CENTIVE
VOL. 3, NO. 1, PP.624-632, DEC 2023
ISBN : 978-602-53004-0-0

Conference on Electrical Engineering, Informatics, Industrial Technology, and Creative Media 2023

Quality Control System Analysis of Crank Shaft Products using Seven Tools Method at PT ABC

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Received on 01-11-2023, revised on 24-11-2023, accepted on 02-12-2023

Abstract

In fierce business competition, companies must focus on improving product quality to meet consumer expectations. Quality is an important factor in consumer purchasing decisions, alongside price. Therefore, quality control is key in the company's entire production process. This research utilizes Seven Tools, a quality testing tool that includes various analysis techniques such as check sheets, histograms, scatter diagrams, Pareto diagrams, stratification, control charts, fishbone, and control charts. The case study was conducted at PT ABC, a motorbike manufacturing company that dominates the Indonesian market. Even though they have succeeded in achieving market dominance, the company still faces the problem of spare part rejects which can harm profits. This research aims to reduce defects in Crank Shaft products with the help of Seven Tools, with a focus on identifying the causes of defects that result in non-fulfillment of quality standards. With appropriate corrective actions, it is hoped that PT ABC can continue to improve product quality and maintain its position in a competitive market.

Keywords: Product Quality, Quality Control, Seven Tools, Crankshaft

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I. INTRODUCTION

In an increasingly advanced era, companies compete with each other to dominate the industrial market, so companies need a strategy to be able to compete, namely by improving product quality [1]. Quality is something that must be fulfilled by companies in order to produce products that consumers want [2]. Basically, the first thing consumers see when using a product is its quality [3]. Quality is a parameter for assessing whether an item has selling value on the market, so quality control needs to be carried out [4].

Seven tools is a basic quality testing tool that can help companies solve problems and improve processes, because seven tools are very necessary for every organization to develop towards the peak of excellence. The seven analytical technical tools used in this research include check sheet analysis, histograms, scatter diagrams, Pareto diagrams, stratification, control charts, fishbones, and control charts.

PT ABC is a manufacturing company that produces motorbikes with production figures that tend to increase from year to year. This is proven by data from the Indonesian Motorcycle Industry Association (AISI) which shows that the products produced by PT ABC still dominate the market. This sales achievement represents 78.7 percent of national motorbike sales recorded by the Indonesian Motorcycle Industry Association (AISI), namely 1,824,073 units. Production activities that occur depend on orders

from customers. Seeing this, PT. ABC strives to always maintain the quality of its products with strict quality control. However, at PT ABC, defective spare parts are often found which can reduce company profits.

Based on the problems described above, it explains how important quality control is in the production process to reduce product defects and save time efficiency. Researchers are interested in conducting research on quality control to minimize defects in crankshaft products using the Seven Tools method by examining further the causes of many defects which result in defects that can be detrimental to the company. This is because to maintain the quality of the motorbike produced, it is necessary to maintain the quality of its components, one of which is the crankshaft component.

A. Quality

Quality can be interpreted as an asset owned by a company to be used as a differentiator or characteristic of a product [1]. Quality is full customer satisfaction. A product is said to be of quality if it can provide full satisfaction to consumers, namely in accordance with what consumers expect from a product [2]. Quality is an aspect of meeting customer criteria without experiencing defects [3]. Quality control is an effort that can be made to maintain and improve the quality of the products produced so that they comply with the product specifications that have been determined by the company [4].

B. Seven Tools

The seven tools analysis techniques used in this research include check sheet analysis, histogram, scatter diagram, Pareto diagram, stratification, control chart, fishbone, and control map. A check sheet or inspection sheet is a simply designed sheet containing a list of things needed for the purpose of recording data so that data collection can be carried out easily, systematically and regularly when the data appears at the scene [5].

