Rejection Analysis in Piston Manufacturing Unit

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ABSTRACT: Rejection Analysis is a process of identification of quality and productivity related problems which the key factors in manufacturing process. The application of rejection analysis allows studying the failed parts. It helps to capture the minute failing details. It provides effective suggestion to the problem encountered in manufacturing process. It eliminates the scrap and tells which part can be rework. After preliminary study on machining process of piston in 6M production line at FEDERAL MOGUL GOETZE INDIA LTD, it was apparent that production line was having more defect and rework and had rejection percentage rate of about 10% .In order to examine this project, study was conducted to observe the process going on in the production line, to reduce the rejection rate by tracking the root causes and by providing suggestion. Some of tools and techniques used to achieve the objectives were check sheet, Pareto chart, cause and effect diagram and control charts. The methodology employed to achieve the stated objective, includes the study on nature of defect occurrence, collection of data on number of defects occurred during three months of study using check sheet, identification of major defect percentage using Pareto chart, finding the causes using cause and effect diagram and investigating the process is in control or not by statistical control charts. Lastly providing the suggestion regarding minimizing the defect and rework. The outcome of project was reduction in overall rejection rate in production line from 10% to 7 % and thus the production line was able to meet the required demand

KEYWORDS: Quality, Defects, Pareto Analysis, Root Cause, Pareto Analysis.

I. INTRODUCTION

An automotive manufacturing industry aims at meeting the customer requirement by providing the good quality of product. So many company focuses to reach the global market in satisfying the customer demand. Quality of the product is achieved by minimization of rework, reducing scrap rate and minimizing man hour on rework. Rejections in automotive industry occur due to not placing the product for required specification. Now a day's rework of rejected parts are common but rework add losses to the company net profit, if the company is a continuous mass production where the products go through a series of process to come out with final product.

Piston head manufacturing travels through a sequence of manufacturing and machining processes to become end product. Quality control at every workstation is important. Controlling measures for preventing the defect parts being accepted and sent through next stations need to be avoided to reduce the defect rate in the processing itself.

Pareto analysis helps to identify and classify the defect according to percentage significant. Cause and effect diagram is a useful tool in identifying the major causes. This diagram helps to build a relationship. Brainstorming is done with utilising these quality tools to provide an effective solution. Thus quality management tools are effective and significant in reducing the rework and rejection rate.

II.   LITERATURE REVIEW

This section highlights on different journals papers regarding area of the project study. These researches uphold the effective methods and techniques which will enhance the project. The literature review focus mainly on topics such as root cause analysis, data analysis, Pareto analysis, statistical process control.

DALGOBIND MAHTO [1] in this paper, it gives details of root cause analysis methods and techniques in identification quality of major key characteristics in manufacturing process. It is very risk in identifying problem in multistage operation. In this paper, root cause analysis was adopted to reduce the defect rate in cutting operation in CNC machines. This study dives detail structure to solve human related problem in manufacturing process. This study gives an idea for stakeholders to promote effective and better solution all time.

TANVIR AHAMAD [2] this paper presents on use of Pareto chart and cause and effect diagram in analysing the defect caused in garment industry. This papers aims at reducing the defect rate caused while stitching clothes. Using these methods it was identified about 80% defect rate in process of stitching. The top five defects was identified and analysed. Using cause and effect diagram causes and effect are constructed. The study provided suggestion to reduce the defect rate. Thus this papers gives idea of how effectively minimizing the rework and defect rate.

A.L. MOE and A.B ABU [3] in this paper, it uses the six sigma approach in defect reducing in automobile industry. The six sigma processes like define, analysis, measure, improve and control are applied. This study includes tools like quality management tools such as Pareto analysis, data analysis, cause and effect diagram and design of experiments. This study aims at finding out the root cause to problem and providing solution .This paper highlighted the cause foe product rejection rate. This paper aims at reducing rejection rate from 38% to 13%. Hence six sigma approach was effective in reducing the defect.

