QUALITY CONTROL ANALYSIS OF STAMPING PRODUCT WITH STRATIFICATION, PARETO DIAGRAM, CONTROL DIAGRAM, AND ISHIKAWA DIAGRAM AT PT.X

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ABSTRACT

PT.X is a company that was engaged in the automotive sector with manufacturing stamping as one of their most important processes. A stamping product is a sheet metal formed by forming process using pressure tools. This paper studied the stamping product as one of the body parts of the car. All of the information was obtained that the defect rate for the two-month period of December 2020 to January 2021 was 1.43% while the standard set is not able to be more than 1.30%. The purpose of this study is to analyze the cause of quality problems that occur in stamping products in order to obtain solutions and minimize defects that could occur in the future. The analytical method that will be used in this research is Statistical Quality Control using 4 of 7 quality control tools (7 Tools). The tools which have been used are as follows: Stratification to classify defects into 19 types of defects, Pareto Diagram, and Ishikawa Diagram are also used based on their ability to find which root would cause the problem and Control Charts as a tool that frequently used to. As the result of the study, the most occurring defect is Gomi with a percentage of 76.46% with the root of the problem that occurs due to material and machine factors. Both of these factors should be a company’s concern.

Keywords: Stamping, Statistical Quality Control, 7 Tools.

I. INTRODUCTION

PT.X is a company that was engaged in the automotive sector with the main product in the form of cars and manufacturing stamping is one of the important processes in it. Based on production data for the last two months, information is obtained that the average percentage of defects that occur is 1.43% while the standard of disability set by the company is not more than 1.30%.

PT X is a company engaged in the automotive sector with the main product in the form of cars and manufacturing stamping is one of the important processes in it. According to production data for the last two months, the average percentage level of defects is 1.43% while the standard set by the company should not be more than 1.30%.

Providing high quality products that have no defective products is an important part of the supply chain between automotive parts manufacturers and final assembly companies (Robert, 2018). Based on the identification of quality problems above, quality control techniques are needed to analyze the problems that occur, so that an appropriate solution can be found to minimize defects that exist in the production process. Methods and techniques for quality improvement known as "quality improvement tools" can be used to complete the steps in the quality improvement process that can solve most problems (Sharma, 2017). Among the many quality tools available to solve problems, Pareto diagrams and Ishikawa diagrams are the most important quality control tools because of their ability to find problems, control and enable continuous improvement in various processes (Perera, 2016). Has become one of the most frequently used tools for monitoring variation in the manufacturing industry today (Long Hui Chen, 2011; Matthews & Mokoena, 2020; Basheka & Auriacombe, 2020; Karvankova et al., 2020).

Based on the problems faced by the company related to quality, this study aims to analyze the causes of quality problems that occur using the stratification stage, Pareto diagrams, control diagrams, Ishikawa diagrams to obtain
conclusions and suggestions regarding actions that can be taken in order to improve the quality of stamping products at PT. X.

II. LITERATURE REVIEW

Product quality and productivity are the keys to success for the production system in industry (Parwati & Sakti, 2012). For companies or business people, quality is one of the important indicators so that companies can remain ahead in the midst of intense competition in the industry.

Quality control is a management activity and technique that can measure product quality characteristics and can compare them to take advance actions. Quality control is an engineering or management activity. (Varsh, 2015). The purpose of quality control is to produce a uniform product by identifying the factors causing product defects, improving customer relationships, increasing profits, and reducing quality control costs (Gunawan, 2014). Check Sheet is a form where the items to be checked have been printed in a form with the intention that data can be collected easily and concisely. (Montgomery, 2009). Check sheets are used to simplify and summarize data collection and reading.

Stratification is an effort to group data into groups that have the same characteristics. (Rosnani Ginting, 2007).

A control chart is a graphical representation of data over time that shows the upper and lower limits of the process that we want to control. The control chart is constructed in such a way that new data can be compared with past data quickly. A sample of the process output is taken and the average of this sample is mapped on a bounded diagram. The upper and lower limits in a control chart can be in units of temperature, pressure, weight, length, and so on (Heizer and Render, 2006:268) Control charts are used to study how the process changes over time. A graph that will describe the stability of a work process. Through this description it will be able to detect whether the process is running well (stable) or not.

Besterfield (2009:78), this Pareto chart is an illustration that sorts the classification of data from left to right according to the order of highest to lowest ranking. A Pareto chart is a chart that contains a bar chart and a line chart. Bar charts show the classification and value of data, while line charts represent cumulative data. Data classification is sorted from left to right according to the order of highest to lowest ranking. The highest ranking is a priority problem or the most important problem to be resolved immediately.

Heizer and Render (2014:255), Cause-and-Effect Diagrams are also known as Ishikawa diagrams and Ishikawa diagrams because their shape resembles a Ishikawa. Where each bone represents a possible source of error. This diagram is useful for showing the main factors that affect quality and have an impact on the problem.

III. METHODS

The method of quality control used for stamping process in PT.X is Statistical Quality Control method with the following data:

1. Primary Data

Primary Data is the data that collected directly from the main sources. The type of data that has been used in this study is observation data. Observation is the process of recording patterns of behavior (people), objects (things), or systematic events without question or communication with individuals studied (Bakhtiar, 2013).

