Application Poka-Yoke to Capture Defect (A Case Study in Industry Component Otomotive)

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Abstract

XYZ is one of the companies that manufacture automotive spare parts. At present the company should focus on producing high quality, non-handicapped products with the fastest production time to win business competition. The company's strategy is to carry out kaizen which is a continuous improvement with the aim of preventing defective materials from entering the production process in the most effective manner. The method used by the company is to conduct inspection on incoming materials using poka-yoke method. The decision to run poka-yoke has been proven by reducing the amount of dimension defects material on the B8A rotor component of the supplier delivered to the production process up to zero the following month and producing a better cycle time in the 79.77 second. It can be concluded that the poka-yoke method is the right way to prevent the defective material from entering into a production process that can cause a defective.

Keywords – *Application Poka yoke, cycle time ,defective component , Incoming quality control.*

I. INTRODUCTION

Companies must continue to grow and increase productivity to meet current competition. The manufacturing industry around the world has undergone significant changes and competition has increased dramatically. Various innovative techniques and practices in plant management have been developed such as Total Productive Maintained (TPM), Total Quality Management (TQM), Business Process Reengineering (BPR), Material Requirement Planning (MRP), Enterprise Resource Planning (ERP), Just in Time (JIT), etc. Despite the amount of quality management in manufacturing and the service sector has created new ways to improve product quality by using various repair tools such as Kaizen, Six Sigma, poka-yoke, and others. In this paper, we will focus on discussing the basic concepts of poka-yoke in implementing them to control the quality of receiving incoming materials.

Various types of automotive products and variants are offered in Indonesia, one of which is a motorcycle. In Indonesia, the motorcycle industry is now showing a huge market demand with motorcycle sales target of 2018 reaching 5.9 - 6.1 million units [1]. Increased sales of motorcycles will be followed by competition in the automotive component industry. Competitive price, timely delivery and good quality are the main requirements in the competition between motorcycle industry components.

The case study was conducted at XYZ, which is one of the automotive industries that are engaged in electric motorcycle components. The product produced by XYZ is a rotor assembly that functions as a motor drive on a motorcycle. Rotor is a very important part of motorcycle products, so quality problems must be maintained from receiving components, the assembly process to become finished products that are ready to send. Based on the assembly parts claim, it was found that the type B8A rotor component had a defect dimension with quantity 8 pcs sent to production and found in the production assembly process (standard dimensions OK: 40.6 ±2/0 mm). The type of defective product can be seen in Figure 1.

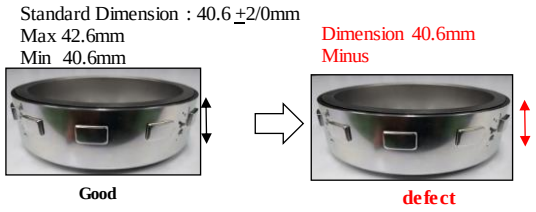


Fig 1. Dimension Problems Rotor Component

From traceability the problem, defective component come from supplier and are forwarded to the Production Assembly line. Components received by material control section before being sent to production are checked by sampling with % AQL method (Acceptance Quality Level) by Incoming quality control but the results are not optimal because of the factor of inaccuracy in reading measuring instruments instruments and workers' moral factors. The team conducts analysis and corrective actions in the process of incoming component from suppliers. The Kaizen approach is carried out to get the right prevention to this problem. The poka-yoke system is the first choice in Kaizen to solve thedefctive dimensions of rotor component in the incoming quality control section.

II. LITERATURE REVIEW

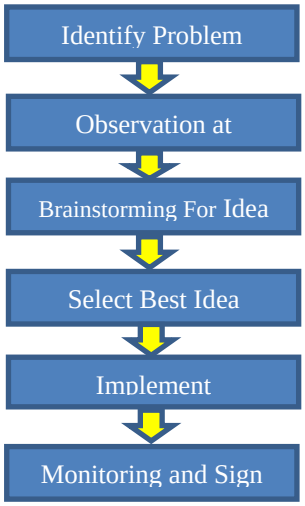
Poka-yoke is the concept of overall quality management. The purpose of poka-yoke is to eliminate defects in a product and to prevent any mistakes in the process as early as possible. An important concept of poka-yoke is to design a process so that the easiest tool to detect defects and fix it. The poka-yoke technique was developed by Shigeo Shingo in 1961. He is a Matsushita manufacturing engineer responsible for the Toyota Production System (TPS) and Just in Time (JIT).

