

PRODUCTIVITY IMPROVEMENT USING QUALITY CONTROL CIRCLE FOR FASTENER INDUSTRY: A CASE STUDY

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ABSTRACT: *This study is a trial to find out the consequences of quality circle on fastener industry to increase its productivity. The study was conducted in a fastener industry for the collection of three months data of quality inspection. The perceived data is examined by fishbone (Ishikawa) diagram, tables & charts such as histograms, pareto charts etc. The outcomes and interpretations are stunning as well as favorable to the organization. It results in drastic wastage reduction, diminishing financial losses, significant increase in average saving & increased employees' incentives, thus productivity increased considerably. This study divulges & conveys that the positive attitude will be blossomed. The fastener's volume significantly increased because the lot rejection rate decreases by superimposing the concept of quality circle for fastener industry.*

Key words: *Quality Circle Impact, Quality Improvement, Optimum Production Rate, Overall Improvement*

I. INTRODUCTION

The word 'quality' has been extracted from Latin word 'Qualis' means 'what kind of'. Quality Circle is a small group of voluntarily participating about 6 to 12 members engage in similar work assemble at frequent intervals to diagnose developments in their corresponding fields by applying demonstrative approach for examining and answering work related issues facing in the process of attaining eminence to the organization.

It is "a way of capturing the creative and innovative power that lies within the work force".

Origin of Quality Circles: Quality Circles were established in Japan in 1962 credited to Kaoru Ishikawa coordinated by the Japanese Union of Scientists and Engineers (JUSE). Nippon Wireless and Telegraph Company was the first where first circles were established. Then only in one year spread in 35 other companies and by 1978 approx there were more than one million QCs.

In India QC was first established in Bharat Heavy Electricals Limited (BHEL). Quality Circle Forum of India (QCFI) was formed as a nonprofit national body in 1982. However, QC is fault-finding exercise in United States so remains unsuccessful. Don Dewa with Wayer Ryker and Jeff Beardsley first established QCs in 1972 at the Lockheed Space Missile Factory in California.

II. LITERATURE REVIEW:

Anita V. Gaikwad (2009) paper entitled "*Quality Circles as an Effective Management Tool: A case Study of Indira Collage of Engineering and Management Library*" describes the contribution of QCs as an administrative approach to upgrade the potential of athenaeum facilities. It explains that this concept encourages candidate contribution, stimulates collaboration and promotes participation towards departmental productiveness. The conclusion of the research is that if this idea is suitably executed in the area of athenaeum and statistics field. The outcomes will be amazing and can also guide us to facilitate designing of better system.

Kannan S (2011) paper entitled "*Organizations' support to quality circles-a comparative study of public & private sector in India*" directs how QCs in state sector are performing better than the citizen sector in India, in terms of contribution, practicing, candidate's feelings about QCs and organizational maintenance to QCs. For study 132 QCs samples selected randomly from six organizations (three state sectors and three citizen sectors) of huge production industries. The outcomes of the research shows after connecting the QC project candidates from each sector skilful enhancement in their occupation with happiness. Instead of a valuable contrast was noticed and higher positive results were found in public sector organizations compared to private sector.

Mr. Lalit Yadav (2012) paper entitled "*Impact of Quality Circle towards Employees & Organization: A Case Study*" gives the QC effect in relation with workers and incorporate. The author had studied the employees' attitude towards participative management after the implementation of QCs. The data is analyzed by cause effect diagram, pareto diagram etc. This study results in wastage reduction, increased employees' motivation, increased in average saving, also encourages good team relationships & skill development. There is increase in the co-ordination between employees and organization and development of positive attitude.

Pramod kumar (2013) study named as "*Quality Circles: An Effective Management Tool (Applied in small scale Organizations)*" deals with the reduction of cost by process modifications of small commercial enterprises. The research examined the importance of QC as a management approach to upgrade the production process performance and made attention on developments so that minimum rejection rate is achieved. Data is collected by testing particularly in the wire harness and cable assembly manufacturing companies for automobiles so by executing this in similar industries quality can be enhanced.

Dominic Savio Roberts (2015) paper entitled "A Study on the Applicability of Quality Circles to Constructional Projects" bothers about the implementation of QCs as a productive technique in construction project. The research methodology was a survey based on a set of questions and

the statistics was analyzed by illustrative study using % characterization and average of index numbers. Due to surveying data it was resulted that the construction industry of India influences favorable states regarding the implementation of QC, therefore, on constructional projects short-term teams were established, and as participative management might not be supported by the present organizational culture have been equipped in doubtful conditions that required development.

