

# Quality Improvement in Back Plate Assembly by using 7QC Tools of Quality: A Case Study

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**Abstract** - In developing Areas of Industries or any field of any organization are continuously running. There for most difficult situations are creates for selecting a best organization which have best quality at low cost and may be have guarantee or warranty for any periods and not known about their life reliability and maintain ability It is most difficult to comparing their characteristics and specification in competitive market so that most upper position of any object or product is quality features which is very stiff cult in selecting of a product. So that Therefore In competitive area every Industries know about requirements of markets and know about other Industries which hoar giving the quality products in markets at that cost and what features put up.

This research is been made in Press CO-MEC Auto component PVT LTD in Faridabad which manufactures the back plate of brake shoes. This Research is on the basis of quality related problem which occurred in back plate assembly. Some defects are occurred in during manufacturing of a back plate which created more rejections and many customer complaints were getting. By this overall efficiency of the company is going to loss every day. These issues are discussed in this study.

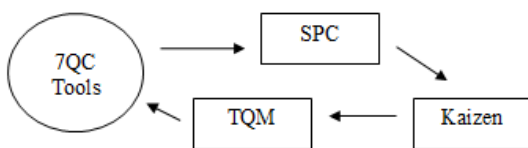
So this research concludes that these problems are effectively removed by rejection control technique or problem solving techniques. The 7QC tools have been implemented which also known as Basic 7QC control tools. 7QC tools also involves the kaizen, 8D, TQM, 5'S Toyota Production system Quality circle, statistical process control and SOP in Total quality Management. So we worked according to these quality control techniques. This research analyzed and identified the defects and makes the list of defects which occurred in back plate Assembly in First stage to last stage of the final products. This also analysis and observed and identified the problems to find out causes of defects and root causes of defects and mode of failure of objects and process variations and machines parameters and we implement for find out defect free solution by using 7QC Approaches for quality improvement of a manufacturing product. For this research we use Flow Chart, Check sheets, Control chart, Pareto analysis Causes and effect diagrams scatter diagrams and stratification and uses graphs as histograms. These are involves the kaizen, Toyota production system, 5's, 8D and TPM

**Key Words:** 7QC tools Kaizen SD, 5's, PDCA, DMIAC Toyota Production system.

## 1. INTRODUCTION

Quality is most important characteristic or features of any industry, because quality shows the market level of any industries in competitive field. It is necessary to know about what is going on markets, and what is demand of markets and what wants of customers. **Mr. Jimmy Th. B. S. AOT** certified consultant and auditor which publish the book of 7 QC Tool which describe the problem solving technique and decision making solution for any area. It gives technique and formulation for decision making solution for total quality management. Quality gurus like **Deming and Juran**, which belonged to japan developed 7 QC tools for solving any type of problem. They are also known as quality gurus (1974). The guru of quality, **Kaoru Ishikawa** developed Ishikawa tools of quality which also known as cause and effect diagrams tools. He did not developed 7 tools of quality but he introduced basic 7 types of quality tools which used for solving the 95% of all problems. He learned that how can implement the 7 QC tools in any problems. **Pranays Parmar** used approaches as statistical Process control Technique for problems of wastages and rework in process. These process variation developed wastage and recycled work. So, he implemented in industries 7 QC tools such as statically process control. **LAUEESHUANG** used 7QC Tools as a kaizen technique which is rejection control technique kaizen tool is used to removal or reduces the wastage which carried out by production process. The tools remove 7 MUDA wastages or 7 type wastages is non-value added which is necessary removed from production. These wastages are known as TIMWOODS. **Parijat Bhangale, Rajesh and Gajamn Gambhire** used 7QC as Basic tools of quality approaches for eliminate the defects in car body panel, by this technique. They present the resolution of defects of a car body panel by which we eliminate the rejection and rework by using 7 QC Tools Method or approaches. They analyzed and find out of root cause by which Defect are created. They used 7 QC tools like flow chart, cheek sheets, causes effect diagrams and Pareto charts. **Behnam Neyestani** uses 7 QC Tools of Quality control technique solve the problems of an organization. He selected appropriate Qualities Technique for solutions of defects. These tools are played important rule for monitoring and collecting data and analyzing the data for solving the problems and detecting in operation of manufacturing. 7QC tools or Basic tools of quality control are Problem solving