Md .MAZIDHUL IBRAM [4] this paper highlights on use of quality tool in minimizing the rework in apparel industry. This paper gives idea of quality and productivity improvement in apparel industry. The methods helps to provide the framework in indentify the defect and analyse. It helps to reduce the defect rate. This paper gives the idea of application of process performance of critical process which leads to proper utilization of machines and time. The paper aims at improve the productivity by minimizing cost and internal throughput.
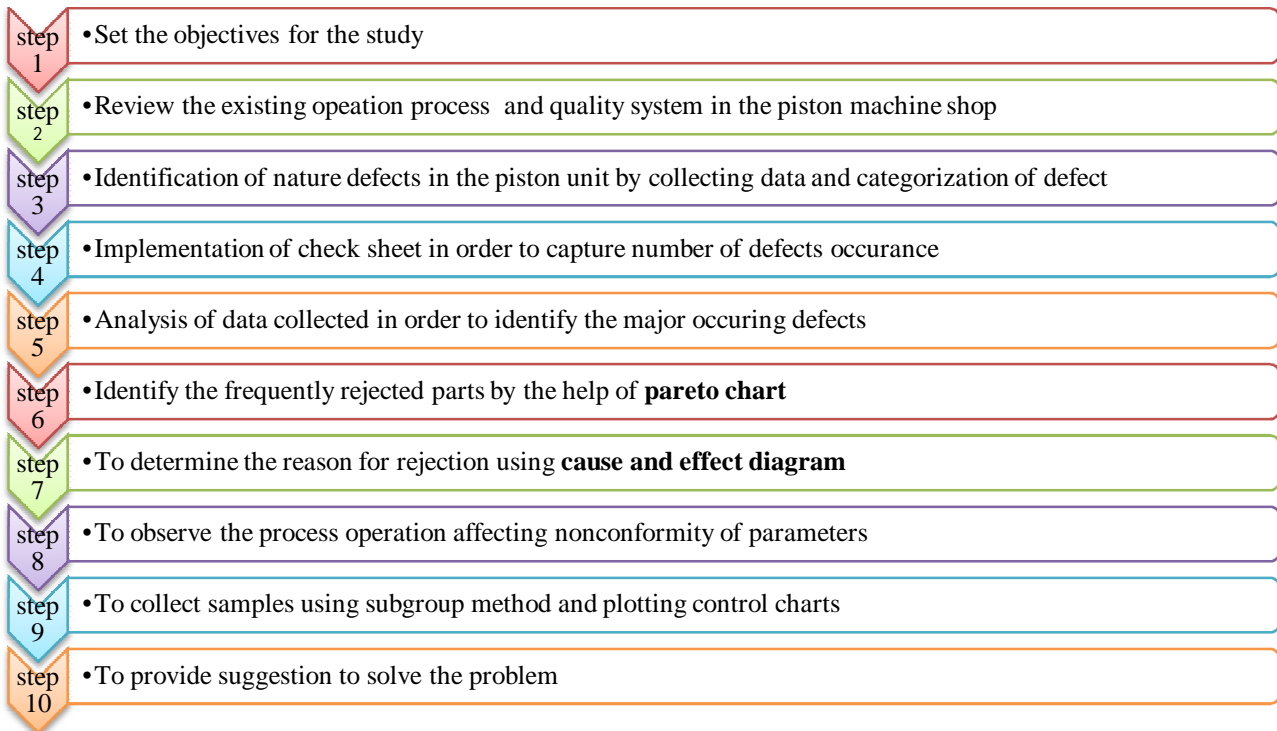
III.   METHODOLOGY

The study exhibited in this chapter includes simple approach in the analysis of rejection rate in particular production line in piston machine shop. The production line consists of sequence of operation in making final product. Defects occur due to deficiency in machining process. The study aims at analysing the rejection rate using quality tools like check sheet, Pareto chart and cause and effect diagram.

step 1	• Set the objectives for the study
step 2	• Review the existing opeation process and quality system in the piston machine shop
step 3	• Identification of nature defects in the piston unit by collecting data and categorization of defect
step 4	• Implementation of check sheet in order to capture number of defects occurance
step 5	• Analysis of data collected in order to identify the major occuring defects
step 6	• Identify the frequently rejected parts by the help of **pareto chart**
step 7	• To determine the reason for rejection using **cause and effect diagram**
step 8	• To observe the process operation affecting nonconformity of parameters
step 9	• To collect samples using subgroup method and plotting control charts
step 10	• To provide suggestion to solve the problem

IV.   DATA COLLECTION

The data has been taken from 6M production line. Identification of defect was made and 10 types of defects were found. Number of defects of the production lines is listed on the Check Sheet. The defect types are expressed by some specific defect codes.

