Quality Management System in Automatic Machine Construction Based on ISO 9001

Meivi Venisa Gosan¹, Wilson Kosashih²
Industrial Engineering Department, Faculty of Engineering, Universitas Tarumanagara
Jl. Letjend. S. Parman No. 1, Jakarta 11440, Indonesia

Meivi.545160003@stu.un tar.ac.id¹, wilsonk@ft.un tar.ac.id²

Abstract. This paper discusses how the implementation of quality management system (QMS) based on ISO 9001, which more studies ways to overcome defective products and also solutions to problems that often occur. This study was conducted at a company in Tangerang which is engaged in industrial automation. The analysis was carried out by observing and interviewing the company’s management. It was found that the quality inspection at this company included starting of incoming raw materials, parts or components in the process as well as finished goods. To cope with non-conformance products, if the product can still be repaired, it will be fixed again. If not, the product will be put on a shelf called “rejected design”. Some of the problems that are often faced by the quality control department include: errors in checking raw materials; reading errors on the gauge; and workers do not use personal protective equipment. The solution to these problems are to: build a mistake proofying culture; apply a system of penalties and rewards; provide training in the use of measuring instruments; and give warnings to workers who do not use personal protective equipment.

Keywords: Quality Management System, Inspection, Automation, ISO 9001.

1. Introduction
The quality of the product is important for a company and is one of the important indicators for the company in determining the merits of a product. If a product has good quality then the product will also get higher value in consumers. To maintain the quality of the products produced, it is necessary to check the products regularly [1]. Almost all companies are required to create various innovations and produce products that have the best quality to meet customer needs and satisfy consumers [2]. Quality becomes a basic factor in consumer decisions to consume these services or products. Production quality also holds the view to be feasible or not the production goods can be marketed. Quality is the overall features and characteristics of a product or service in its ability to meet and satisfy the needs that have been promised and implied. [3][4]. Quality is a characteristic of a service or product that includes engineering, marketing, manufacturing and maintenance, where the service or product if used will be in accordance with the expectations and needs of the customer [5][6].

According to Devani & Wahyuni [7], intended control is a process to measure output relative to a standard, take corrective action, if there are outputs that can not meet the standard. Control of product quality is effort to reduce the damaged product from the company. The purpose of quality control are that: a) goods produced can reach predetermined quality standards; b) ensuring that inspection costs can be as small as possible; c) ensuring that the design costs of products and processes by using certain production quality can be as small as possible; and d) striving for production costs to be as low as possible [8][9]. Meanwhile according to Deming [10], quality assurance is a complete system or a process-driven approach of company’s management to assure and direct the quality of the company's products and services to be maintained as planned. This paper describes the application of quality management system at a company engaged in the field of industrial automation.

2. Method and Materials
2.1. Data Collection
This review uses a case study description approach. Primary data was collected by observing and recording the symptoms that occur in the production process from raw materials to the final product. Data collection by interview aims to find information directly to the quality control department of this
company by asking questions and gathering relevant information. Secondary data documentation was also carried out to study company documents in the form of history, reports on production activities, reports on the number of production and number of defective products, and other documents. Last, root causes identified by using fishbone diagram. Some corrective actions are suggested to company’s management to cope with the identified problems.

2.2. QC Equipment
The inspection process is carried out visually to see defects or cracks in the material, and also to check and measure its size. Size checks usually use either a caliper or a measuring tape (meter) as can be seen respectively in Figure 1.a and Figure 1.b. Caliper is a measuring instrument whose accuracy can reach one hundredth of a millimeter which has the function of measuring the height, thickness, the inside of an object. The calipers used are ordinary type and digital type. Measuring tape is a length measuring instrument that can be used in measuring objects that are long and large enough, for example measuring wood, long metal plates, and so on.

(a)  
(b)  
Figure 1. QC Equipments: (a) Caliper, (b) Measuring Tape

3. Results and Discussion
3.1. Quality Management System at the Company
This company has a high commitment to always maintain the overall quality of raw materials and ensure the products produced are in accordance with the standards owned by the company. By having a high commitment, the company succeeded in carrying out ISO 9001 certification regarding quality management. This company has implemented ISO 9001 since 15 October 2014, and aims to be used as a basis or guidelines for carrying out all activities in the quality management system in the company, as illustrated in Figure 2. The scope of the company's quality management system implemented in this quality guideline is all activities involving the design and manufacturing process of automation and customized machines, jigs and fixtures, with no exception clauses. This company implements make to order production system, which means the company will only make products if there is an order from the customer [11].

Figure 2. QMS Based on ISO 9001 [12]
3.3.1. Inspection of Incoming Raw Materials
When the ordered raw materials arrive, the quality control staff will check whether the raw materials that come in accordance with the required specifications as shown in Figure 3. This process inspection consists of checking raw material specifications, quality of raw materials and quantity of raw materials as illustrated in detail in Figure 4. If the raw material meets the standards, the raw material is marked using yellow or white markers for easy viewing.

![Figure 3. Inspection of Incoming Raw Materials](image)

**Figure 3. Inspection of Incoming Raw Materials**

![Flowchart of Incoming Raw Materials Inspection](image)

**Figure 4. Flowchart of Incoming Raw Materials Inspection**

3.3.2. Inspection of Components in Process
A part or component will be checked again conformity to its required specifications. If it is non-conformance (NC), the quality control staff will report to the production department to be repaired again, if it is conformance (C), it will be affixed with a component or material card and then submitted to the assembly line, as shown in Figure 5. Figure 6 shows the detail description for inspection of components in process.
3.3.3. Finished Goods Inspection
Examination of finished goods is carried out after the product has been assembled and ready to be shipped. Quality control at this stage is done by checking the specifications of finished goods, testing (trial and error) the product whether it can work well or not as shown in Figure 7 and Figure 8.
3.2. Failed Product Handling
Due to a NC component can be reworked by the production department, the probability of a finished goods being rejected at this company is very low. If the faulty product can't be repaired again, it will be put on a shelf called "rejected design" as shown in Figure 9.

![Figure 8. Flowchart of Finished Goods Inspection](image)

3.3. The Root Causes Analysis
By using Ishikawa’s fishbone diagram analysis as shown in Figure 10.a and Figure 10.b, there are some problems that often occur in this company are as follows: a) errors in checking raw materials; b) reading errors on the gauge; and c) workers do not use personal protective equipment.

![Figure 9. Samples of “Rejected Design”](image)
Figure 10. Results of Ishikawa's Fishbone Diagram: a) Error Checking Raw Material; b) Inappropriate Dimension

4. Conclusion
This company is one of the manufacturing industry companies that designs, manufactures automatic machinery and performs general maintenance services for any industry, which was established in 1987. Since 2014, the company has obtained ISO 9001 certification and is committed to maintaining the quality of its services. This company has proven successful in maintaining and running this quality management system in a disciplined and sustainable manner. In this study, identified several root problems that often occur in the field using Ishikawa's fish bone diagram. The following are some recommended actions for this company, among others: a) to build a mistake proofing culture, not accept, not process, not pass the defective product, and also conduct its socialization; b) to apply a reward and punishment system; b) to provide training in the use of measuring instruments; and c) to
give warnings to workers who do not use personal protective equipment. The implication of this study is that the company is expected to be able to implement continuous process improvement using the plan-do-check-action methodology approach.

5. References
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