technique which trouble shoots of quality issues. It is also known as Brainstorming technique. These are used in any areas of in which problems are created. These tools are analyzed the problem from starting Process to the final stage of any objects. They can do 95% solution of the problems by right using and Right thinking of tools. These tools are develop a quality Models for all type of an organizations. These can be used for small and Medium and large group of Industries. 7QC Tools are statistical tools and graphical tools which trouble shoots the problems of quality issues. These are simple statistical techniques which helpful in removal of defects and scraps and rejection in productions. 7QC tools of quality which control the quality performance of a manufacturing product. These tools are also known as magnificent Tools which magnify the problems and carry out the main causes of defects and find out of solution 7QC tools are implemented with quality programs or quality Eng. or Practitioners which used with 7QC tools are implemented with quality programs or quality Eng. or practitioners which used with 7QC Tool for a continuous by process improvements.



**Figure-1** 7QC Tools related with kaizen and SPC with correlated with TQM in a quality programs.

## 2. METHODOLOGY

7QC Tools are problem solving tool which gathered the data and after gathering and analysis these data and find out of main causes which is root causes of problems generation and measures the data evaluate the corrective actions. These tools have Numerical data which analyzed by numerical Method and monitored and after that processes these data and evaluate the causes for problem solving of any type of defects, implement the 7QC tool and find out the solutions. 7QC Tools are first time developed in japan. 7QC tools are introduced by Quality Gurus. Quality gurus are Deming, Juran and Kaoru Ishikawa. Deming and Juran developed 7QC Tools. They told about 7QC tools is a Problem solving techniques which remove the quality related problems by using these tools. Quality guru Ishikawa introduced together 7QC Tools for solving the problems of any organization. He told that 95 % Problem solved by using seven tools. The Ishikawa developed Quality circle Method. He is known as father of quality circle. For this research we analyzed the company manufacturing operation and used the 7QC Tools.

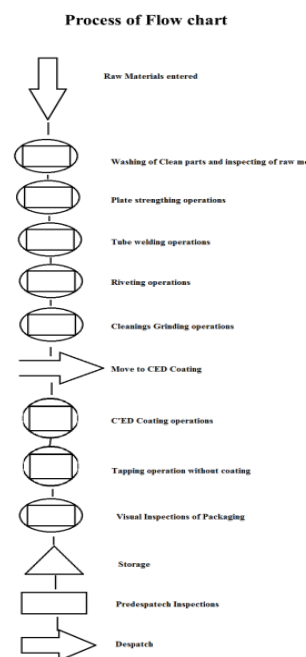
1. Flow Chart
2. Pareto Chart

3. Cause & Effect
4. Histogram
5. Scatter diagram
6. Control Chart
7. Check sheets

### 2.1. Flow Chart:-

The flow chart is been used for observing and analysis the manufacturing operations, procedures, process for produce and manufacture a product. I identify the process which essential for manufacturing a back plate. I analysis the all process which start from raw material to final product to customer delivery. I observing and monitoring the whole Cathode Electro Deposition Process and Procedures and Machine and instrument and setting parts which used in manufacturing monitoring the process receiving part of child parts of Back plate the After that washing of Child parts, After that strengthening operations of Plate by welding and after that riveting operations and Now analyses the Cleaning and Grinding operations of Back plate. Now move to CED coating in paint shop. Now after that we observe coating operation and move in trapping operations and Inspection operations and monitoring to storage and Pre-dispatch inspection and dispatch section. I analyzed and monitor the all process which used in Back plate for manufacturing.

We used Rectangle circle, arrow and boxes for showing the operations or process for understanding and analyzing the process which represent the how the process in complete and stand and monitor the cycle time.



**Figure-2.** Flow chart of process

We find out major defect, Damage, scrap and scratches and wrinkles, lining and Lamination and short blank and blank out etc. and other variation like dimensionally missing operation, tolerance problems and gap variation and welding defect etc. These major or mains defects which produce minor effects are identified by analyzing the operation.

**2.2. Pareto Charts or diagrams or analysis:-**

We analysis and monitoring overall operations and find out major and minor defects from the analyzed data and find out the problems which affect the quality system and many scraps and repair and rework and done it and many timed loss and productivity effected by this rejections. So we find out fused on this analysis we take sample read only daily and analysis of rejection of Jan 2019 to Feb 2019 we find out monthly rejection of the section of back plates assembly. Our target is zero % age defects. It means manufacture defect free products.