Nature of defect occurrence in 6 months production
- Burr
- Patches
- Shades
- Damages
- Deep lines
- Inner diameter variation
- Outer skirt diameter variation
- Compression height variation
- Groove diameter variation
- Pin hole diameter variation
- Fixture seat variation

defect types (damages at Circlip groove, damage at crown head, damages at fixture seat)

PARETO ANALYSIS

During the study, performed Pareto Analysis based on three months combined defect data of 6M production line from the inspection department. From this analysis, identified the major defect significant. Here horizontal axis represents defect type, vertical axis represents defect amount and right vertical axis represents defect percentage
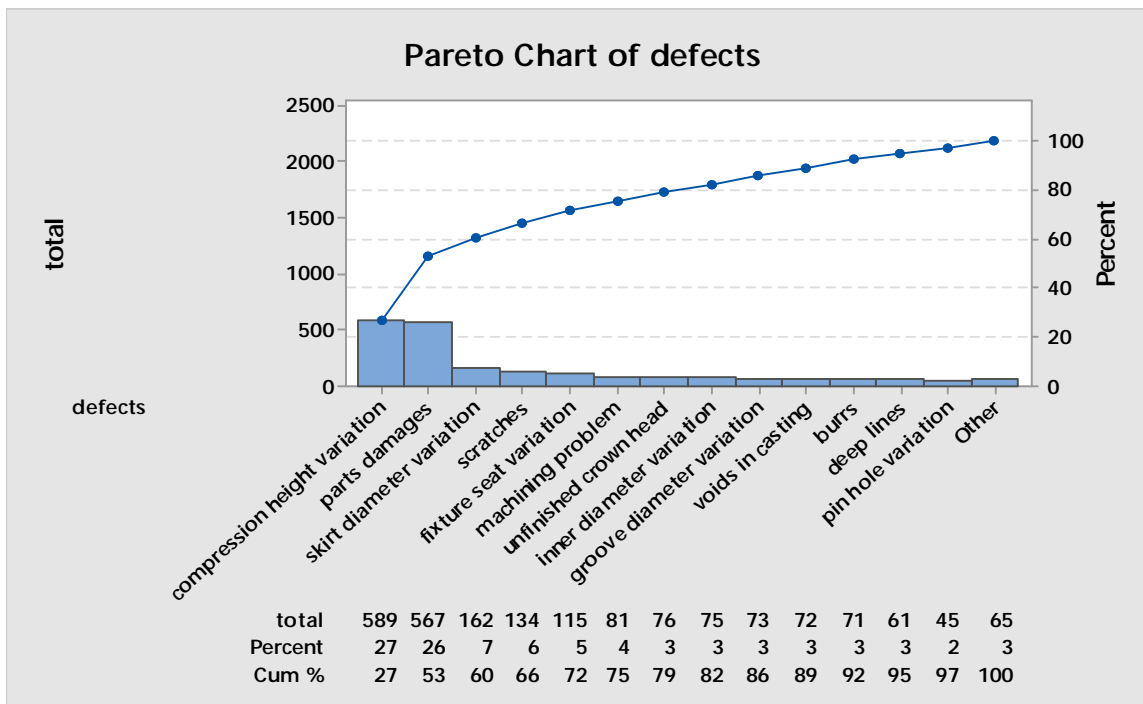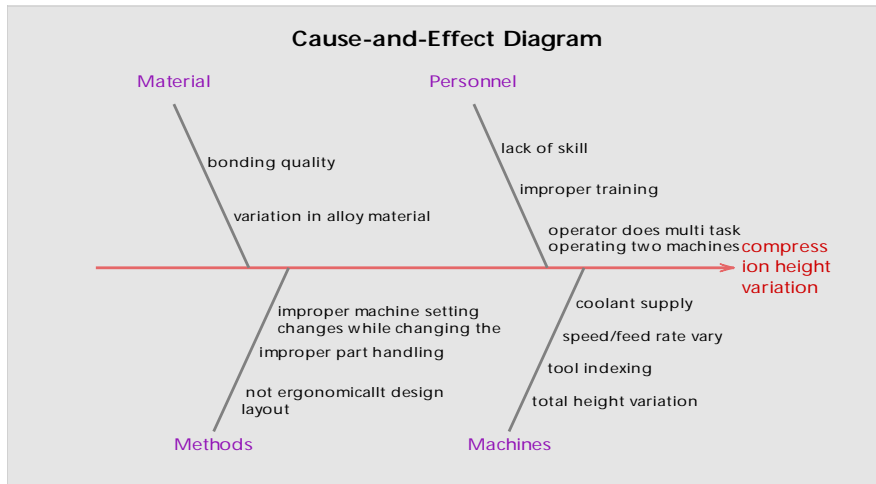