Poka means mistakes and Yoke means avoiding, so poka-yoke is to prevent human error in production routes [2]. The main approach of Poka-yoke is to achieve a defective zero product [3]. In order to produce products that are free from defects, poka-yoke does not prevent the damaged material in the process of the incoming material from entering production. It will improve the quality of the products that will be produced and continue to improve the industry status [4]. Poka-yoke mechanism consists of control methods and reminders. This is used as a way of finding the root of the problem that will be solved as a whole [5].

Jig is designed to increase productivity in operations by helping employees work more easily, faster and more comfortable [6]. According to Jamshidi [7], there are a large number of different thumbs and designs and designs in different companies for various manufacturing and installation applications. There are many attempts to design and release jigs and fixtures so that they can hold multiple component variants [8,9]. Therefore, jigs and fixtures provide significant benefits in the industry primarily for the manufacture and installation of large volumes and complex products

III. METODOLOGY

Defects must be identified in the first phase of receipt of the material, and then analyzed for defect reasons, perhaps because of the quality of the supplier who does not adhere to the standard or lack of personal knowledge of incoming material inspectors. Figure 2 is the methodology of using poka-yoke in this study [10], [11], [12].



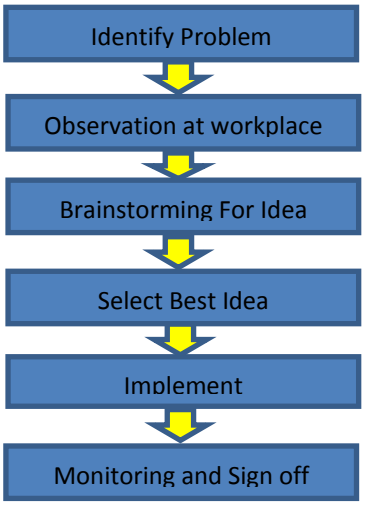


Fig 2. Steps to Perform poka-yoke

After deciding to use poka-yoke as a method to solve the problem, the following steps must be taken:
Level 1: Identifying problems, complaints from the part of the production grouping are grouped according to the results of data analysis collected to expand the problem solving.

Step 2: Look at the workstation, the problem can be analyzed with a fish bone diagram.

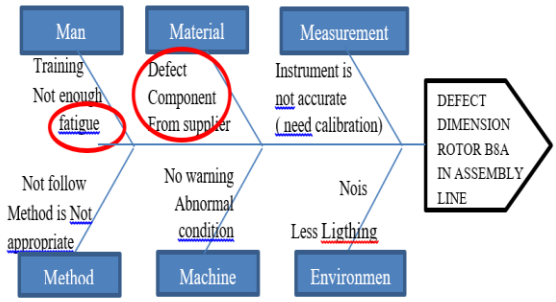


Fig 3. Fish Bone Diagram

Step 3: Brainstorming for Ideas, This is a communication and discussion technique in solving problems. At this stage all experts review the problem and provide various solutions to avoid defects. This step ends with a variety of alternative solutions. The cause may be related to unsuitable humans, machines, materials, or methods. Most problems are found in various categories such as broken components, tools or machine failures, unskilled labor.

Step 4: Choose the best idea; having got various alternative solutions now is the time to choose the best of all the settled solutions. Selected as the best solution is poka-yoke. This is based on selection criteria based on cost considerations, time required, and changes in existing systems, opportunities to develop new solutions, simplicity in operations, and so on.

Step 5: Implementation and implementation plan, this step is related to planning implementation. This relates

to material requirements, material processing and mechanisms that are finally implemented in the real workplace. In this step, the real thing in this research is the problem behind it; the problem is compiled using a quality control tool. The cause may be related to humans, machinery, materials or methods.

