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Effectiveness Analysis of Soehnel L1 Machine using Overall Equipment Effectiveness (OEE) Method in PT PQR

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Abstract:- The purpose of this research is to know the level of effectiveness on Soehnel L1 machine at PT. PQR and know the factors that cause significant failure that affect the effectiveness of Soehnel L1 machine in PT. PQR The method used in this research is descriptive analysis method, that is describes availability, performance and performance of Soehnel L1 machine based on actual data and information by collecting, compiling, classifying, and analyzing specially information and data about effectiveness of Soehnel L1 machine during January 2015. The calculation results obtained from the average OEE value is 46.21% consisting of the three OEE factors, such as availability rate 85.30%, performance efficiency 56.16%, quality rate 96.50%. The human factor the lack of awareness of the technician on the knowledge it possesses, the method factor the infrequent supervisors in place resulting in the absence of supervision of the operator's work, the technician's limited engine knowledge engine makes the technician unaware of how to properly deal with damage to the components, in this setup can result in a dented tube.

Keywords:- *Effectiveness of SoehnelL1 Machine, Availability, Performance, Quality, Overall Equipment Effectiveness.*

I. INTRODUCTION

In the world of manufacturing industry, the production process is done almost all using machinery and equipment. The more often the machine works and even exceeds capacity can decrease engine capability, speed up engine life and often replace frequently damaged components. One of the problems faced by manufacturing companies is how to carry out production processes as efficiently and effectively as possible. In general, which causes the company can not be as efficient and as effective in the production process can be categorized into three, namely: human factors, machinery and environment. And one of the most important of the three categories is the engine factor.

System selection is very advantageous because machine usage can be improved properly if the performance measurement system is appropriate for use. One of the tools used by the world is Overall Equipment Effectiveness (OEE). With OEE calculations performed calculations of each element of OEE is the value of inverse (availability), the value of engine performance (performance) and the quality value of the resulting output (quality). (Nakajima, Seiichi, 1989) says that "ideal conditions for OEE after TPM implementation on the body are> 90% availability, performance efficiency> 95%, quality level> 99%, ideal value of ideal OEE conditions is> 85%.

In a company must have provisions that have been made in maximizing the work. PT. PQR has standardized in work where wasted time should not be more than 150 minutes and reject products follow no less than 99%.In this study observations on Berocca Mango effervescent products are produced by the Soehnel L1 machine. During the observations made on the machine, has found problems that occur in the machine is the length of downtime and the number of reject products while for the standard time wasted set by PT. PQR should not be more than 150 minutes and the standard for quality should not be less than 99%. In observation of the Soehnel L1 machine conducted observations for 1 month on January 1, 2015 - January 31, 2015 on 3 shifts at PT. PQR.

II. MATERIAL AND METHODS

A. Material

Total Productive Maintenance (TPM) was first introduced in Japan in 1971 which was originally a method for Total Productive Maintenance (TPM) against industrial machines. Increased utilization of industrial machinery is done through better maintenance to ensure the sustainability of production resources.

Basically Total Productive Maintenance (TPM) is defined as a team-based enterprise scope effort to build quality and productivity into production systems and improve overall equipment effectiveness (OEE). Total Productive Maintenance (TPM) refers to the key words: Total, Productive, and Maintenance, as follows:

➢ Total
- All employees and management are involved.
- Covers the total life cycle of the production system.

➢ Productive
- Creating maximum productivity through zero defects, zero accidents, and zero damage.
- Minimize problems in the production system.

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➢ *Maintenance*

Maintain good production system, which includes: individual process, factory, and whole production management system. (Gasperz, 2012). Total Productive Maintenance (TPM) covers several things such as total commitment to the program by top management, wider empowerment of workers to perform 14 corrective actions, and is an activity that takes a relatively long time to implement and the process is continuous. TPM makes maintenance activities an important focus in the business world and is no longer considered an unfavorable activity. In TPM, downtime for maintenance is scheduled as part of the daily production process and is even an integral part of the production process.

Measuring the Overall Equipment Effectiveness (OEE) value for the Soehnel L1 machine, there are 3 (three) main ratios to note: availability, performance, and quality.The data needed to calculate the value of OEE (Overall Equipment Effectiveness) is the product data soehnel machine L1, planned downtime, and down time losses on soehnel machine L1After doing the calculation to 3 (three) ratio, then got the value of OEE.

B. Methods

The methodology in this study is described as follows:

➢ *Data collection*

Technique of collecting data is done by direct observation in field conducted during 31 (Thirty One) day observation on machine Soehnel L1. The data needed to calculate the value of OEE (Overall Equipment Effectiveness) is L1 soehnel machine product data, planned downtime, and down time losses on L1 soehnel machine, data obtained from direct observation for 31 (thirty one) days observation in 3 (Three) work shifts on the Soehnel L1 machine.