2. Secondary Data

Secondary data is the form of physical data of historical reports or records obtained from a company. The secondary data that has been used in this study is check sheet. Check Sheet is a form where items that to be checked and printed in the form with the data can be collected easily and concisely (Montgomery, 2009).

3. Data Analysis Methods

In this study, we used secondary data with quality control methods to analyze it, namely 7 Tools which as follows:

a. Stratification
Stratification is used to divide various defects that occurred into 19 types of defects which as follows: gomi, shiwa, kiriko, sockline, crack, dent, Tg crack, crack (lh), dent scrap, ding, heko material melengkung, scratch, cembung, oil waving, necking, cekung etc.

b. Pareto Diagram

Pareto Diagram is a graphic that ranks data classification in descending order from left to right. The aim of pareto diagram in this study is to show which defect is the most occur on the period time and refer to cumulative data.

c. Control Chart

Control chart is a graphical representation of data overtime that shows the upper and lower limits of the process that we will control. The upper and lower limits in a chart can be in units of temperature, pressure, weight, length, and so on (Heizer dan Render, 2006:268). Control chart is used to investigate how the development time to time. The graphic will shows the stability of a work process. Through it we can detect if the process is work well or not.

d. Ishikawa Diagram

Heizer dan Render (2014:255), Cause-effect diagram or fishbone diagram and Ishikawa Diagram is known because of the shape that similar to fish bone. Which is every bone is pictured the possibility of the failure source. Cause-effect/Ishikawa’s diagram in this study is used to finding a root failure that causing defect, it purposed to stipulating improvement that needs for a company as recommendation.

1 Conclusion

Conclusion is the result of analysis from data processing that can support the recommendation that will be given to the company. Suggestion is a recommendation that refers to the conclusion of data processing result.

IV. RESULT AND DISCUSSION

1 Check Sheet

The use of check sheets on PT.X is one of way of observation to checking defects in stamping products that include, item name, work time, checking date, area of the defect on panel, defect types, and quantity of defect.

2 Stratification

From the data of defects types on check sheet, defects can be sorted into several groups. There are 19 types of defect for stratification on stamping products which as follows: gomi, shiwa, kiriko, sockline, crack, dent, Tg crack, crack(lh), dent scrap, ding, heko, curved material, scratch, convex, oil waving, necking etc. There are 8505 unit is defected that divided into 19 types of defect on stamping process. Table 2. Stratification defects of stamping products result.

Table 1. Stratification defect of stamping process
1 Pareto Diagram

In Pareto diagram, it can be seen cumulative data from defects occurring in the period of December 2020 to January 2021. The cumulative data is referred to check sheets using defect types as classification and number of defects as the cumulative data.

<table>
<thead>
<tr>
<th>Defect</th>
<th>Total</th>
<th>%</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gomi</td>
<td>6758</td>
<td>79.46%</td>
<td>79.46%</td>
</tr>
<tr>
<td>Shiwa</td>
<td>552</td>
<td>4.14%</td>
<td>83.60%</td>
</tr>
<tr>
<td>Kiriko</td>
<td>652</td>
<td>7.67%</td>
<td>91.20%</td>
</tr>
<tr>
<td>Sockline</td>
<td>6</td>
<td>0.07%</td>
<td>91.33%</td>
</tr>
<tr>
<td>Crack(Lh)</td>
<td>2</td>
<td>0.02%</td>
<td>91.36%</td>
</tr>
<tr>
<td>Crack</td>
<td>25</td>
<td>0.37%</td>
<td>91.65%</td>
</tr>
<tr>
<td>Dent</td>
<td>294</td>
<td>3.60%</td>
<td>95.11%</td>
</tr>
<tr>
<td>Tj Crack</td>
<td>1</td>
<td>0.01%</td>
<td>95.12%</td>
</tr>
<tr>
<td>Dent Scrap</td>
<td>112</td>
<td>1.37%</td>
<td>96.44%</td>
</tr>
<tr>
<td>Ding</td>
<td>83</td>
<td>0.98%</td>
<td>97.41%</td>
</tr>
<tr>
<td>Hiko</td>
<td>40</td>
<td>0.47%</td>
<td>97.88%</td>
</tr>
<tr>
<td>Material Melengkung</td>
<td>5</td>
<td>0.06%</td>
<td>97.94%</td>
</tr>
<tr>
<td>Material Dent</td>
<td>32</td>
<td>0.38%</td>
<td>98.32%</td>
</tr>
<tr>
<td>Scratch</td>
<td>67</td>
<td>0.79%</td>
<td>99.11%</td>
</tr>
<tr>
<td>Combung</td>
<td>38</td>
<td>0.45%</td>
<td>99.56%</td>
</tr>
<tr>
<td>Oil Waving</td>
<td>4</td>
<td>0.05%</td>
<td>99.60%</td>
</tr>
<tr>
<td>Necking</td>
<td>1</td>
<td>0.01%</td>
<td>99.61%</td>
</tr>
<tr>
<td>Cekung</td>
<td>24</td>
<td>0.28%</td>
<td>99.89%</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
<td>0.13%</td>
<td>100.00%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8505</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**Picture 1.** Pareto diagram

From the diagram above, defect Gomi is the most defect occurring in the stamping process in PT. X with percentage of 76.46%. Gomi is a fleck that appears and abrasive on the surface of the metal plate because of a speck of dust on the stamping process. This high percentage of gomi make it as a priority of quality problem that must be clear first.