Pareto chart of defects

Observations from Pareto Analysis for Top Defect Positions

- Compression height variation is the most frequent defect with as much as 27% of the total defect.
- Part damages are the second most frequent defect with 26.10% of the total defect.
- Among other defects contribution of skirt variation is 7%, scratches is 6.1%, fixture seat variation is 4.9% of the total defect.
- These five top defect positions are the vital few which contribute to 72% of total defects occur.

Cause-and-Effect Diagram

Material   Personnel

bonding quality   lack of skill

variation in alloy material   improper training

operator does multi task
operating two machines   compress
ion height
variation

improper machine setting
changes while changing the   coolant supply
improper part handling   speed/feed rate vary

     tool indexing

not ergonomicallt design
layout   total height variation

Methods   Machines

VI.SUGGESTIONS

CAUSE TYPE	CAUSES	MEASURES
Operator skill (man)	Due to absence of skill chances of accidents at operation station is more.	Operator should provide with sufficient training.
Machine setting (machine)	Improper setting of machines while product change due to negligence.	Operator should be trained about machine setting or operator should consult supervisor rather than himself changing.
Part handling (method)	Improper loading/unloading parts from or to machine	Operator should be careful while handling. Should wear gloves.
Operator awareness (man)	Operator is not locating the part properly on gauge. Specified tolerance limit may vary due to Negligence.	Operator should be trained regarding slight changes in part specification may affect quality.
Work place is not ideally designed (method)	CNC Machine placement in layout is not proper .Cycle Time taken by worker to produce a piston is more and chances of piston getting damaged is high.	Workplace should be ergonomically designed
Lot of rejection at the final inspection (man)	Due to negligence and ignorance of slight changes occur	Self-check (in- process)should be frequently done by worker

Temperature of a piston is not maintained accurately (method)	Leads to variation in the size of the piston.	Coolant should be changed and maintained at constant temperature
Performance of the machine (machine)	Regular repairing affects the production	Regular maintenance is required
Material properties (material)	Poor material properties leads to Crack and damages	Material should be ductile enough to absorb pressure at peaks and not shatters
Tool grinding (method)	leads to deep cut or improper surface finishing	Tool has to be grind or changed whenever its necessary
Tool indexing (method)	Wrong positioning o tool will damage the piston	Tool has to be accurately set.
Wrong Positioning of piston into chuck (method)	Accuracy cannot be maintained	It has to be done with lot of care and training.
Metal Chips present on the chucks and tool (method)	It will shade the surface of piston and results in the patches and scratches	Make sure that chips are removed properly
Speed (machine)	Improper machining on the surface of piston	Operator should follow the SOP strictly

VII. RESULTS

We found that overall 10% rejection rate can be reduced by mainly concentrating on two areas of defect like compression height variation and part damages. We have provided some suggestion related to defect types. So by taking corrective and effective measure it is possible to meet nearer to zero defects.

VIII.CONCLUSION

Minimization of defect and rework is an important factor ensuring the quality of product. The importance of automotive industry in the economy is high. So manufacturing the quality product is essential to sustain in the global market. Customer satisfaction depends on quality of product. Good quality results in good establishment of brand name, good providers and builds reputation in market. We should know that 1 % defect leads to 100% defective for customer to buy product. This study indicates eliminating non-value added activity like rework, man hour spent on rework and taking effective measures will enhance the net profit, saves time and improve overall quality of product.

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