Removing the Problem of Screw Miss in Assembly of Lever Combination Switch using Poka-Yoke

Anil Kumar, Vijay Mittal

Abstract*- *A new approach for the implementation of quality philosophy Zero Quality Defects with usage of the Poka-Yoke method in the Assembly Line has been presented. The possibility of usage of mistake proofing device is connected with monitoring and improvement of operations in the process. The Poka-Yoke method of preventing errors by putting limits on how operation can be performed in order to force the correct completion of the operation has been presented. The possibility of implementing of the Poka-Yoke method as a factor of improving operation in the process in the assembly line has been shown. The aim of method Poka-Yoke in those practical examples is to eliminate or minimizes human error in manufacturing process and management as a result of mental and physical human imperfections.

Index Terms— Lever Combination Switch; Mistake proofing; Poka Yoke ; Mindarika Company Limited

I. INTRODUCTION

1.1 Background

Quality is now involved in every kind of business: manufacturing, hospital, school, food industry, public utility, etc. This is not focused only in production areas but in service areas also. It has turned out to be a core competency for many companies to improve their competitive advantage. Why is quality important? High quality products or services are leading to business success, improved competitiveness, higher customer loyalty, and lower costs.

Lean Manufacturing is one of the strategies that can help organizations to satisfy customer needs and help organizations to have greater performance.

1.2 Project/Concerned Place Introduction

1.2.1) Introduction

Mindarika Pvt. Limited, with Rs.1.30 billion (USD 32.12 million) in revenue, is India's largest 4 wheeler automotive switch manufacturer. Mindarika Pvt. Limited has consciously evolved into a complete design and development centre for four wheeler automotive switches. It offers customized solutions to the automotive industry in the realm of product improvisation and new product development. The core strengths at Mindarika are skilled manpower, adherence to

the highest quality standards and providing cost effective solutions. **Products for 4 Wheelers produced by the company are-** *Lever Combination Switches, Panel Switches , Power Window switches ,Oil pressure switches, HVAC panel Assemblies, Ashtray & Lighters etc.*

1.2.2) Mindarika's Quality

Quality of automotive parts and customer service has been the focus of the company to gain market share and to satisfy their customers. Table shown below explains the various certificates achieved by the company-

Name of the Unit	Certifications
Mindarika Pvt. Ltd.	TS:16949:2002,QS 9000 : 1998, ISO 14001 : 2004
Minda Industries Ltd. Switch Division	ISO 9001: 2000, ISO 14001 : 1996 OHSAS 18001

Table 1- Quality certificates awarded to Mindarika

II. LITERATURE REVIEW

This chapter will discuss concepts of quality including continuous improvement, lean techniques. Moreover, this chapter is devoted to the review of literature which includes the concept of automotive parts manufacturing and processing.

2.1) Lean Manufacturing Principles

Lean Manufacturing focuses on eliminating waste while delivering quality products at the lowest cost to the manufacturer and consumer. Lean manufacturing is a management philosophy focusing on reduction of the 7 wastes (Over-production, Waiting time, Transportation, Over-processing, Inventory, Motion and Scrap) in manufactured products. By eliminating waste, quality is improved, production time is reduced, and cost is reduced.

2.2) Mistake-Proofing (Poka-Yoke)

The originator of this idea was Shigeo Shingo from Japan. The term Poka-Yoke comes from anglicizing the Japanese words "poka" (inadvertent mistake) and "yoke" (prevent).

The underlying philosophy of Mistake-Proofing explicitly recognizes that:

- *People forget and make errors*
- *Machines and processes fail and make errors*
- *The use of simple mistake-proofing ideas and methods in product design and process design can eliminate both human and mechanical errors.*

Mistake-proofing is achieved, in its simplest form, by taking the three sequential steps as shown below-

1. Identify possible errors that might still occur in spite of preventive actions.

2. Determine a way to detect that an error or malfunction either is taking place, or is about to take place.

3. Identify and select the specific action to be taken when an error is detected.

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Mistake-proofing is achieved by 100% inspection while the work is in process, not by the use of quality inspectors between work areas. The key to this inspection is the fact that it is accomplished as an integral part of the work process either by the worker or, better yet, automatically, not by an "inspector".

The researchers investigated the application of poka-yoke in construction through six case studies carried out in Brazil and England. The pattern-matching approach, supported by quantitative and qualitative data, has confirmed the usefulness of this approach in construction practice. However, the empirical evidences revealed that the sector makes little use of this approach at the present moment. In this sense, there is great scope for developing mechanic and electronic mistake-proof devices to adapt into existing construction machinery.