A flowchart is a graphic description which contains the steps and sequence of a program. Flowcharts help analyze problems into smaller segments and help analyze other alternatives in the operating process. flowcharts make it easier to solve existing problems, especially problems that want to be investigated and evaluated [6]. A control charts is a graphic depiction of data that includes the upper (maximum) and lower (minimum) limits of the process you want to control [7]. Explained that a histogram is a tool for presenting data visually in bar form (block graph) which shows the distribution of values obtained in the form of numbers. Histograms function to make it easier to see more clearly defect data on a product [8]. Scatter diagrams show the relationship between two measurements. If these two elements are interconnected, the data points will form a thick band and are used to see the spread [9].The Pareto diagram was first introduced by Alfredo Pareto and first used by Joseph Juran. The function of the Pareto diagram is to identify or select the main problems for quality improvement from the largest to the smallest [10].According to Fishbone, it is also called a fishbone diagram or known as a cause and effect diagram discovered by Dr. Kaoru Ishikawa, Fishbone is used to identify and analyze processes or situations and find possible causes that occur [8].

II. RESEARCH METHOD

Research on the PT ABC company began with an introduction to the company, namely with literature studies and direct field studies. After that, a problem is found which is then formulated and the problem is identified. Then continue collecting the required data. The data taken includes product defect data and production data for 1 month. The type of data taken is divided into two, namely primary data and secondary data. The data that has been obtained is then processed using the seven tools method. The processing results are then analyzed and concluded and then compiled in a report.

III. RESULTS AND DISCUSSION

A. Flow Chart

Flow diagram that illustrates the flow of the production process at PT ABC starting from raw materials to becoming one motorcycle. The following is a flowchart of the process of making motro bicycle products at PT. ABC: This study focused on machining. This part processes several products including Crank case, Crankshaft, Seher block, Cylinder header. However, this study only focused on one product, namely the crankshaft. The crankshaft production flow is as follows:

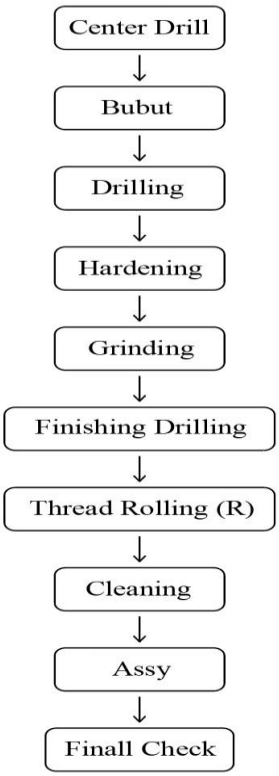

Figure 1. Crankshaft Flowchart

B. Check Sheet

Checksheet is the first step before processing using software. At this stage the data is compiled using tables from product defect data obtained from the company. The amount of observed data amounts to 30 days. The following is a checksheet table of crankshaft products on PT ABC:

1. Crankshaft L

Data on the types of defects of crankshaft L products in the company there are 16 types. However, to facilitate observation, 5 types of defects that have the most frequency are taken so that later solutions can be given first. The biggest types of defects are NG center distance with a total of 14 units, minus centering depth of 13 units, blonk lathe process diameter of 12 units, blonk grinding diameter of 8 units and NG press results of 7 units.

2. Crankshaft R

Data on the types of defects of crankshaft R products in the company there are 16 types. However, to facilitate observation, 5 types of defects that have the most frequency are taken so that later solutions can be given first. The largest types of defects are FBO Distance Center NG of 21 units, broken rear center drill of 14 units, broken front center drill of 7 units, lathe diameter of blonk of 7 units and diameter of grinding blonk of 6 units.

C. Control Chart

In this study, the processing of crankshaft product data was carried out using MS Excel as a tool to analyze quality control statistically.

1. Crankshaft L

From the table above, the values of the proportion of defects, CL, upper control limit and lower control limit are obtained. Furthermore, a P-Chart control map can be created as follows:

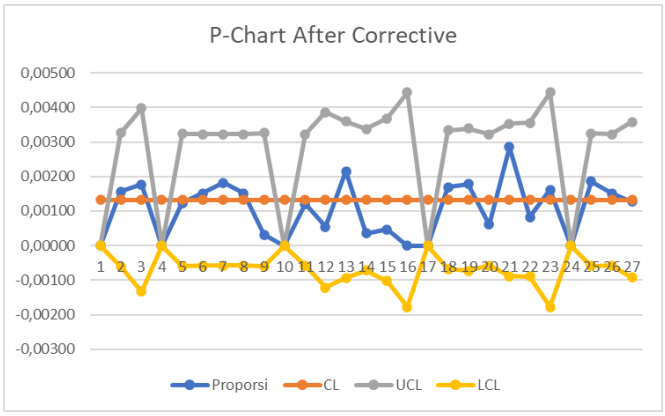

Figure 2. P-Chart After Corrective Crankshaft L

After making improvements with data deletion, it can be seen that the data obtained is all nothing that exceeds the set control limit so that it can be said that the data is within the controlled and safe limits.