III. QUALITYCIRCLE CONCEPT

Structure of quality circle: organizational structure of QCs different from industry to industry, they consist of following basic segments:

- 1) **A steering committee:** this is the upper part of the network guided by superior administrative includes delegates from the top management personnel establishes policy, plans & directs the program.
- 2) **Coordinator:** he is the executive officer who correlates and assists the facilitators of various departments and prolong link with superiors.
- 3) **Facilitator:** he is the senior supervisory officer. He provides feedback & resources, organizes training, conduct meetings and maintain budget & records in his department/section.
- 4) **Circle leader:** elected by circle members and conducts circle activities such as help in collection data related problems, ensure effective participation of all members, schedule circle meetings etc.
- 5) **Circle members:** they are the enormous segment of the system. They are the workers of the organization whose help in achieving desired results. They focused on organizational problems, give views, opinions and ideas during problem solving stages. All meetings and training programs should be seriously attended by them.

Process of quality circles: the steps for the operation of quality circles are:

- 1) **Problem illustration:** identify various problems in work area that need to be solved
- 2) **Problem selection:** choose the issue to be considered primary on priority basis which is most critical.
- 3) **Problem analysis:** by using basic problem solving methods analyzed and clarified the problem
- 4) **Generate alternative solutions:** produce several feasible substitute considerations by identifying and studying causes
- 5) **Choose the most favorable conclusion :** all the substitute considerations are compared on the basis of efficiency, productivity and investment and most appropriate solution will be selected
- 6) **Formulate scheme of operation:** the scheme of operation of changing conclusion into actuality will be prepared by the assumptions “who, what, when, where, why and how” of answering issues.
- 7) **Illustrate conclusion to the authority:** for approval conclusion will be presented to the authority by the members.
- 8) **Application of result:** the approved result is evaluated by the management which is examined and if favorable, applied on huge level.

Quality circle techniques: quality circle techniques are as follows:

- 1) **Brain storming:** the aim is to provoke innovation and autonomous communication between its participants without any judgment.
- 2) **Fish-bone (Ishikawa) diagrams:** followed by identification of issues, the cause for the same will be searched then a fish bone diagram is drawn for the cause and effect relationships.
- 3) **Sampling & charting methods:** Observing of key events and plot them in the particular series and with the relations between them by QC members. For example, as in a pareto diagram high frequency events being highlighted.

IV. REASEARCH METHODOLOGY

The QC approach is considered in a fastener production field. The purpose of the case study is successful implementation of the quality circle methodology. The in-house rejection and customer rejection is listed for all processes and products in the final inspection area of the industry which is the uttermost phase of comprehensively examination of all commodities. To know PPM level catalogue of product inspection and rejection is preserved. The quality cost of the manufacturing industry is higher with higher PPM (parts rejected per million of the product) that can be identified as a problem. To find the highest contributed complication among the problems noticed in the final inspection area Pareto Charts are used. A steering committee is formed voluntary. To enhance the grade of industry by diminishing number of imperfections all workers are also invited to join the quality circle team. Training is given to all employees to reduce defects to zero level for which this team is responsible. A stimulating brain storming assembly is conducted to discover the means of solving the recognized complications and everyone is requested to contribute their precious recommendations and suggestions. Data collection is done and analyzed for further improvements.

Data Collection & Analysis:

The data collection for the month of January 2018 is represented below:

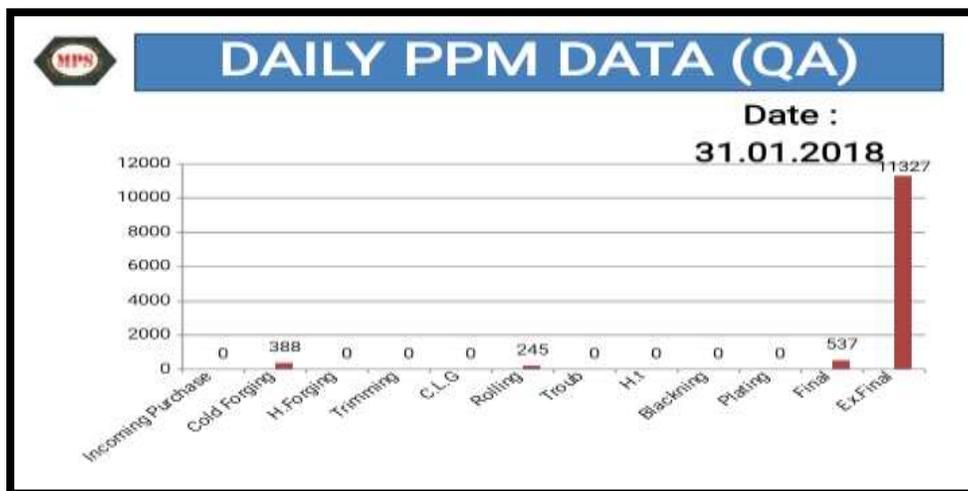


Fig: 4.1 (Daily PPM data for the month of January 2018)

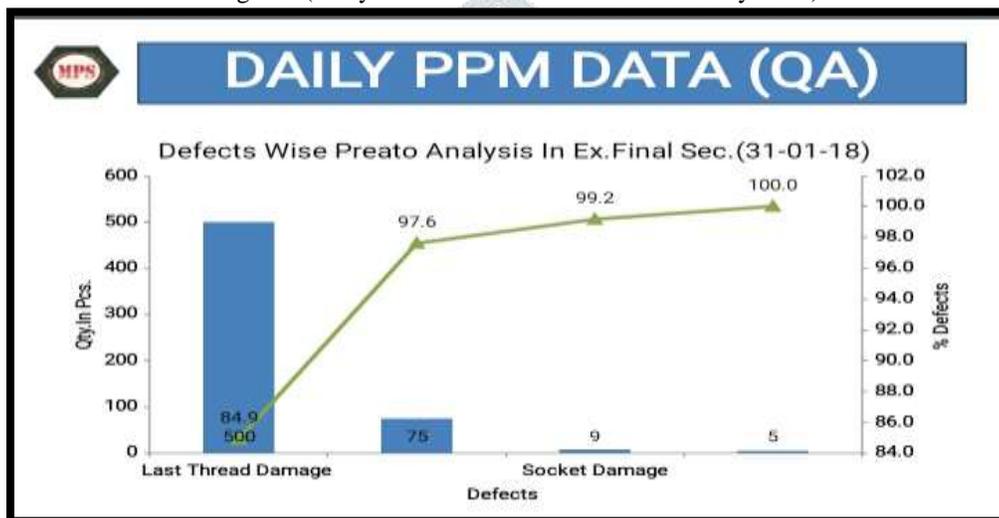


Fig: 4.2 Pareto analysis in ex. Final sec (Jan 2018)

Table 4.1 In-process status

Sr. No.	Date	Section	Part Name	Problem Description	NG qty.	Action Taken
1	04.01.2018	Cold forging	M20*1.5*40 Rim Bolt	Crack on head	80000pcs	Hold
2	06.01.2018	Thread rolling	M8*40 Socket Head	Reverse Thread	100kg	Sorted & found 30 pieces NG
3	16.01.2018	Thread rolling	M6*1.5*58 Wheel Bolt	Bearing face damage	200kg	Under sorting
4	24.01.2018	Thread rolling	M24*100 Fit Bolt	TRD o/s	1000Pcs	Under sorting



Fig: 4.3 status of final inspection (Export) (Jan-18)

Table 4.2: Final inspection status

Sr. No.	Date	Customer	Part Name	Problem Description	NG Qty.	Action Take
1	01.01..2018	PRK	8M6*16 Low head	Head & thread under cut down	2500pcs	Allowed by Raman sir
2	04.01.2018	PRK	8M6*12Sh Bolt	Head & thread under cut down	2000pcs	Allowed by Raman sir
3	05.01.2018	PRK	M24*100 Fit bolt din 609 8.8	Body black spot Dia min & u/s 0.003 mm	11pcs 18pcs	Under sorting
4	10.01.2018	PRK	M4*20 Pull dowel pin	Chamfer not ok	5000pcs	Hold
5	19.01.2018	PRK	M6*35 CSK10.9	TPG NOGO loose	15000pcs	Under sorting

Status of Dock Audit (Jan-18):



Fig: 4.4 status of dock audit (zero defect achievement)

The data collection for the month of February 2018 is represented below:

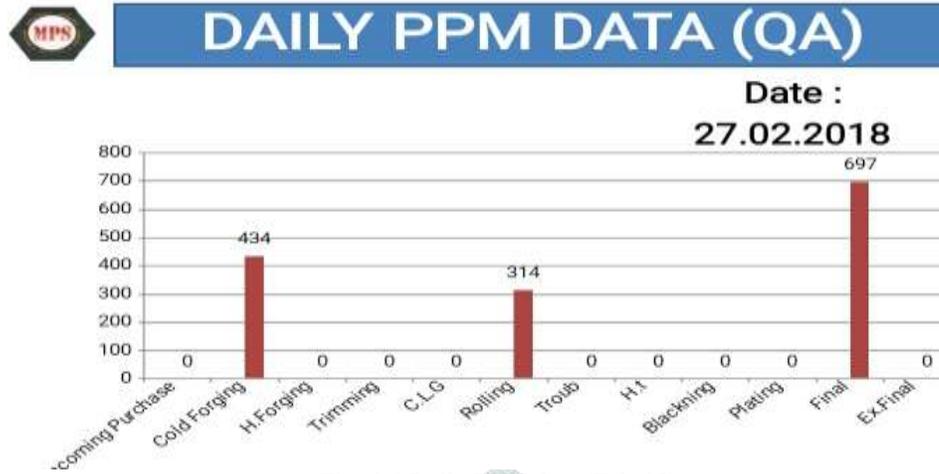


Fig. 4.5 Daily PPM data (Feb-18)

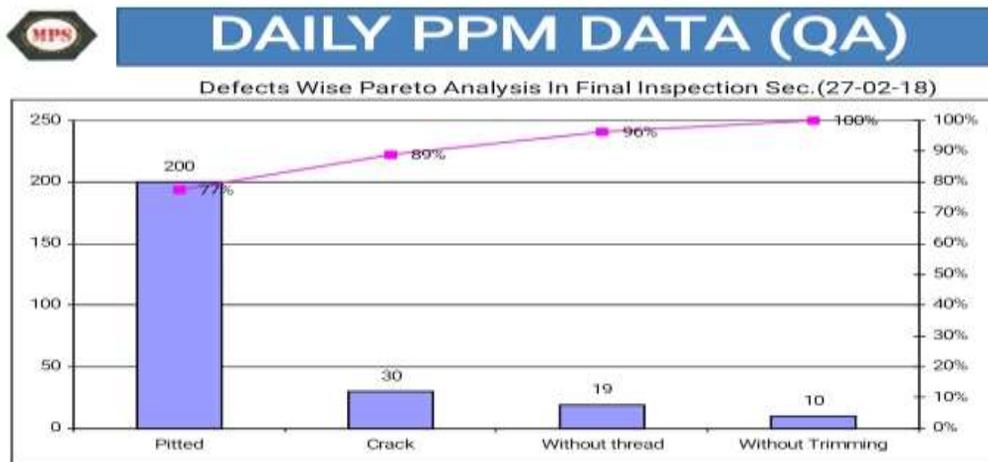


Fig.4.6: Defect wise pareto analysis in final inspection (Feb-18)

Table 4.3: in-process status

Sr. No.	Date	Section	Part Name	Problem Description	NG qty.	Action Taken
1	05.02.18	Thread rolling	M24*220 HB	Ring gauge tight	200pcs	Rerolling & found ok
2	07.02.18	Thread rolling	M26*35 CSK	Angle damage	300pcs	Sorted & reject 20pcs
3	16.02.18	Cold forging	M16*1.5*58.5 Wheel bolt	Total length under size 0.5mm	1000pcs	Sorted & reject 50pcs
4	26.02.18	Thread rolling	½” UNF*44 Wheel bolt	Reverse thread	1000pcs	Sorted & reject 50pcs
5	27.02.18	Thread rolling	½” UNF*44 Wheel bolt	Thread gap more	500pcs	After rework found ok

Status of Final inspection (Export) (Feb-18):

