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Quality Control by Methods Control $\bar{x}$ and R in Value Insulation Products TV Model 21ES251E2 in Electronic Fabrication Company in Indonesia

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Abstract

An electronic fabrication company in Indonesia is a company that produces various kinds of electronic goods, including TV (TV), LCD, and refrigerator. Companies with the right quality products will attract consumers to buy their products, but in a more effective process of production processes in all companies, although there are many better ones. Based on these conditions done with quality as an effort to maintain the quality of the products produced. The problem that emerged in this research is how the quality of Isolation on TV model 21ES251E2. After doing quality testing of Insulation value on TV model 21ES251E2 in an Electronic fabrication company in Indonesia using $\bar{x}$ *a control chart and R, it can be said that the quality of Isolation value on TV model 21ES251E2 is still in the excellent category.*

Keywords - *Electronic fabrication company in Indonesia, Control Chart* $\bar{x}$ *and R, TV Model 21ES251E2*

I. INTRODUCTION

Quality has been a criterion used by consumers to choose products and/or services. Thus, companies have attempted to improve the quality of their products/services by implementing quality programs. Moreover, some companies' efforts are directed to statistical process control (SPC), an essential aspect of quality-management programs, to intervene in the production process to avoid non-conforming items. Among many tools from quality management, control charts have been used to detect the shifts in specified characteristics of a process.

An electronic fabrication company in Indonesia is a company that produces several kinds of electronic goods, such as television (TV), LCD, and refrigerator. Customer satisfaction is essential to improve customer-focused products and services. To maintain the quality of products produced by electronic fabrication company in Indonesia, then the company does quality control where quality control at electronic fabrication company in Indonesiastarted from raw materials, production process to the finished product that is ready to be marketed to consumers.

Some things are essential in making television that determines whether or not the television. One of the most important is the Insulation of the finished product of television. This Insulation is the value of conduction that reduces the flow of energy that passes through television products.

Based on the explanation of the Insulation, which is the value of conduction that serves to reduce the flow of energy that pass on the television product, then electronic fabrication company in Indonesiaperforms quality control on the measurement of Insulation on the finished product of television, that is television model 21ES251E2 by outgoing quality control in electronic fabrication company in Indonesia. This type of TV product is chosen because this product is a type of product that is widely used in everyday life by consumers. It is expected that with the learning of quality control of television insulation buoy model 21ES251E2 model can be known whether the quality of the television model, 21ES251E2 falls into either category or not.

II. LITERATURE REVIEW

Product quality is an essential guarantee of a manufacturing company to the customer and an essential point in survival. According to Gasperz, quality is everything that can fulfill the wishes or needs of the customer. Quality both conventionally and more strategically can be stated that:

1. Quality consists of several product features, both natural features and attractive features that satisfy the customer's wishes and thereby satisfy the use of the product.
2. Quality consists of everything free from deficiencies or damage.

Quality control is a system of verification and maintenance or maintenance of the desired level or degree of quality of products or processes with careful planning, appropriate use of equipment, continuous inspection, and corrective action whenever necessary. Quality control is not only an inspection activity or determines whether the product is right (accept) or ugly (reject).

A. Control Chart

A control chart is a graph that is used to determine whether a process is in a stable state or not. If all data are within the control limit, then the process is within the (stable) control limits. This section shows the data changes over time but does not indicate the cause of the deviation, although deviations will be seen in the

control chart. This chart is a line graph showing the boundaries of the control area.

Control charts aid in detecting unnatural patterns of variation in data resulting from repetitive processes and provide criteria for detecting a lack of statistical control. A process is in statistical control when the variability is only the result of accidental causes. Once the acceptable level of variation is determined, any deviation from that level is assumed to be the result of an assignable cause that should be identified and either eliminated or reduced.

B. Control Chart $\overline{X}$ and R

The production process will be found in the deviations of the resulting size. It is difficult to obtain two workpiece objects that are precisely the same, even though both are made through the same machine/process or operator (let alone different ones). Various factors, among others, will cause deviation or variability of the product:

1. The raw materials used come from various sources that allow for differences in chemical composition, hardness, or other characteristics that differ significantly.
2. The existence of tolerances related to the treatment of special treatment on materials such as pressure, temperature, and others.
3. The existence of differences in human factors (operator) in knowledge, skills, experience, motivation and so forth.