2. Crankshaft R

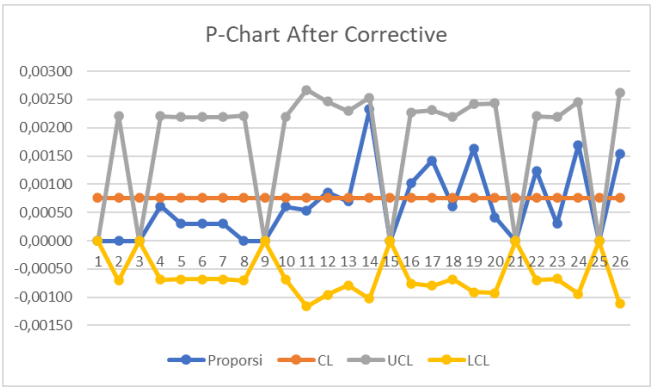

Figure 3. P-Chart After Corrective Crankshaft R

Based on the results of processing using corrected data, it can be seen that there is no data that is outside the control limit, both the upper control limit and the lower control limit, or it can be said that all data is within the control limit. Data can already be implemented.

D. Histogram

A histogram is a bar-shaped graph that illustrates the comparison between the number of defects in a month and the frequency (units).

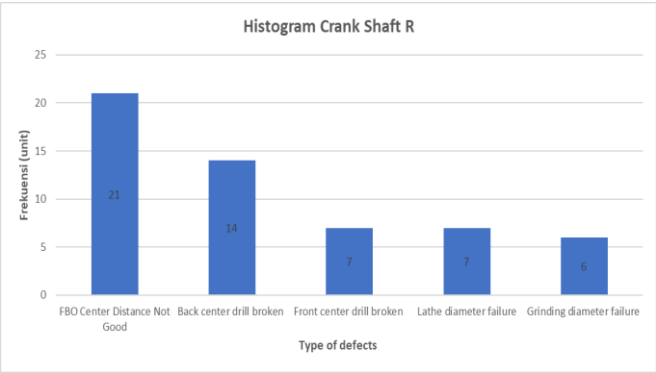

Figure 4. Histogram Crankshaft R

From the histogram graph above, it can be analyzed that there are types of types of defects that occur in the crank shaft have different frequencies (units). The most common types of defects are FBO Distance Center NG of 21 units, Broken rear Center drill of 14 units, Broken front Center drill of 7 units, Diameter of lathe blonk of 7 units and Diameter of Grinding Blonk of 6 units.

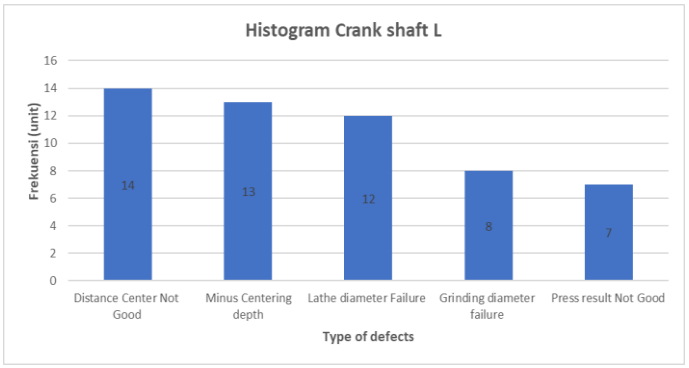

Figure 5. Histogram Crankshaft L

From the histogram graph above, it can be analyzed that there are types of types of defects that occur in the L crank shaft have different frequencies (units). The most common types of defects are the distance of the NG center with a total of 14 units, the depth of minus centering as many as 13 units, the diameter of the blonk lathe process as many as 12 units, the diameter of the blonk grinding as many as 8 units and the results of the NG Press as many as 7 units.