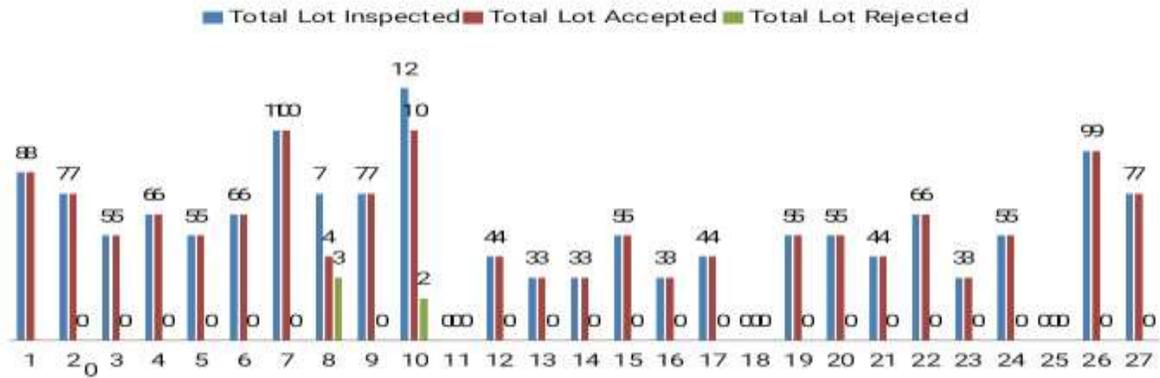


Fig.4.7: status of final inspection (Export) (Feb-18)

Table 4.4: Final inspection status

Sr. No.	Date	Customer	Part Name	Problem Description	NG qty	Action Taken
1	08.02.2018	1. PRK 2. PRK 3. Euro bolt	1. M12*45 BHCS 2.MB*20 Button Flange 3. M20*60 CSK	1. Crack on head 2. crack on head 3. total length down	1. 10000 pcs 2. 20000 pcs 3. 1674pcs	1. sorted & found 236 pcs reject 2. sorted & found 265 pcs reject 3. sorted & found 624 pcs reject
2	10.02.2018	1. PRK 2. Euro bolt	1. ϕ 20*140 Pull dowel pin 2. M16*45 CSK 010.9	1. counter on burr 2.crack on head	1. 450pcs 2. 11000 pcs approx	1. allowed by Raman sir 2. sorted & found 469 pcs reject

Status of Dock Audit (Feb-18):

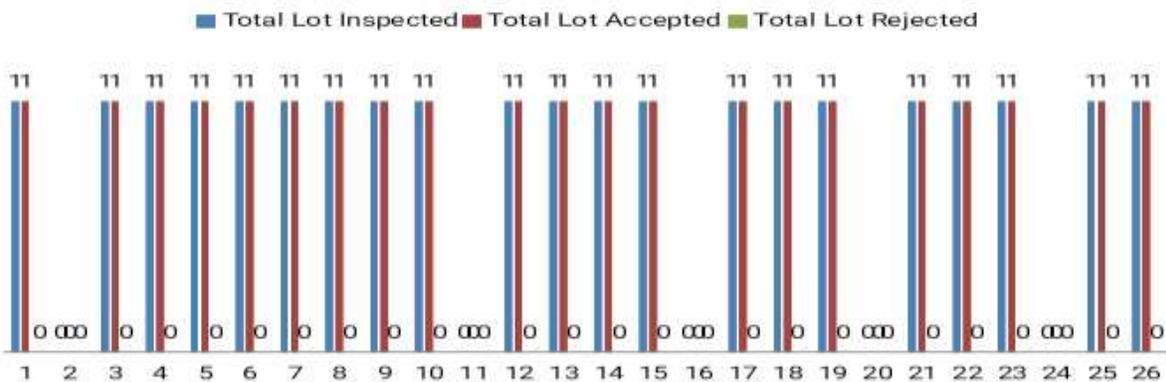


Fig.4.8: status of dock audit (zero defect achievement)

The data collection for the month of March 2018 is represented below:

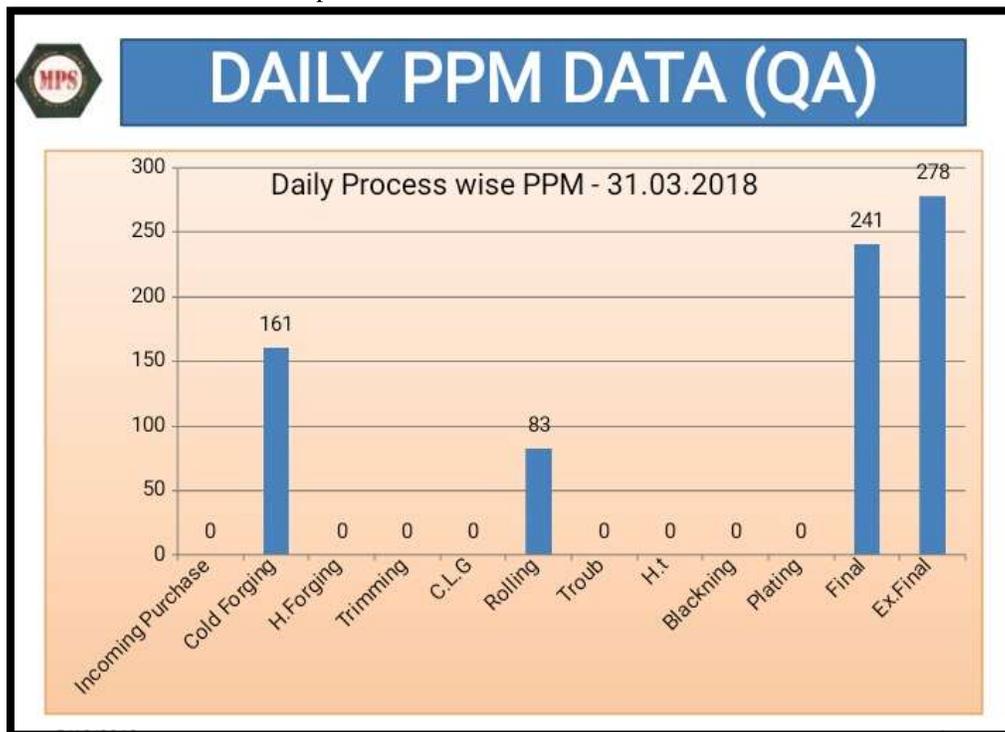


Fig. 4.9 Daily PPM data (March-18)

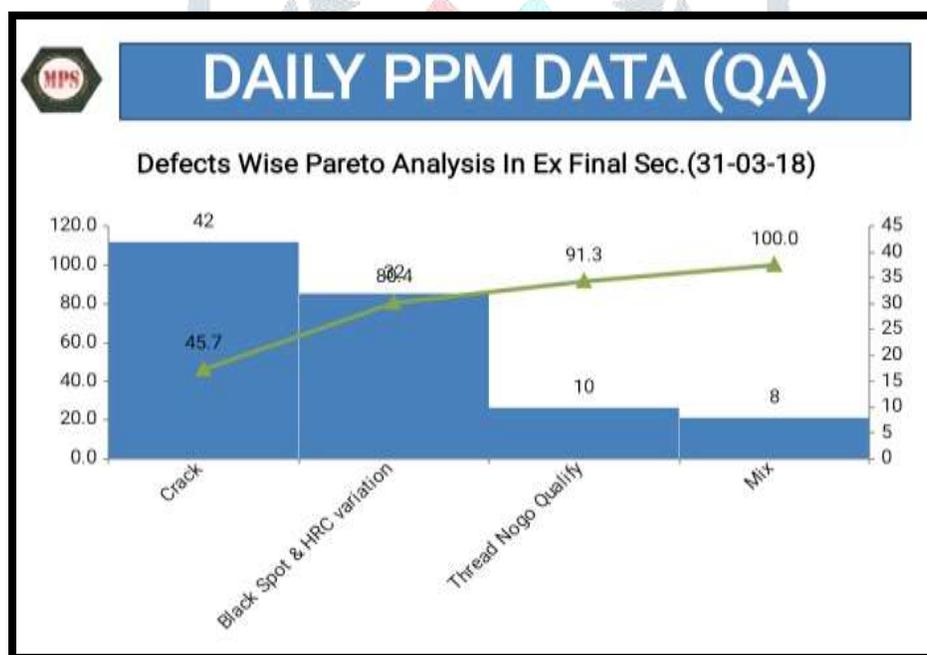


Fig. 4.10 defects wise pareto analysis in ex. final sec. (march-18)

Table 4.5: In process status

Sr. No.	Date	Section	Part Name	Problem Description	NG Qty.	Action Taken
1	08.03.18	Cold forging	M8*45hexbolt	Total length oversize	70 pcs	Sorted & 35 pcs reject
2	20.03.18	Thread rolling	M20*2.5*90 wheel bolt	Go gauge tight	-	Allowed in nut by Raman ji
3	21.03.18	1.cold forging 2.cold forging	1.M20*1.5*53 wheel bolt 2.M14*1.25*32 flange screw	1.D head damage 2. Chip on head	1. 500pcs 2.2000pcs	1. sorted & 30 pcs reject 2. under sorting