The variability of the above "deviations" will generally be random and difficult to control. Other efforts to produce products of the same or perfect size will also be uneconomical. This requires limits of tolerance or size loosen to ensure that the product can meet the specified requirements. Concerning the problems associated with the concept of variability, there are some general terms that we must know and understand first, such as:

Tolerance is the magnitude of deviation of the size that can be allowed from a workpiece due to the production process. For example, if a process has to be made with a diameter of 30 mm and a tolerable tolerance of ± 0.015 mm, then when the production process will produce a shaft with a diameter between 29.985 and 30.015mm in this case, the production process can be said to be still under control. Accuracy is the degree of compliance that can be met by any product that is made when compared with a predefined specification or standard. Accuracy is the degree of accuracy of the results achieved that show small differences or deviations from one another.

The occurrence of variability in the size of a product can be caused by factors that are difficult to predict or can be caused by factors that clearly can be identified as a first incident. Causes classified as "chance causes" are rarely caused by a single cause and are generally the interaction of several minor causes, but they are random, not following repetitive and difficult to predictable cycles. By this accidental factor is not so gloomy as it is generally still within the allowed tolerance area.

Production processes that occur can still be classified under control. On the other hand, the variability of the identified size comes from causal factors classified as 'assignable causes' that will cause the workpiece to come out of tolerable size limits, and to prevent it from reoccurring in the next cycle, the process must be corrected and controlled more closely. The "assignable" causes factor may come from one or more factors such as raw materials, machinery, work equipment, operator skills. In this case, once a deviation occurs, it is likely to continue over and over again in subsequent cycles unless corrective action is taken immediately against known causal factors as "catastrophic carriers." The deviations caused by these 'assignable' factors sign that the process is out of control, resulting in a size that can be tolerated.

A control chart is an analytical tool that is made following statistical methods, where data relating to product/process quality will be plotted in a map, as shown in the following figure:

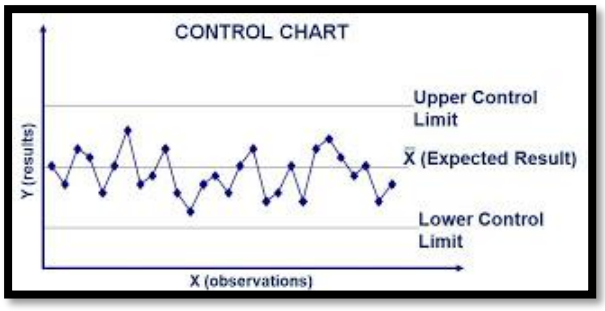

Figure 1.Examples of control chart

The control chart, if there is any data outside the control limits above UCL or below LCL, indicates that the process is in the out of control position and the production process because it is corrected immediately. The variability deviating from the control limits is caused by the "assignable" cause factors. Conversely, when the data plot is located between UCL and LCL, it is not necessary to worry because the process can still be said to be controlled. The variability that occurs between these control limits is generally due to random causal factors.

Upper Control Limit (UCL) and Lower Control Limit (LCL) in this case, the value is taken ± 38 to the average value of the existing size. The data distribution is assumed to be expected so that according to the normal distribution, this can be described as follows :

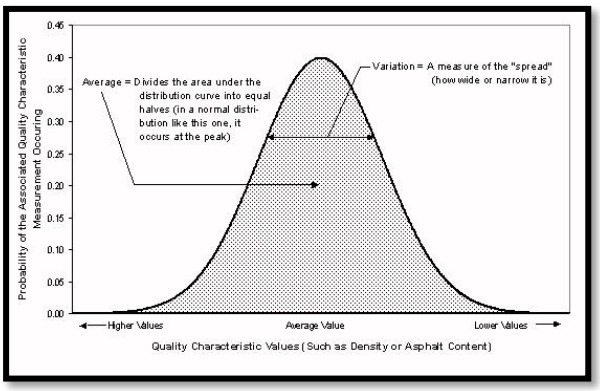

Figure 2.Normal distribution for control chart applications

C. Variable Control Chart

The data required here shall be measurable, and the quality characteristics shall be determined by the magnitude of deviation from the standardized unit of measure for the outcome of the ongoing work process. There are 2 kinds of variable control chart:

1. $\overline{X}$ *CHART*: Control chart concerning the average price of the output of work.
2. R *CHART*: Control chart by considering the range or the difference between the maximum and minimum price of the work output data (reflecting the dispersion of existing data).