E. Pareto

A pareto chart is a bar chart and a line chart. Bar charts show the classification and value of data, while line charts represent cumulative total data, so with this concept we can see the types of defects that are a priority in making corrective decisions. The table below shows the number of good notes and cumulative presentation values in the R-type crank shaft product that will be used to create a pareto chart as follows:

Tabel 1. Presentase Komulatif Crankshaft R

Jenis Kecacatan /R	Frekuensi (unit)	Persentase	Persentase Kumulatif
FBO Center Distance Not Good	21	38,18%	38%
Back center drill broken	14	25,45%	64%
Front center drill broken	7	12,73%	76%
Lathe diameter failure	7	12,73%	89%
Grinding diameter failure	6	10,91%	100%
Total	55	100,00%	

After experiencing processing using the minitab application, a pareto chart is obtained as follows:

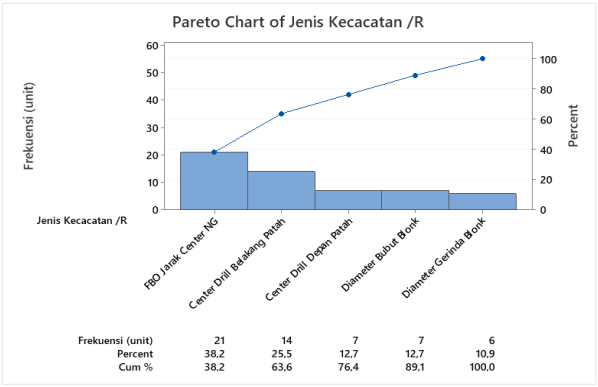

Figure 6. Pareto Chart Crakshaft R

Based on the results of data processing using a pareto chart, it can be known the frequency value of defects ranging from the largest to the smallest. The blue beam image shows the frequency (units) while the yellow line running over it shows the cumulative presentation. From the graph we can know that the diagram above is in accordance with the pareto rule, which is 80:20 which means 80% of problems (defects) are caused by 20% of causes. The biggest type of disability is FBO distance centering NG (Not Goal). Therefore, it is necessary to make improvements first by focusing on the causes of FBO distance centering NG.

The table below shows the number of good notes and cumulative presentation values in type L crankshaft products that will be used to create a pareto chart as follows:

Tabel 2. Presentase Komulatif Crankshaft L

Jenis kecacatan /L	Frekuansi (unit)	Presentase	Persentase Kumulatif
Distance Center Not Good	14	26%	26%
Minus Centering depth	13	24%	50%
Lathe diameter Failure	12	22%	72%
Grinding diameter failure	8	15%	87%
Press result Not Good	7	13%	100%
Total	54	100%	

After experiencing processing using the minitab application, a pareto chart is obtained as follows:

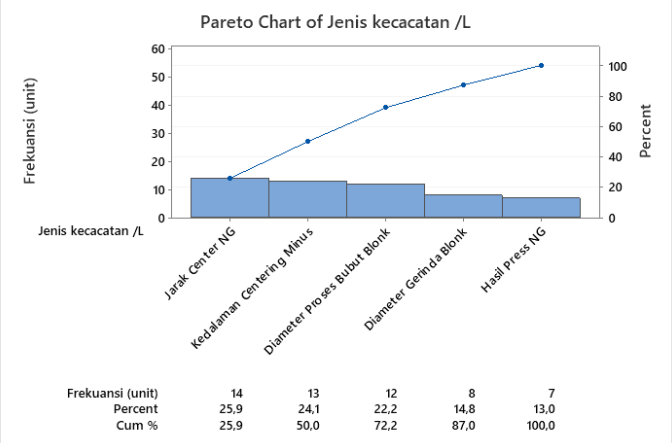

Figure 7. Pareto Chart Crankshaft L

Based on the results of data processing using a pareto chart, it can be known the frequency value of defects ranging from the largest to the smallest. The blue beam image shows the frequency (units) while the yellow line running over it shows the cumulative presentation. From the graph we can know that the diagram above is in accordance with the pareto rule, which is 80:20 which means 80% of problems (defects) are caused by 20% of causes. The largest type of defect cause is Distance center NG which means it must be treated immediately because it produces the most causes of defective products.