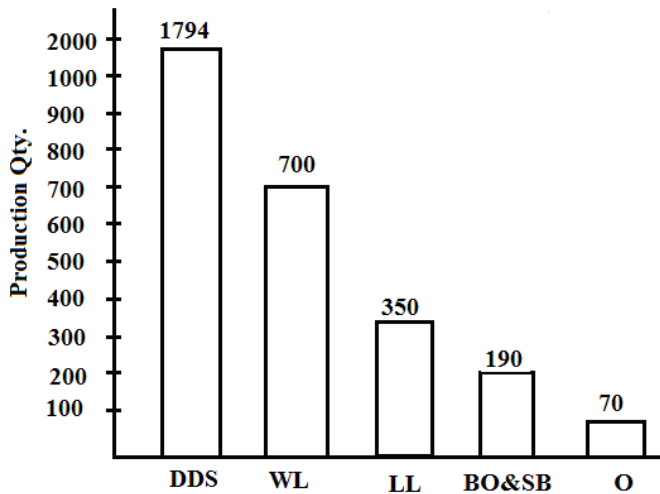


Figure-3. Pareto diagram

Table-1. Percentage of rejection

Types of defects	Rejected qty.	Cumulative %age	Cumulative qty.	%cumulative of rejected qty.
DDS	1794	57%	1794	57
WL	700	22%	2494	79
BO & SB	350	11%	2844	90
LL	190	7%	3034	97
O	70	3%	3104	100
Total	3104	100	3104	100

For this we analysis this data by using pare to diagram by pare to diagram we analyze data on graph in which show the % age and qty. and Defect According to their length or height which effect on productivity.

This principal tells those 20 % major defects are due to 80 % minor defects. If 20 % major defects are removed then 80 % removed without any interference. So we analyzed these

defect on graphical methods in which we take X-Y axis plane. The left side of plane on Y-axis we take qty. or frequency of defect and another side of Right side of Y-axis, we take cumulative % age of defect and on X-axis we take different type of major defects. The defects are in pare to chart is are arranged in decreasing orders After using from 20 to 80 % rule this diagram show the Dent Damage & secretes and wrinkles are major role play in increasing of rejections. So we focus on these two defects by this way we eliminate these defects.

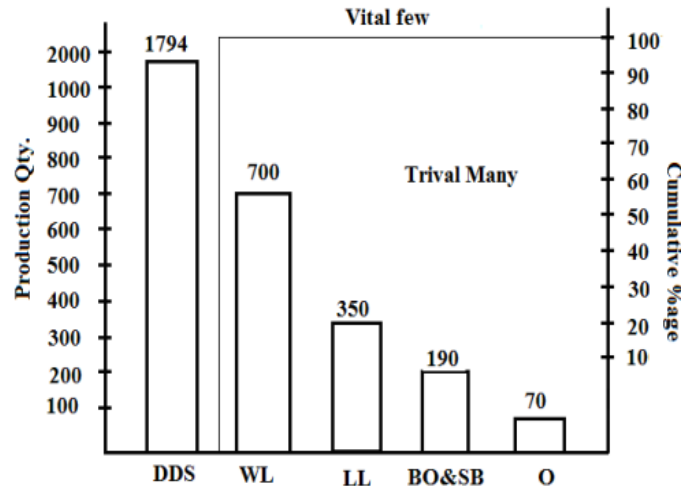


Figure-4 Pareto analysis

**2.3. Causes effect diagram:-**

It has fish like structures. This tools used for causes and effects of problems. We collect the data and find out their causes and root causes by 4 M or 6M method. It is brain storming techniques.

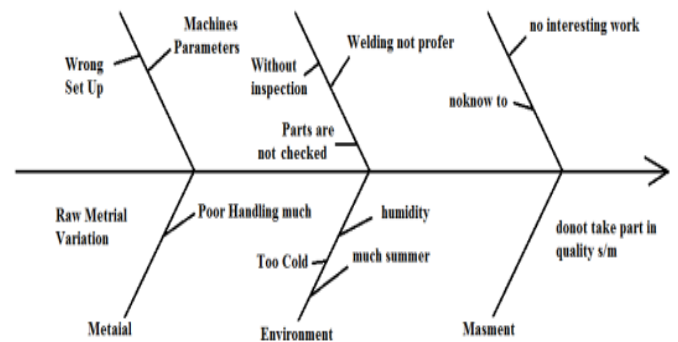


Figure-5. Causes & Effects Diagram

This causes creates many problems the major defect by why -why analysis

**Dent Damage, Scratches (DDS)**

**Table-2.** Why-Why analysis

Cause	Why	Why	Why
	Making of center for mounting hole in MIG welding While Tube are masked by insertion of PIN through the both notes	Heavy burr during piercing operations and blanking operation	Welding spatter & poor and blanking operations

**Effect of Dent:**

1. Non confirming product.
2. Fitment problem at customer end.
3. Back plate is damage due to fitment problems.
4. Many scratch observed during operations.