The work process will be controlled if the data plotted on or R will differ within the control limits.

III. METHODOLOGY

The research was conducted in one of the Manufacturing Industries in Indonesia. This study aims to determine and study the quality control of the insulation value of several TV models model 21ES251E2 in electronic fabrication company in Indonesia by using the control chart $\overline{X}$ dan R, knowing what kinds of defects that arise in the TV product model 21ES251E2 in electronic fabrication company in Indonesia and know the cause of disability in the TV product model 21ES251E2 in electronic fabrication company in Indonesia.

There are several research methods that can be used in this practical work. The methods are Field Method, which includes observation, review, and direct view of the ongoing work process in the company or factory concerned, and interview with related parties. Then the method of Library Studies conducted includes the collection of sources of reports from various sources contained in libraries, campuses, companies, and others. After the measurement data obtained Insulation value on TV model 21ES251E2 calculation to get the value $\overline{\overline{X}}$ and $\overline{R}$, UCL as well as LCL. After that can be seen whether the value of Insulation on the TV model 21ES251E2 still included in the category of good and controlled or not.

IV. RESULT AND DISCUSSION

Based on Manufacturing Manual guidance explaining all procedures and rules in producing TV model 21ES251E2 Outgoing Quality Control (OQC) section should check the insulation value of each TV model 21ES251E2, specified insulation specification between 13Ω to 20Ω is typical, or in other words, condition good. In order to know the quality, then the Outgoing Quality Control (OQC) measures Insulation against TV model 21ES251E2 as much as 6 times sampling with the size of each 12 units (n = 12). Here are the results of insulation measurements on samples taken by the Outgoing Quality Control (OQC) section to determine the feasibility:

Manual calculations are performed to create a control map based on boundaries calculated using the formula theoretically.

Table 1.Results of Measurement of Insulation Value on TV Sample Model 21ES251E2

Sample	Measurement Results Insulation In Ω(Ohm) (n=12)											
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
1	18	16	15	14	17	13	15	14	18	18	14	19
2	18	14	15	14	17	18	15	14	17	17	18	13
3	15	18	18	15	15	19	17	18	15	18	17	19
4	17	17	18	14	14	18	15	15	14	17	18	15
5	18	18	17	18	18	19	15	15	18	18	18	14
6	17	17	15	17	17	13	15	15	17	17	18	18

The following is a manual calculation of the insulation data above:

Table2.Calculations $\overline{\overline{X}}$ and $\overline{R}$

	Insulation Measurement Results (n=12) Ω (Ohm)													
Sample	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	$\overline{X}$	R
1	18	16	15	14	17	13	15	14	18	18	14	19	15,9167	6
2	18	14	15	14	17	18	15	14	17	17	18	13	15,8333	5
3	15	18	18	15	15	19	17	18	15	18	17	19	17	4
4	17	17	18	14	14	18	15	15	14	17	18	15	16	4
5	18	18	17	18	18	19	15	15	18	18	18	14	17,1667	5
6	17	17	15	17	17	13	15	15	17	17	18	18	16,3333	5
Total													98,25	29
$\overline{\overline{X}}$													16,375	
$\overline{R}$														4,83

1. $$\overline{\overline{X}} = \frac{15{,}9167 + 15{,}8333 + ... + 16{,}3333}{6} = 16{,}3750\ \Omega$$

$$\overline{R} = \frac{6+5+...+5}{6} = 4{,}8333\,\Omega$$

2. UCLandLCL

UCL : Upper Class Limit

LCL : Lower Class Limit

CL = $\overline{\overline{X}}$ = 15,1154Ω

UCL $= \overline{\overline{X}} + (A_2 \times \overline{R})$

$= 16{,}3750 + (0{,}27 \times 4{,}8333) = 17{,}68\ \Omega$

LCL $= \overline{\overline{X}} - (A_2 \times \overline{R})$

$= 16{,}3750 - (0{,}27 \times 4{,}8333) = 15{,}07\ \Omega$

Where the value of A2 of 0.27 is the coefficient obtained from table factor A2 for the $\overline{X}$ chart.

