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Reducing the Rejection & Improving Productivity of Pistons

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Abstract:- The automotive industry is striving hard to find new methods to reduce the manufacturing cost, rejections and improve quality. Productivity is the measure of extent to which a rated output can be expressed from giving input. Productivity improvement deals with achieving the more output from the less input within specified time. This can be done by improving basic process, improving existing methods and procedure and also by controlling rejections and rework. Rejection or scrap is threat to any organization. Eliminating or minimizing the scrap is the main aim of any manufacturing unit. The outcome of the present work is being suggestion to improve and change certain procedure in the process and also to improve certain process, which is causing bottlenecks in the 5C line. By implementing certain changes in the process the productivity is observed to be increased considerably by reducing rejection rate from 10.61% to 5.50% in 5C line.

I. INTRODUCTION

As the global economic condition changing in a rapid motion, generally any industry as to focus more on profit margin, as customer always looks for high quality product. This can be done basically by improving the existing methods, procedure and also by controlling rework and rejections. Productivity improvement is to do the things at right time, better and make it a practice of continues process. Therefore it's important to adopting new and efficient techniques to improve productivity. Productivity is a quantitative relationship between what we produce and what we have spent to produce. Productivity is nothing but reducing the wastage of resources spent to produce the product.

II. PROBLEM DEFINITION

In the past two years auto-mobile industry is programming fast. There are lot of many new vehicles are coming to the market and for existing models demand is increased. When the demand is increased suddenly for expansion needs money and lot of lead time. So, to meet the customer demand better option is to make use of existing facilities, improving productivity and reducing the rejections.

III. LITERATURE SURVEY

A methodology has been developed for reducing the rejection and for improving productivity of the company. It is known that some changes have taken for reducing the rejection and improving the productivity.

Rohit Sharma et al. [10] proposed the paper titled TPM implementation in piston manufacturing industry for OEE, this paper focus on improving the maintenance in a piston manufacturing set up using an innovative maintenance regime mix to improve overall equipment effectiveness.

Elmeekkaway T.Y [6] in their study on defect analysis for quality and productivity improvements in a manufacturing system. Productivity is sometimes measured in goods produced per hour or production per employee. Productivity can be increased in a number of ways reducing cost, increasing efficiency of use of raw material, or increasing product quality. Any reduction of material or labour used to make defective products will decrease costs and, therefore, increase productivity.

IV. METHODOLOGY

The following is the flow chart for fulfilling the set objectives

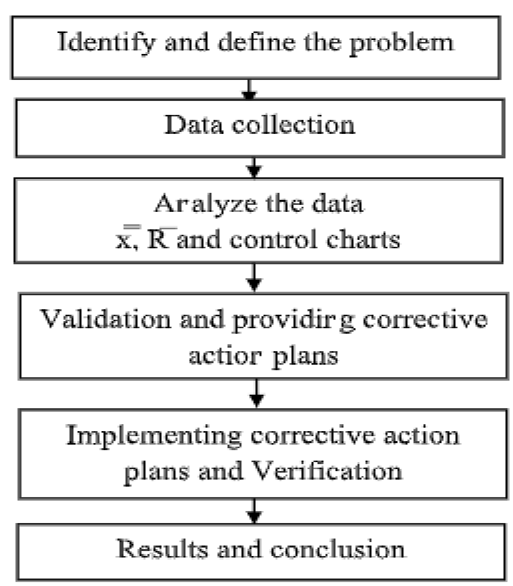

Fig 1:- Step by Step Procedure

V. EXPERIMENTAL WORK

Rejection in any manufacturing company is causes that add up the cost of the process, reducing the productivity and the output of the manufacturing unit. Eliminating or reducing these causes involves detecting the root causes that ultimately results in the defective output. The defects are the threats that directly targets productivity of any manufacturing company, hence minimizing or eliminating is main aim of any organization.