F. Fishbone

1. Crank Shaft R

FBO Distance Center NG

Fishbone is used to find elements that cause various types of defects. Here are some proposed improvements that can be used to minimize product defects according to the fishbone diagram above:

Tabel 3. Fishbone Crankshaft R

Kind Disabled	Factor Cause	Problems	Proposed Improvements
FBO Distance Center NG (Not Good)	Machine	1. There is a Scrub that props up 2. Machine settings that are not up to standard	Improvised with the addition of an automatic air hose, the technician rechecked the engine settings
	Man	1. Operator fatigue (Lack of evaluation, High working hours) 2. Lack of concentration	Leaders routinely remind operators to get enough rest so that when working they are not easily tired and operators understand the condition of their respective bodies so that when working the body is in a fit state
	Materials	1. Reject from supplier 2. Non-dense elements of the product	Repeatability consistently and scheduled, blank part sampling checking is carried out according to OS
	Methode	1. Inconsistent implementation of SOPs	Reminding to self-check the results of work before getting to the QC, reminding operators to always comply with the SOPs that have been set
	Environment	1. Hot air temperature 2. Placement is not according to the rules	Adding fans in the production area, Reminding operators to place process parts in accordance with established standards

2. Crank Shaft L
   Distance Center NG (Not Good)

Here are some proposed improvements that can be used to minimize product defects according to the fishbone diagram above:

Tabel 4. Fishbone Crankshaft L

Kind Disabled	Factor Cause	Problems	Proposed Improvements
Distance Center NG	Machine	1. Centering oblique pendulum process (Run Off 0.3 NG) 2. Puser Failure 3. Installation of scrub cannacle products	Checking the machine regularly, monitoring puser replacement regularly so that it is not easy to AUS,
	Man	1. Operator fatigue (Lack of evaluation, High working hours) 2. Lack of concentration 3. Operator teledor	The leader routinely reminds operators to get enough rest so that when working it is not easy to experience fatigue and operators understand the condition of their respective bodies so that when working the body is in a fit state, Reminding operators to always

Kind Disabled	Factor Cause	Problems	Proposed Improvements
			focus on work, monitoring the condition of all operators
	Material	1. Reject dari supplier 2. Non-dense elements of the product	Checking part sampling is carried out in accordance with the OS set by the company
	Methode	1. Inconsistent implementation of SOPs	Reminding to self-check the results of work before getting to the QC, reminding operators to always comply with the SOPs that have been set
	Environment	1. The engine area is not kept clean 2. Hot air temperature	Improvised air hoses so that the machine area is free from scrubs "production residue, The addition of fans in the production area, especially in the operator's resting area, always reminds operators of the importance of cleanliness in the work machine area to minimize scrubs that block products

IV. CONCLUSION

From the results of research and data processing on machining crankshaft products at PT ABC, the following conclusions can be drawn:

1. From the data analyzed using a histogram, there are several types of defects that have the highest number of defects. In the R crankshaft product, the highest type of defect is FBO, the distance of the NG center, which is 21. For crankshaft L products, the highest type of defect is the Distance Center NG (Not Good), which is 14 units.
2. Based on the proportion control graph (P) that has been made, out-control data is obtained from the upper and lower limits. The L crankshaft product underwent data out of control on the 10th. Meanwhile, crankshaft products experienced data out of control on the 3rd, 10th, 17th, and 24th. All data that is out of control is corrected by means of data that is out of control deleted first and processed again in the same way. After the data undergoes reprocessing, the data is obtained which is In Control.
3. From the results of the analysis using the Fishbone diagram, there is a type of defect that has the highest number of defects, namely FBD, the distance of the NG center, which is 21 units. This type of defect is analyzed according to 4M+1E aspects, namely Man, Mechine, Material, Method and Environment. The Mechine aspect is that the clamp chuck bolt is broken and there is a block feller for setting the center distance which causes excessive load. The Man aspect is the operator's lack of concentration and mishandling from technicians. The material aspect is the presence of rejected material from suppliers and there are product elements that are not solid during the casting process. The methode aspect is the inconsistent application of SOPs. And the last aspect, namely Environment, is hot air temperature and placement that is not according to the rules. The improvement proposal given is that the process handling is carried out according to established SOPs. The implementation of SOPs is not in accordance with the provisions causing small problems that will later have an impact on product quality.

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