilling machine in a gear manufacturing company. The scope of this case study is limited to the drilling fixture of the drilling machine to eliminate the possibility of drilling on the opposite face of a gear. The configuration of the cell arrangement is shown in figure 2.

Steps for implementing the Poka Yoke
Problem Recognition: As shown in figure 2 the cell is producing small diameter gears starting from turning operation on lathe machine, followed by hobbing, shaving, and culminated at drilling operation as per the requirement of the customer. The problem which was occurring frequently after the drilling operation is that, drilling was taking place on the opposite surface of the gear also which is causing the rejection of components. In this way problem is recognized in drilling operation which is to be resolved.

Analysis: Since all the causes of rejection are related with various factors i.e. man error, machine error, material error, method error and information error. Analysis of this problem has been done in detail as shown in figure 3. The two
prominent reasons which have come up after the detailed study of the rejection of machined gears after drilling operation on opposite face of the gears are inadequate training of the operators regarding standard operating procedure and second is, there was a problem in the drilling fixture in the sense that there was no such arresting system in the fixture which can prevent the placing the gears on the fixture, if it is placed wrongly by operator.

**Implementation of Poka yoke:** In this stage need for Poka Yoke has been identified to rectify the problem of drilling fixture as found in analysis stage. As we can see in figure 4a that as per drawing of the gear there is two hole of 8 mm diameter is needed on the gear face “A” and one hole of 8 mm is needed on the gear face “B”. Problem which is occurring during drilling operation is that sometimes due to same dimensions of the hole, by mistake operator is performing the drilling operation of face “A” on face “B” and vice versa. To compensate this problem, drilling fixture is modified and pin is inserted on the drilling fixture so that correct hole can be drilled only on the correct face as shown in figure 4a & 4b.

**III. RESULT & DISCUSSIONS**

Implementation of this Poka Yoke has been done successfully on the drilling fixture of the drilling machine. This Poka Yoke helped to increase in quality and performance of the drilling machine by controlling the rejection of gears that affected the whole lot. The number of gears drilled wrongly on the opposite face was reduced considerably. This resulted in turn better quality products and reduction in rejection costs. Overall equipment effectiveness (OEE) of the machine is also increased considerably.

**Horizontal Deployment:** Same Poka Yoke has been successfully implemented on the other gear cells of the company also, which are having a similar nature of production configuration.

**REFERENCES**