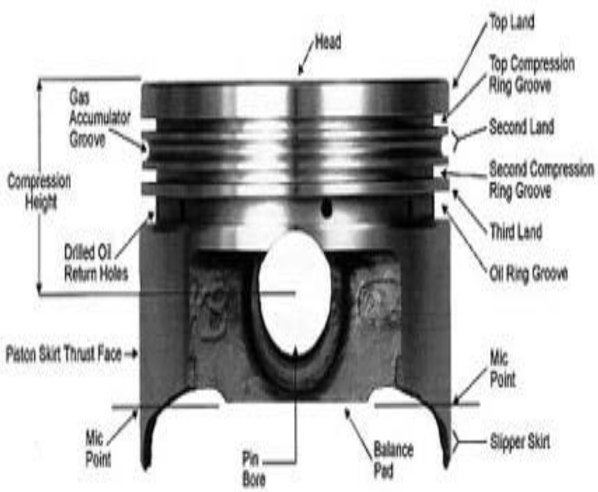

Fig 2:- Nomenclature of piston

The rejection data is collected from piston machine shop department about all the machining lines in shop floor and represented in the Pareto chart.

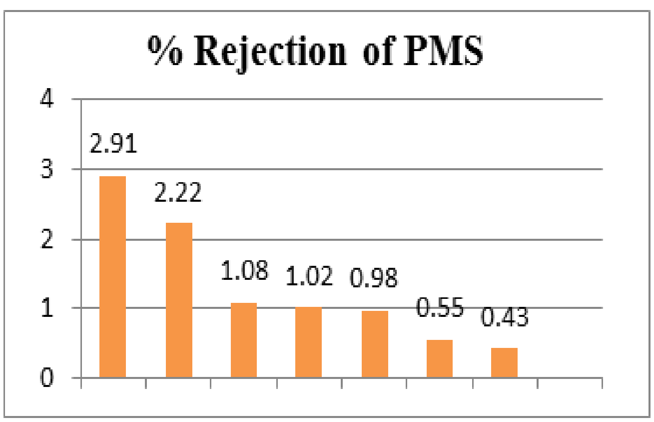

Fig 3:- Rejection data of machining lines in PMS

The Figure 3 shows the rejection data of all machining lines in PMS. From the Figure 3, the 5C line has the more percentage of rejections when compared to all other lines in PMS. In present work 5C line is concentrated to reduce the rejection and to improve the productivity.

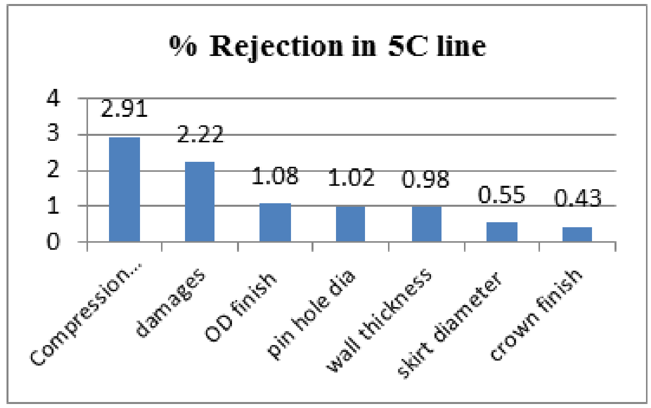

Fig 4:- Rejection data of 5C line

The Figure 4 shows rejected parameters data of line 5C, compression height (2.91%) and damages (2.22%) are the parameters rejecting more numbers in 5C line.

A. *Problem Compression Height*

The "Finish pinhole boring" operation of piston is done on a special purpose turning machine. Operation is very crucial and the tolerance level is in microns, hence the possibility of rejection is high in this particular operation. The various defects which are found out in this operation are

- ➢ *Compression Height*

Finish pin hole boring is carried in the TAKISAWA machine which as the tolerance in microns. By considering the scarp data from the January month, it is found that many defective pistons (2.91%) were due to compression height.

Process interpretation reveals that, compression height tops first in the list of reason contributing to defective piston in 5C line.