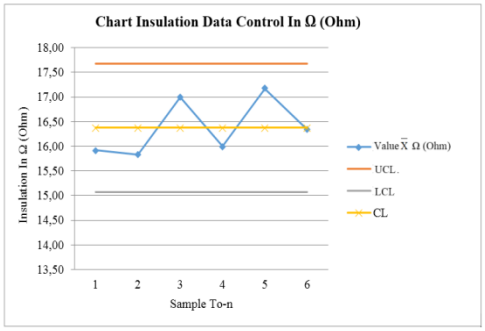

Figure 3.Control Chart $\overline{X}$ With Boundaries Based on Formula Calculations

$$CL = \bar{R} = 4{,}8333\Omega$$

$$UCL = (D_4 \times \bar{R})$$

$$= (1{,}72 \times 4{,}8333) = 8{,}3132\ \Omega$$

$$LCL = (D_3 \times \bar{R})$$

$$= (0{,}28 \times 4{,}8333) = 1{,}3533\ \Omega$$

Where the value of D4 of 1.72 and D3 of 0.28 is the coefficient obtained from the table factors D3 and D4 for the R chart.

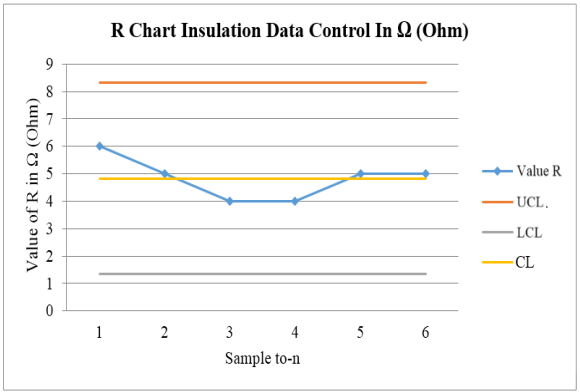

Figure 4.Control ChartR With Boundaries Based on Formula Calculations

Based on the results of manual calculations can be seen on the control charts such as Figure 3 for the control map and Figure 4 for control chart R, thus can be interpreted that electronic fabrication company in Indonesia that produces TV model 21ES251E2 still produce TV with insulation value that its size still enters within the specified limits, either based on the limit determined by manual manufacturing that is between 13Ω (Ohm) up to 20Ω (Ohm) and based on control limit obtained by calculation formula as the limit. It is characterized by a control chart flow that does not exist that exit the upper and lower class limits on the $\bar{X}$ chart. Likewise, on the R chart, no one comes out of the upper-class limit and lower class limits.

Based on that part of the Out Going Quality Control electronic fabrication company in Indonesia, determine whether the TV model 21ES251E2 is available for sale. So with the views based on the measurement, Insulation is described with the control map.

As in figure 3 for the control $\bar{X}$ chart and figure 4 for the control map R, then the Out Going Quality Control electronic fabrication company in Indonesia may state that the TV model 21ES251E2 is feasible and ready to market.

V. CONCLUSION

Based on observations made at an electronic fabrication company in Indonesia at the time of practical work has been done discussion and analysis, obtained some conclusions that answer the purpose of writing this helpful work report. The conclusions that can be taken are as follows:

1. Based on the results of data processing that has been done by using the control map and R can be seen that the quality of TV models model 21ES251E2 in electronic fabrication company in Indonesia is still in both excellent and controlled categories. It is shown from the control chart $\bar{X}$ and R, which shows that none of the measurement data is out of the control limits.
2. In the TV product model, 21ES251E2 in an electronic fabrication company in Indonesia has not found any disability that ever happened to TV product at an electronic fabrication company in Indonesia. Type of disability that ever happened to TV product at an electronic fabrication company in Indonesia is Insulation value outside of the allowed limit, Inappropriate image position in the middle, Color in a lousy picture, like reddish picture color or there is a picture which is somewhat blackish, TV buttons that do not function properly and happened vibration when the TV volume is magnified.

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