4	22.03.18	Cold forging	M12*1.75*40 CSK	Burr on socket	700pcs	After rework found ok
5	26.03.18	Cold forging	M16*2*35 Hex screw	Total length oversize	200pcs	After soting found 30 pcs & after rework found ok
6	27.03.18	Cold forging	M12*1.25*35 Collar bolt	Chip on across flat	500pcs	After sorting found 40 pcs rejected
7	28.03.18	Thread rolling	1”*8” HB	No go pass	2000pcs	Allowed by Raman ji
8	29.03.18	Thread rolling	M20*1.5*53 Wheel bolt	MD undersize (0.02mm)	1500kg	Allowed by Raman ji
9	30.03.18	Cold forging	M6*10 Button Flange	Without flange	500pcs	Sorted & 25 pcs reject

Status of Final inspection (Export) (Mar-18):

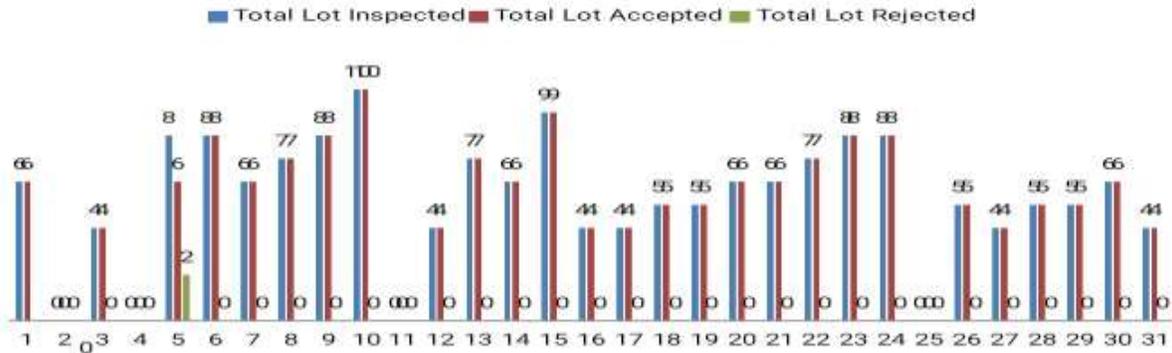


Fig. 4.11 status of final inspection (Export) (Mar-18)

Table 4.6: final inspection status:

Sr. No.	Date	Customer	Part Name	Problem Description	NG Qty.	Action Taken
1	05.03.2018	1. PRK 2. PRK	1. M8*100 Button Head 2. M6*18 CSK	1. Pitted 2. Total length under size	1. 5000 pcs 2. 7000 pcs	1. sorted & 365 pcs reject 2. allowed by Naresh ji

Status of Dock Audit (Mar-18):

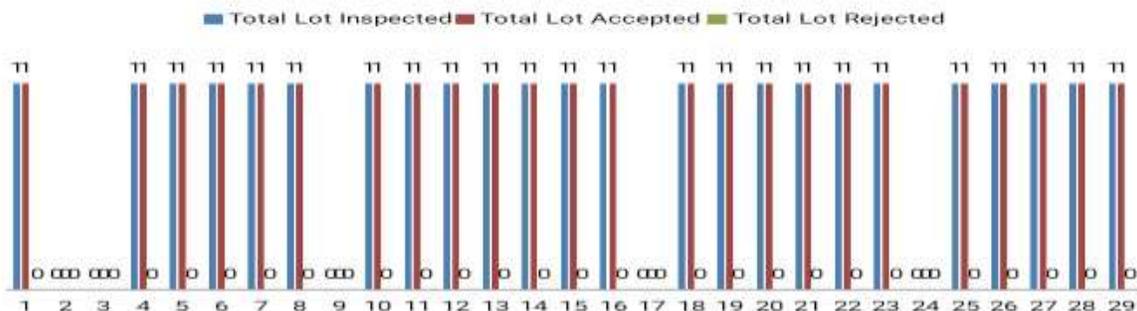


Fig. 4.12 status of dock audit (zero defect achievement)

V. RESULTS & CONCLUSIONS

The fasteners industries are developing day by day because joining of two parts with the help of fasteners provides a kind of flexibility in assembling parts. The final outcomes of the present case study that there is steady decrease in lot rejection along with a positive linear increase in lot acceptance when lot wise inspection is done. Production & quality is improved by achieving zero defect quality stage, eliminating extra process steps, and PPM data reduction due to imposing of QCs.

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