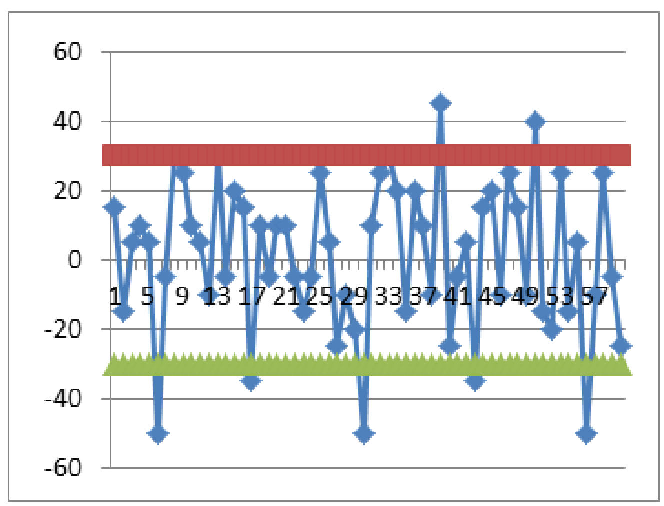

Fig 5:- Control chart for compression height of fixing eye side

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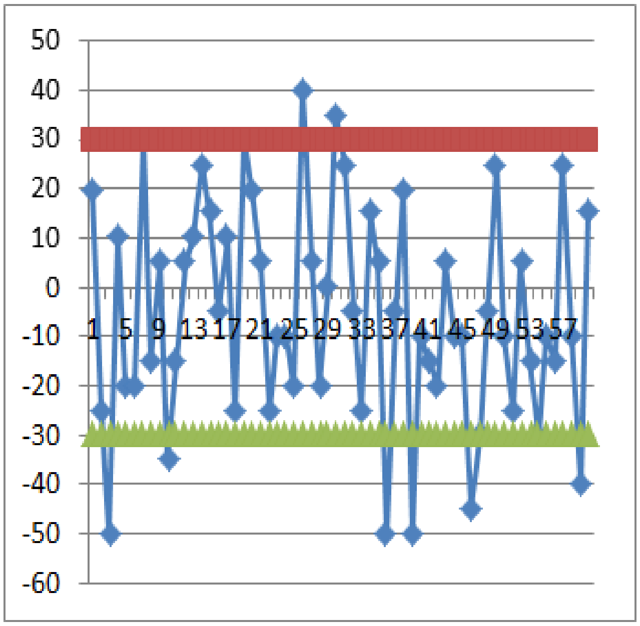

Fig 6:- Control chart for compression height of opposite fixing eye side

Figure 5 and 6 shows data from the 5C line in TAKISAWA machine, for compression height. The control chart in which sample data points are outside the control limit, it can be said that scrap is more and process is unstable.

Figure 7 shows the fixing eye an opposite fixing eye side of piston manufactured in 5C line. Rectangular projection indicates fixing eye side.

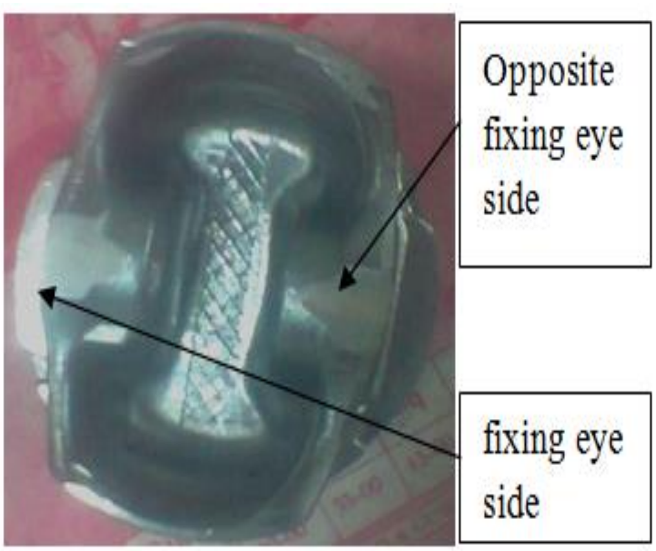

Fig 7:- Piston showing Fixing eye and opposite fixing eye side

Sl No	Problem causes	Grouping	Valid YES/NO
1	Total height	Material	NO
2	Chips get stuck in the fixture seat	Method	YES
3	Loading and unloading of piston	Man	NO
4	Height variation in cavity machining	Method	NO
5	Setting correction in machine	Man	NO
6	Operator knowledge	Method	YES
7	Damages in fixture seat of machine	Machine	NO
8	Clamping pressure variation	Machine	NO
9	Chips present in pinhole of piston	Method	YES
10	Wall thickness variation observed	Material	YES
11	Seating the piston to the fixture in the takisawa machine	Method	NO
12	Pin hole diameter is more	Material	NO
13	If previously machined chips are not removed properly	Method	YES

Table 1:- Validation of causes for compression height

The Table 1 gives the probable reasons for compression height variation, the various causes identified under cause and effect diagram are each taken into consideration and they are checked of their role in causing the compression height variation.