Step 6: Monitoring and signing, Product is produced and observed for some time, the decision is decided whether the repair is final or requires further analysis.

IV. RESULT AND DISCUSSION

From identification, the defective product comes from the supplier, it is obtained by observing both the processes of suppliers and processes of internal company, which are incoming and assembly lines. The cause of disability of the B8A rotor component is from a supplier who does not follow the specifications and by the team and the supplier has taken corrective action. And for prevention within the company is done by poka-yoke on incoming quality control. This is so that all components of the B8A rotor that will enter the assembly line are in good condition without any defect dimensions. Here is the flow process of material from supplier as show in figure 4:

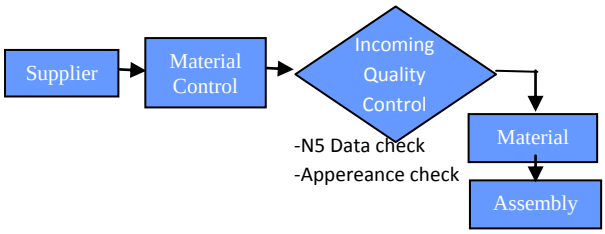
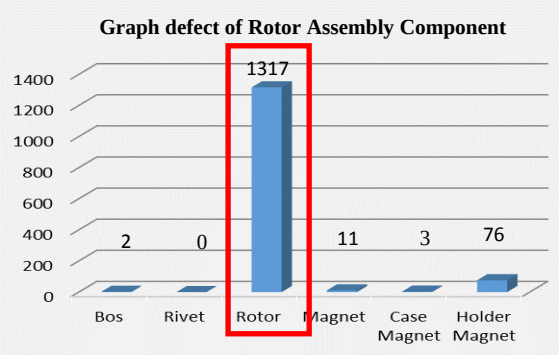


Fig 4. Flow material inflow

In the activity of collecting component defect data for analyses the problem, we obtain data on the defect of B8A Rotor assembly components. Six components from the supplier are assembled into B8A Rotor Assembly in production line. In accordance with graph 1 in the 3 months period the biggest quality problem is the B8A Rotor component as much as 1317 pcs so that in this study the rotor component will become an object of improvement.

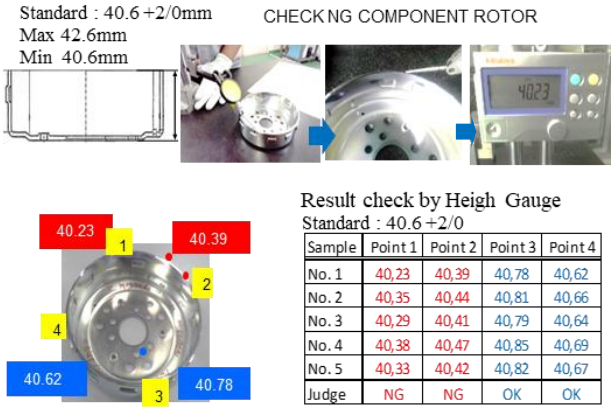


There are 1317 defect component rotors were found by Incoming Quality control, the next step is to know the defect type on the component, table 2 is the report of the rotor component defects consisting of 5 major defect types that can be seen in table 1.

Table 1. Type defect of B8A Rotor component

8BA Rotor Component Defect						
Item Defect	Oct'18	Nov	Dec	Total	Tools	Remark
NG Pin Gauge	324	0	0	324	Pin Gauge	Detect
NG Plug Tread	243	131	0	374	Tread Gauge	Detect
NG Pin and Plug Tread	121	0	0	121	Pin & Tread Gauge	Detect
Appereance	358	0	0	358	Visual	Detect
Dimention 40.6 Minus	0	0	140	140	Plug Gauge	Not Detech
Total Quality / Month	**1046**	**131**	**140**	**1317**		

Based on the biggest defect type ,the researcher decided to analyze the B8A Rotor component as research material with the type of NG defect dimension 40.6mm minus because it is known that this defect has passed into the production process as much 8 pcs . In the process of checking N-5 data on the dimensions of the B8A rotor component using a height gauge the incompatibility data shown in Figure 5 are as follows:



Result check by Heigh Gauge
Standard : 40.6 +2/0

Sample	Point 1	Point 2	Point 3	Point 4
No. 1	40,23	40,39	40,78	40,62
No. 2	40,35	40,44	40,81	40,66
No. 3	40,29	40,41	40,79	40,64
No. 4	40,38	40,47	40,85	40,69
No. 5	40,33	40,42	40,82	40,67
Judge	NG	NG	OK	OK

Fig 5. Check N-5 Data of B8A Rotor Component

Checking B8A Rotor component using the Height Gauge has the potential measurement errors by the inspector so that with the implementation of Kaizen with the poka-yoke method the human error can be eliminated , the idea is to use a measuring aid using a jig to speed up the checking process in the incoming material and also ensure that the product does not occur pass to the assy process. The following are the standard specifications on the requested tool: 40.6 $\pm$ 2/0, Max: 42.6mm, Min: 40.6mm. Then the height of the goal jig: 40.6mm. The shape of the Jig for measurement can be seen in Figure 6. Below.

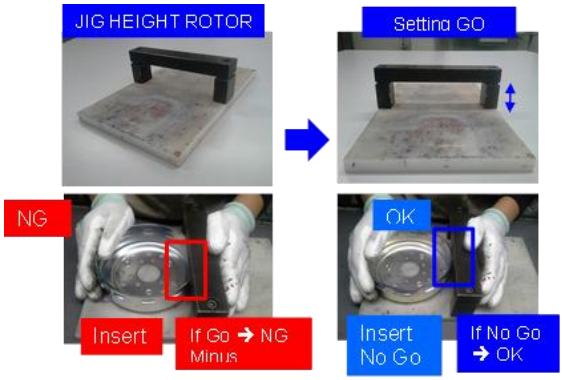


Fig 6. Jig for detection dimention 40.6 minus

The way the jig works by entering the B8A rotor component into the JIG, if rotor component can enter into the jig can be declared NG dimension and if it can't get away means good dimensions. The results of using a jig, no B8A components were found that escaped to the assy process and the checking process time was faster than the previous check. The measurement time data using height gauge and the jig is shown in Table 2 as follows.

Table 2. Measurement time data

Check by height gauge

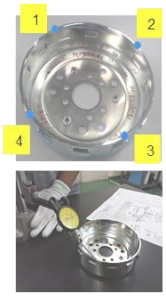
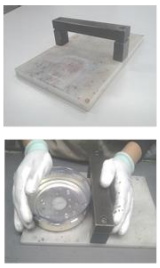
Activity	Cycle Time /pc (second)
Put Part	3.35
Adjust High Gauge	8.69
Zero Set	20.52
Check Point 1	18.62
Check Point 2	11.83
Check Point 3	11.94
Check Point 4	12.08
Total	87.03

Check by JIG

Activity	Cycle Time /pc (second)
Put Part	3.22
Check Point 1	1.01
Check Point 2	0.94
Check Point 3	1.07
Check Point 4	1.02
Total	7.26

From the data above, it was found that there was an acceleration in the measurement of the dimensions of the B8ARotor component which was 87.03 - 7.26 which was equal to 79.77 seconds, as shown in table 3

Table 3. Comparing cycle time

HEIGHT GAUGE	TIME	JIG	TIME
	87,03 second		7,26 second

Monitoring is carried out for 1 month in the incoming quality control section, from the results obtained there are no more dimensional defective components sent to the assembly line. From the kaizen results (poka yoke) it is very helpful for companies to anticipate defective products flow out in next process.

V. CONCLUSION

Poke-yoke is a system for managing work and eliminating the possibility of user errors or preventing errors from occurring, visual inspection and the use of measuring instruments by humans tend to be unstable because they are influenced by human factors themselves. Mistakes are human nature so we cannot blame humans for any mistakes. In applying poka-yoke it can eliminate errors due to human factors and speed up work time. In this study with simple kaizen can increase work productivity by reducing the time of checking and preventing defective components from suppliers pass into the production process.

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