2 Control Chart

Control charts have been used to see changes in production results or the amount of damage that has occur in percentage over time. Table 3. Control diagram in period of December 2020 to January 2021.
From the control chart, it can be seen that the high percentage point for defect occurs in on December 16th, 2020 with the following data (Table 3.):

Table 2. Defect Data on December 16th 2020

<table>
<thead>
<tr>
<th>Defect</th>
<th>Total</th>
<th>%</th>
<th>Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gomi</td>
<td>240</td>
<td>47.9%</td>
<td>47.9%</td>
</tr>
<tr>
<td>Dent</td>
<td>193</td>
<td>38.5%</td>
<td>86.4%</td>
</tr>
<tr>
<td>Kiriko</td>
<td>51</td>
<td>10.2%</td>
<td>96.6%</td>
</tr>
<tr>
<td>Shiwa</td>
<td>17</td>
<td>3.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Jumlah</td>
<td>501</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

3 Ishikawa Diagram

Ishikawa or fishbone diagram is used to find the root of the problem of defect occurs according to higher percentage data on December 16th, 2020. On the data, 4 defects occur, Gomi, Dent, Kiriko, and Shiwa.

According to Ishikawa diagram, it can be seen that the main cause of defects that occurred on stamping process on December 16th 2020 according to the factors causing the defect as follows:

a. Man
Because of the ability of workers is not good enough, it causing incomplete for repair clearance.

b. Methods

1 Washing dies methods doesn’t have the proper standard. So even the washing dies proses have been done before production but in the actual condition defect, Gomi still occurs. It because there is no standard regarding to the proper and optimal washing dies method.

2 The product contaminated by dust on the raw material shipment process from supplier to production area. One of the reasons is because the raw material was not covered in plastic.

c. Machine

1 The casting powder goes into stamping process due to the air process and the hardchrome layer on the chipped dies.

2 The cut clearance of the dies in the damage condition, so it makes the remaining pieces in the form powder entering the stamping process.

3 The chip of the rest pieces is difficult to entering scrap shutter because of the shape of guide to scrap shutter is not big as it.

4 There is no routine schedule to cleaning dies before production start.

5 The washing frequencies of the dies is insufficient.

d. Material

1 The dent material can occur because of two things which are problem in handling process at the supplier and dirty material.

2 Dirty material can occur because there is no proper standard operational for brush roll and flow rate so that it makes washing process not working well. Besides that, the supplier has not committed to washing the material before the raw material blanking process is carried out at the production site.

3 Powder material that contained in the production material can be caused by the residue from shearing process because the Zn and Fe content in the material is too high.

e. Environment

The gomi that occur in the storage area caused dusts in the storage area, it probably because there is no cover for material storage area, or because of rolling door in the storage area is left open for a long time.

V. CONCLUSION

The quality is a perception and concepts that should be applied by the company in the business world which is full of competition. It needs strong commitment to maintain and improvement the quality continuously so that will be a concern for the company to reach their goals. Based on the discussion in chapter 4 the conclusion of this research report are as follows:

1 During the production process conducted in December 2020 to January 2021, there are 19 types of defects by the total number of defects that occur as 8505 unit.

2 Based on the pareto diagram, there are 5 top defects recorded, which are gomi, kiriko, shiwa, dent, and dent scrap.

3 Based on the diagram control, defects and occurs mostly on the 16th of December 2020 with 4 types of defect recorded that gomi, dent, kiriko, and shiwa.
4. Gomi dominates the types of defects that occur in the stamping process in PT. X as many as 76.46%. Based on the analysis of the defect gomi that has been done using an Ishikawa diagram, it showed that the most potential problem caused by the factor of the material and the machine.

5. The impact of the gomi which have higher percentage caused decreasing the quality of product in the stamping process in PT.X. The improvements that can be done to minimize the types of defects such as:

a. Performed scheduling re-hardchrome based on the number of stroke production, so hardchrome can be fixed before old hardchrome exfoliate

b. Enlarge the line of scrap shutter or make kaizen for additional of guide scrap so that the scrap peice can be wasted through the scrap shutter easily.

c. Making regular schedule of washing dies mainly for parts that have high failure rates if there are any defects. Standardize the settings of the brush roll and flow rate so that the process of washing material can be performed optimally

d. Do a trial either in the lab or in production areas to determine the content of Zn and Fe that is ideal for each part in the process of stamping

Advice

This study is a necessary a further observation about the causes of and solutions to problems that can be an alternative for the improvement of quality in PT. X primarily related to quality problems caused by the defect gomi.

REFERENCES