The various causes which leads to decrease in productivity in compression height that are identified and represented in the form of cause and effect diagram it is shown in Figure 8.

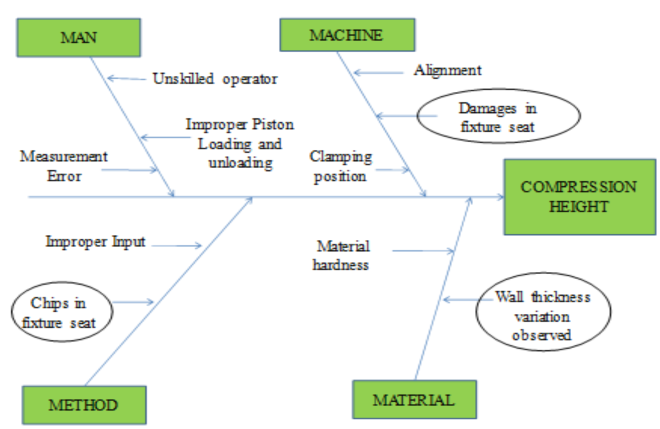

Fig 8:- Cause and Effect Diagram

ISSN No:-2456-2165

Problem	Present cause	Suggestion/implementation	Status
Wall thickness	Wall thickness variation observed due to center core shift in foundry	Centre case shift need to be corrected in foundry	Completed
Chips in fixture	Chips get stuck in fixture seat	New fixture is introduced with new design, so that no chips will get stuck in fixture seat	Completed

Table 2:- Action plan for compression height

Table 2 shows corrective action plan, such as newly designed fixture is introduced to ease removal of chips.

Old fixture in the takisawa machine for compression height process shown in Figure 9.

Fig 9:- Old fixture of Takisawa machine

New fixture shown in Figure 10 is designed as per the requirement. The requirement is that the chips should not remain on the machine fixture during machining, because the un removed chips will varies the height of piston during machining. By proper flow out of chips from the fixture, compression height variation get minimizes.

Fig 10:- New fixture of takisawa machine.

B. Validation of New Fixture

After implementing corrective action plans for compression height. Data is collected for compression height in the TAKISAWA machine and interpreted in control chart.

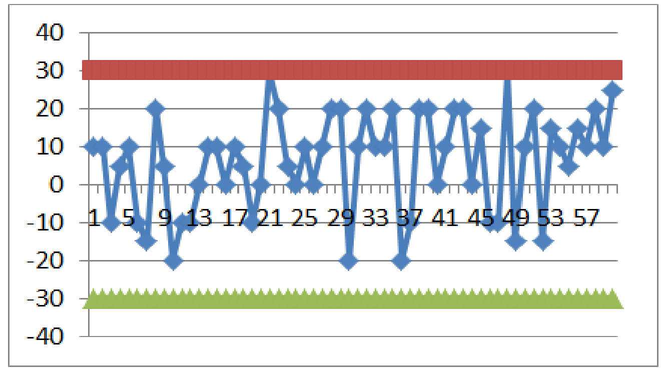

Fig 11:- Control chart for fixing eye side compression height after implementing action plan

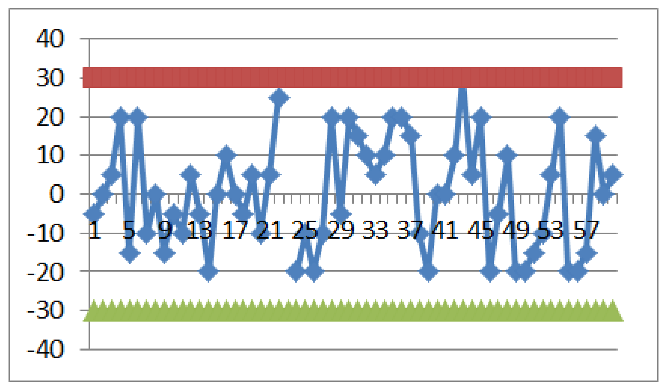

Fig 12:- Control chart for opposite fixing eye side compression height after implementing action plan

It can be seen that in figure 11 and 12 after implementing corrective action plan for compression height and changing the fixture in the machine. Above control chart shows that no sample data points are outside control limit. The process is stable and capable.