**Wrinkle (WL)**

**Table-3.** W- Why analysis

Cause	Why	Why
	Decoiling operations are not done.	Sometime raw material variation occurred.

**Effect:-**

1. Non Confirming product.
2. A Customer end the fails the product

**Blank out & Short blank:-**

**Table-4.** Why Analysis

Causes	Why	Why	Why	Why	Why
	Sheet wrong feed in banking tools	Sheet not proper set with stopper	Blank out due to operation mistakes	Sheet length short of (BO & SB)	Sheet guide stopper worn out over gap between sheet and sheet guide block & pins.

**Effect:-**

1. Non confirming products.
2. Rejected by customers.

**Lamination & Lining**

**Table-5.** Why Analysis

Causes	Why	Why	Why
	Manufacturing fault	Sheet movement over sliding on sheet to sheet	Sheet length variations

**Effect of L.L:-**

1. Non confirming product.
2. Customer dissatisfied.

**Other defect:-**

1. Dimensionally variations.
2. Gap between back plate and retaining plate, locating plate and riveting effect
3. Plate missing
4. Tolerance problems.

**Table-6.** Why Analysis

Cause	Why	Why	Why	Why	Why
	Raw material Dimensions variations	Poor operator working	Without Checking deliver at next stations	Excess clearance locator & center hole	In complete machine stock power cut and Gap between child parts while placing part in tool

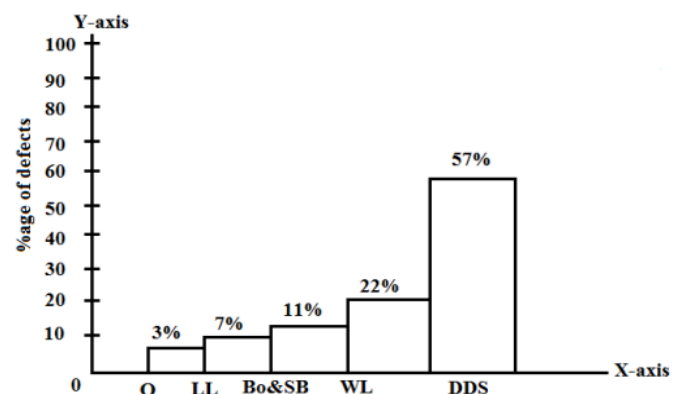
**Effect:-**

1. Non confirmation product
2. Fitment problem at customer end
3. Customer dissatisfied

In this way, we find out the root causes and effect of these defects by using cause and effect or fishbone diagrams.

**2.4. Histograms:-**

It is tool which present the graphical presentation of the data which prepared by defect and show on the graph in numerical form. These numerical data have different % age of rejection qty. and provide a set in which data occurred.



**Figure-6.** Histogram

Histogram shows % age of defect on X-axis and defects take in Y-axis and defects take in increasing orders. It provides the shape of Numerical data.

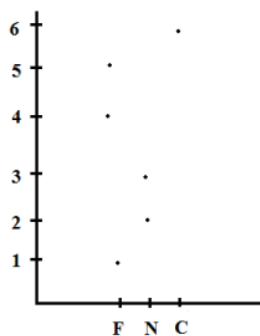
**2.5. Scatter diagrams:-**

It shows the relationship between two variables. And it shows the power of cause effect diagrams. Scatter diagram help in understanding the relationship between two variables and also help in future reference. If we do any changes in independent variables then behavior of dependent variables easily understand. It conform the causes if dependent variables fall effect on in dependent variables. Here we analysis major causes and their effects have no relation.

These variables have no relation are called zero degree correlation.