Arash Shahin and Maryam Ghasemaghaei describes Poka yoke as one of the effective quality design techniques experienced in manufacturing has been suggested and developed for service fail-safing. They also proposed a framework, by which the common and uncommon elements of service Poka yoke and Service recovery solutions have been classified and addressed schematically.

M. Dudek-Burlikowska & D. Szewieczek implementated the quality philosophy Zero Quality Defects with usage of the Poka-Yoke method in the polish organization. The possibility of implementing of the Poka-Yoke method as a factor of improving operation in the process in the motorizations companies has been found by them.

Ramin Sadri, Pouya Taheri, Pejman Azarsa and Hedayat Ghavam explained that construction defects are always the key concern of the construction industry. In this paper, application of Poka-yoke to construction industry is investigated. The results show that the construction operations have high potential of mistake-proofing.

2.3) View of Product under consideration (*LEVER COMBINATION SWITCH)*

Figure 1- Schematic of a LEVER COMBINATION SWITCH

III. OBJECTIVE

To remove the problem of Screw Miss during Assembly of Lever Combination Switch.

IV. RESEARCH METHODOLOGY

4.1) Introduction

The purpose of this study is to help Mindarika Private Limited to improve product quality and manage the data for a continuous improvement plan, then provide feedback to the company for the future improvement.

4.2) Define

Reports from the production and operation department and quality department about the product quality and effects of poor quality products will be gathered.

4.3) Data Collection

Data related to production will be collected. It will include the total produced quantities, rejected quantities, and type of defects in the specific product.

4.4) Data Analysis

The various Quality and Lean tools will be used to analyze data, identify problems, seek root causes of problems, and solve problems.

V. RESULTS

5.1) Definition of the problem Screw Miss

Before explaining the problem of Screw Miss let us have a look on a diagram taken from the assembly line.

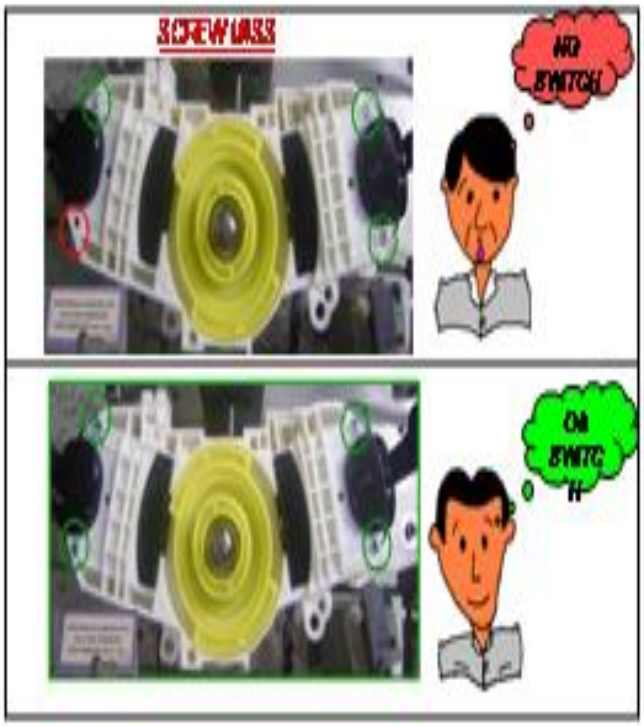

Figure 2-Diagram showing problem of Screw Miss

From a view on the above diagram we can define Screw Miss as "**The problem in which one of the screws is missed from the 4 numbers of screws used for binding all the parts of the Combination Lever Switch together".**

5.2) Analysis of the problem (WHY WHY ANALYSIS)

To find the root cause of the Screw Miss problem we will make a Why Why Analysis for which the two main factors governing the process of Screwing. They are-