VI. RESULTS

The scrap % in the 5C line due to compression height variation,

- Before implementing corrective action plan, scrap in 5C line is 2.91 % for compression height variation.
- After implementing corrective action plan, scrap in 5C line is 1.09 % for compression height variation.

A. Results for 5C Line

The scrap percentage in the 5C line due to compression height in existing system

- Number of pistons produced per shift(8hrs)=720 pistons
- Number of pistons rejected in a shift=21 piston
- Scrap = 2.91 %

The scrap percentage in the 5C line due to compression height, after implementing the action plan

- Number of pistons produced per shift(8hrs)=731 pistons
- Number of pistons rejected in a shift=8 pistons
- Scrap % = 1.09 %

B. Comparison of Number of Units Produced

The primary objective of the company was to increase the production rate of 5C line. From the study, in existing system it is found that the piston production rate units / shift in 5C line

After the implementation of the corrective action plans, the system showed up a daily production 731 units / shift in 5C line.

Sl.No	Status existing system	Status after implementation
1	Productivity = 720/shift	Productivity = 731/shift
2	Rejection rate= 10.61%	Rejection rate= 5.50 %

Table 3:- comparative data for 5C line

Tables 3 shows with a considerable increase of piston production rate 5C line are 11 units / shift.

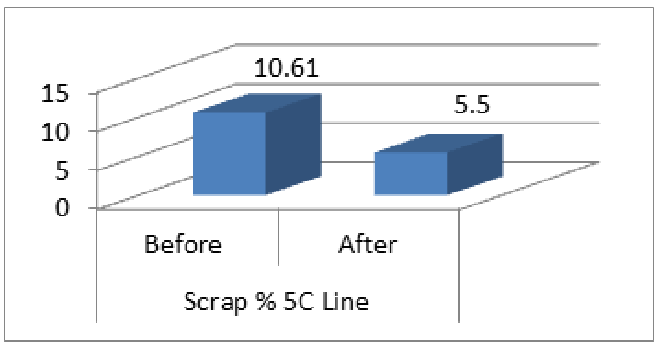

Fig 13:- Scrap Reduction in 5C line

Figure 13 Shows the scrap in 5C line for existing system is 10.61 % and after implementation of action plan scrap is 5.5%.

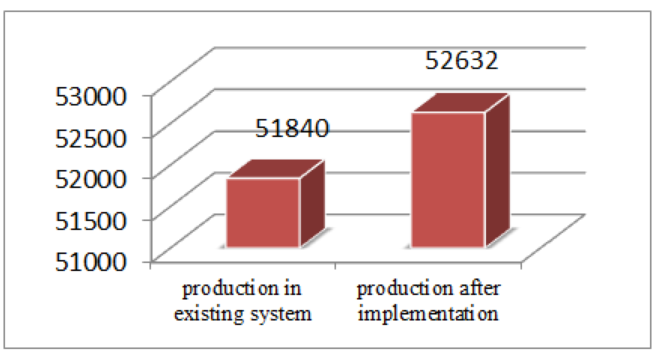

Fig 14:- Productivity Improvement for 5C line

Total number of pistons produced in existing system is 720 units / shift in 5C line

Total number of pistons produced after implementing corrective action plan is731 units / shift in 5C line.

VII. CONCLUSION

- After new designed fixture is replaced with old fixture, compression height has been reduced to1.09% from 2.91%.
- The company started to provide education and training to line staff. So that company satisfies the needs of its customers in quality and quantity.
- Regular training is required to implement SPC tools to improve productivity.

REFERNECES

[1]. Md. Mazedul Islam, Adnan Maroof khan, Md. Mashiur Rahman Khan, Minimization of reworks in quality and productivity improvement in the apparel industry, International journal of enginnering and applied sciences, volume.1, issue 4, 2013.

[2]. Harsha G. Hegde, N.S. Mahesh, Kishan Doss, Overall equipment effectiveness improvement by TPM and 5S techniques in a CNC machine shop, volume.8, issue 2, September 2009.

[3]. Dipanushu jain, Munish Mehta and Janender Kumar, Identification and elimination of bottlenecjs:vA case study, International journal of recent trends in mechanical engineering, volume.2, issue 2, April 2014.