**Table-7.** Correlation between variables

	Dependent variables	Independent variables
S.N.	Major causes	Major effects
1.	Tube ID variations	Fitment problems (F)
2.	Decoiling operations	Non – conformity (N)
3.	Sheet dia.	Non – conformity (N)
4.	Dimensionally variation	Fitment problems (F)
5.	Excess clearance between plates	Fitments problems (F)
6.	Sheets movement	Customers satisfied (C)



**Figure-7.** Scatter diagram of zero degree correlation

**2.6. Check sheet:-**

The check sheet does not help the problem solutions. It has only records or situation. It shows the conditions of parameters and characteristics & specifications of any machines or workstation or assembly department. It have record of production in which pass product qty. and rejected quantity are written in different list check sheet is different to every M/CS and assembly sections and departments. By this way using 7QC tools of quality we find out the defects and their causes and effect and their statistical data or numerical data on which analyzed done.



**Figure-8.** Defects of back plate

**3. RESULT AND DISCUSSIONS**

By using 7QC tools of quality control like Flow chart scatter & fishbone Histogram check sheet, pare to analysis find out the defect and causes and root causes and their defects and provide a statistical data and record on which analysis have done and carried out the results by using these tools.

Results of these data represent by 7QC Tools.

**Flow chart:-**

Find the variation which present in process and procedures and operation which are necessary for manufacturing in back plate assembly.

**Pareto analysis:-**

Pareto analysis that 20% major defect dent, damage and wrinkles are covered the all 80 % minor defect and other variation have in small areas.

**Causes effect diagram:-**

Causes effect diagram are find out the main causes or root causes of any defects and their effects which creates the quality problems issues by use why-why analysis.

**Scatter diagrams:-**

It shows the relationship between two pair defects that which defects depend on other defects.

**Check sheet:-**

Check sheet shows the records of statistical or numerical data of production activity.

Now find out the deflection and variation and causes of defect and their defects on production system. We take the step for the corrections and removal of these defects.

For removal and reduces of these defects we find out solution with help of quality circle teams and quality Eng. Mr. Anil Aggarwal & Mr. Sunil Kumar and with help of same workers and discuss about corrective action which prevent the defects and removes the defects.

Defects	Causes	Corrective Action
1. Dent damage scratches (DDS)	1. Trolley arms uncover 2. Welding spatter & Buru 3. Masking of center bore mounting hoatzin MIG welding while tube are Masked by insertion of pin through the Both holes	1. Trolley arms converted by plastic tubes. 2. Welding parameters are changes 3. Proximity sensor introduced for sensing of making arrangement being placed on center Bore Mounting notes
2. Wrinkles (WL)	1. Decoiling operations are not done. 2. Raw material variations	
3. Short Blank and Blank out (BOSSB)	1. Sheet Wrong feed in banking tools 2. Sheet not proper set with stoppers 3. Blank out due to operator mistake	1. All action concerned operators and helpers trained for blank out. 2. All concerned supervisors & operators were called in a joint meeting to make them aware of defect.
	4. Over gap b/w sheet and sheet guide	
4. Lamination & Lining	1. Manufacturing fault 2. Sheet movement 3. Sheet length variations or diameters	Visually inspections and measurement of length or diagram the specific length or diagrams which are given by customer specification is 310 mm diagram of sheet. If sheet diagram of length fluctuate or less or more by which variation comes are short out and return to vendor company.
5. Others defects	Excess clearance out of Tolerance incomplete in/c stroke variation of raw material	1. Setup approval of machines. 2. Introduced Proximity sensor which detect presence of 10mm plate 4. Do the Inspection or verification in Process.

**Control chart:-**

One tool is such that which not find out problem causes & not carried out solution. These tools not only are of control the process or operations and procedure variations in manufacturing system. This tool is known as control chart tool of quality. These tools are also called statistical process control tool which verify the variation which came improves. These tools verify the stability of procedures or operations in process. Here we are used two control charts.

1. X Charts

2. R Charts

X Charts is the mean or Average of any which are specified under limit tolerances. It of data it is the ratio of sum of data to no of data which occurred and observing in statistical process. R Chart is difference between UCL and LCL which present in data of any samples of product.  $R = UCL - LCL$

Experimentally, here we measure the tube ID (inner dia.) and tube angle by Vernier calipers and bevel protectors.

The list count of Vernier Caliper is 0.01mm.

The list count of bevel protector is 5 minutes.