a. Associate Skills
b. Standard Work Adherence

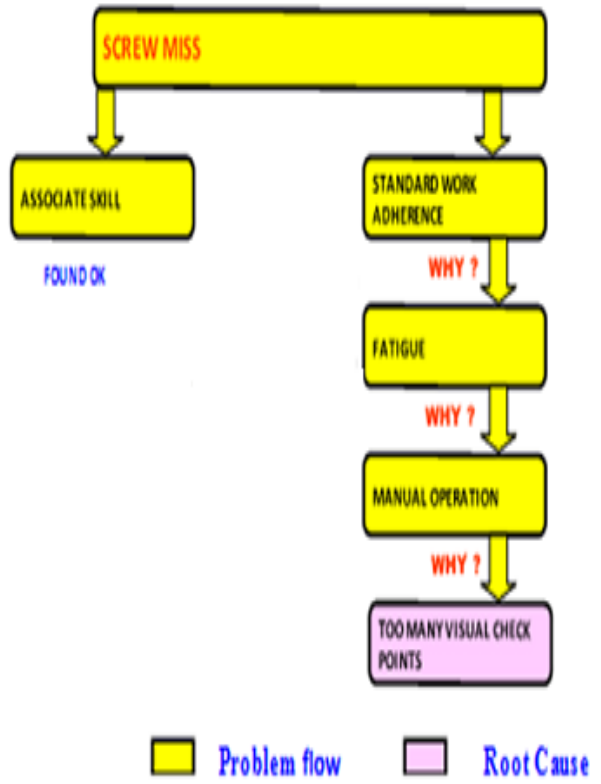

Figure 3- Why Why analysis of Screw Miss Problem

This Why Why Analysis explains that the too many check points causes leads to fatigue in workers. This fatigue leads to Standard Work Adherence .So **too many check points leads to the problem of Screw Miss**.

5.3) Developing Solution of problem

The problem of Screw Miss can be removed if all the check points are replaced with a single checking station.

For achieving the above target we will use a lean technique i.e. **Poka Yoke**. Poka Yoke is one of the tools that use the zero-defect principle. The goal of poka-yoke is to observe the defective parts at the source, detect the cause of the defect, and to avoid moving the defective part to the next workstation. Some examples of Poka Yoke are given below-

Examples of Common Mistake-Proofing Methods-

• Color- and/or shape-coding of materials and documents.

• Use Counters, symbols and/or icons to identify easily confused items.

• Identify and document "**Red Flags**" i.e., ***Red Flags point to Errors, and Errors point to Defects***.

So taking the reference of the above examples, for achieving the Zero Defect condition i.e. No Screw Miss condition, we will use a Screw counter, which will count the number of screws inserted in the product before leaving the screwing station.

A diagram taken from the Assembly Line will explain the two conditions i.e. the condition of screw miss and the condition of the process/product after implementing the Poka Yoke.

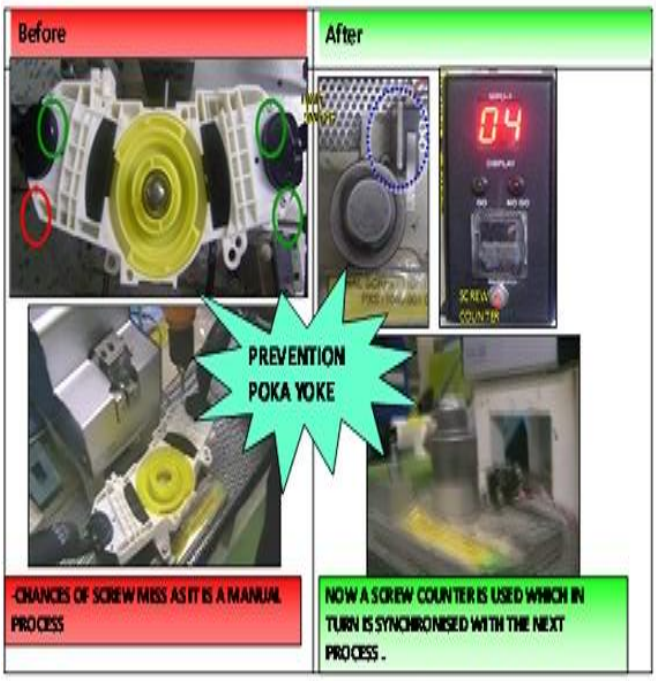

Figure 4- Before & After condition of Screw Miss

The Before Condition explains that there are chances of Screw Miss during the Manual operation of counting of switches.

The After condition explains the use of Technique of Prevention Poka Yoke. Using this principle we started the use of a Screw Counter. This screw counter helps us counting the numbers of screws inserted in the product and only that product will move to the next step which has the required number of screws inserted in it. If any product is missing with the screws that will be identified at the same station and the product is repaired immediately without fail. This process ensures the transfer of only OK product to the next step hence removing the problem of Screw Miss.

5.4) Recommendations for removing the problem of Screw Miss

Poka Yoke Principle should be used. Use of a Screw Counter at the Locking Station helps in counting of Inserted screws. This will ensure that only correct product will move to next step without fail.

VI. RECOMMENDATION FOR FURTHER STUDY

This study provided the procedures and solutions based on the Poka Yoke to solve problem of Screw Miss. This study can be applied to other assembly lines, which are facing similar kind of problems, for minimizing the rejection of some particular product.

ACKNOWLEDGMENT

"**Removing the problem of Screw Miss in assembly of Lever Combination Switch using Poka-Yoke.**" This study reviews the finding one of the cause of rejection of Lever Combination Switch during its assembly. Poka Yoke principles are employed to find its solution and then it's after effects are described. I would like to thank Dr. Vijay Mittal, for advice, support, guidance, and time while writing my thesis. I also

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