So, we use the control chart for stability of process for controlling of the procedures of manufacturing system. For measurement of tube of back plate, accurate tolerance limits are

Tube length – 50mm,

Tube ID –  $13.05 \pm 0.7$

Tube angle -  $35 \pm 2$

Measurement of Tube ID

Tube id  $\pm 0.7$  Tolerance limit

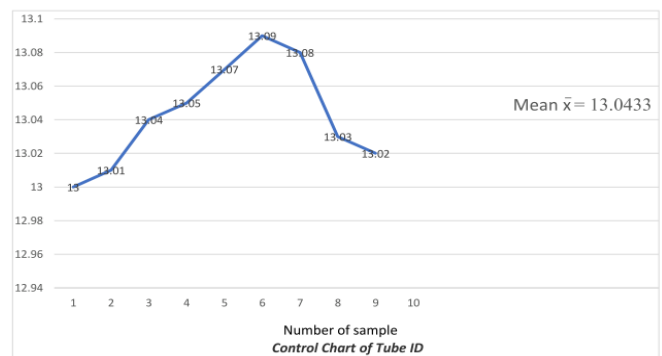
Accurate value of tube Id -  $13.05 \pm 0.7$

13.75 upper limits for tube id

12.35 lower limit for tube id

Now we take 9 variations of tube id which take under limit which are accept table 13.00, 13.01, 13.05, 13.07, 13.09, 13.08, 13.03, 13.02

Average or mean  $\bar{X} = \frac{13.00+13.01+13.04+13.05+13.07+13.09+13.08+13.03+13.02}{9} = 13.0433$



**Figure-9.** Control chart of tube id

**Measurement of Tube angle**

Tube angle tolerance limit is  $\pm 2$

Accurate angle  $= 35 \pm 2$

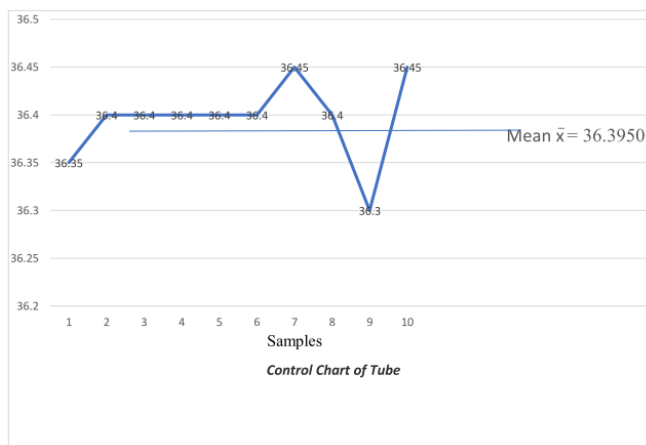
Upper limit for tube angle = 37

Lower control limit = 33

Now we take 10 parts which have different value under limit which are acceptable.

36.35, 36.40, 36.40, 36.40, 36.40, 36.40, 36.45, 36.40, 36.30, 36.45

Average or mean  $\bar{X}$   
 $= \frac{36.35+36.40+36.40+36.40+36.40+36.40+36.45+36.40+36.30+36.45}{10} = 36.3950$



**Figure-10.** Control chart of tube angle



**Figure-11.** Dent due to bare trolley arm



**Figure-12.** Trolley arms covered by plastic covers

**4. CONCLUSIONS**

By this research it has been carried out the conclusion that this technique are implement in any field of any organizations for removal and reduces the any types of problems. By using Brainstorming ideas we have find out solution of any problem. These tools magnify the problems and clamed out by magnificent solution. This is magnificent tools of quality programs which is given by professor. By using these techniques we can solve the 90% problem by easy way in Industrial areas. These tools remove the every variation which comes in every procedures and operations and process in manufacturing section.

By using 7QC tool in Press co-MEC Auto component industry we reduces and removes the defects of Back plate Assembly and improve the quality of company and manufacturing product at lower cost Flow chart, Pareto are effectively and easily understand and show the identification of causes.

Histogram provides % age of defect in total rejections which goes to loss of company budget which expand on manufacturing operations and product. It gives the highlight of defects of causes effects diagram find out root causes of defect of back plate which are analyzed by the diagram. These are helpful for understanding of causes of plates.

Check sheet used for past record of production activity which are helpful for my research and R chart control chart control the whole process of manufacturing system. By using tools, we improve the quality of back plate of brake shoes

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