- *Measurement of Overall Equipment Effectiveness (OEE)*

According to Nakajima (1988), OEE represents the value expressed as the ratio between the actual output divided by the maximum output of the equipment under the best performance conditions. The purpose of OEE is as a performance measurement tool of a maintenance system, by using this method it can be known availability of machine / equipment (availability), production efficiency (performance), and quality of machine / equipment output. Therefore, the relationship between the three elements of productivity can be seen in the formula below.

OEE = Availability x Performance x Quality

Availability is the availability of machine / equipment is the comparison between the operating time (operation time) to the preparation time (loading time) of a machine / equipment. Then availibility can be calculated as follows.

$$\text{Availability} = \frac{Operating\ Time}{Loading\ Time}\ x\ 100\ \%$$

Performance is a benchmark of the efficiency of a machine's performance running the production process. Performance rate is the result of multiplication of operating speed rate with net operating speed. Net operating speed is useful to calculate the decline in production speed. Three important factors for calculating performance rate are ideal cycle time, processed amount and operation time. Then the performance can be calculated as follows:

$$\text{Performance Rate} = \frac{Operating\ Speed\ Rate}{Net\ Operating\ Rate}\ x\ 100\ \%$$

Quality rate is the ratio of the number of good products to the number of products processed. So quality is the result of calculation by factor processed amount and defect amount. This formula is very helpful to reveal the quality problems of the production process.

$$\text{Quality Rate} = \frac{Processed\ amount - Defect\ amount}{Processed\ amount}\ x\ 100$$

- *Identify the underlying factors using a fishbone diagram*

Having known the dominant lossess then sought after the root cause of the problem by using a fishbone diagram.

III. RESULT AND DISCUSSION

A. Result OEE

After calculating the three ratios, we can know the effectiveness of Soehnel L1 machine for 31 days in PT PQR. To determine the value of OEE on Soehnel L1 machine, the calculation of the availability, performance, and quality values were performed.

Here is the OEE calculation of January 1, 2015:
OEE = availability (%) x performance (%) x quality (%)
OEE = 90.91% x 55.50% x 97.15% = 49.02%

Here is the OEE calculation for January 1 - January 31, 2015 can be seen in Table 1.

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Tgl	Availability Rate (%)	Performance Rate (%)	Quality Rate (%)	OEE (%)
1	90,91%	55,50%	97,15%	49,02%
2	82,20%	55,40%	96,60%	43,99%
3	81,82%	68,40%	94,87%	53,09%
4	83,33%	58,67%	96,22%	47,04%
5	90,91%	58,54%	96,26%	51,23%
6	65,91%	53,03%	97,36%	34,03%
7	83,33%	46,37%	96,97%	37,47%
8	89,77%	45,58%	96,40%	39,44%
9	87,50%	58,18%	96,13%	48,94%
10	84,09%	47,64%	96,75%	38,76%
11	83,33%	56,51%	96,83%	45,60%
12	90,91%	53,76%	97,23%	47,52%
13	85,98%	67,16%	96,33%	55,63%
14	83,33%	67,65%	96,34%	54,32%
15	87,12%	69,79%	94,08%	57,20%
16	83,33%	50,26%	96,68%	40,49%
17	90,91%	59,39%	95,90%	51,77%
18	90,91%	60,18%	96,50%	52,80%
19	80,30%	69,62%	96,98%	54,22%
20	90,91%	55,71%	96,61%	48,93%
21	83,33%	48,61%	97,77%	39,60%
22	73,11%	52,46%	96,96%	37,19%
23	85,61%	65,21%	94,63%	52,83%
24	90,91%	52,79%	96,73%	46,42%
25	83,33%	57,28%	97,43%	46,51%
26	84,85%	42,97%	97,48%	35,54%
27	90,91%	54,09%	96,22%	47,31%
28	90,91%	56,77%	96,01%	49,55%
29	82,58%	49,39%	96,84%	39,49%
30	90,91%	55,02%	96,16%	48,10%
31	81,06%	49,10%	97,04%	38,62%
Average	85,30%	56,16%	96,50%	46,21%

Table 1. Measurement Overall Equipment Effectiveness (OEE)
Source: Data Processing

B. Analisis Data

After doing data processing, the next step is to analyze the value of availability rate, perfomance rate, quality rate; and then analyzing the value of Overall Equipment Effectiveness (OEE); then analyze the value of OEE by using fishbone diagram.

➢ *Availability Value Value Analysis*

The availability rate analysis describes how much loading time is available where the time spent is absorbed by downtime. From the data processing that has been done, got the average availability value on Soehnel L1 machine equal to 85,30%. According Nakajima (1988) ideal value availability of 90% means the availability value of Soehnel L1 machine is still less than the standard where the value is still not good. This is because the Soehnel L1 machine often breakdown where the biggest downtime on January 6 is 450 minutes so this most affect the availability value on the Soehnel L1 machine.

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➢ *Value Performance Rate Analysis*

In the performance rate analysis describes how much the ratio of the actual operating speed to the ideal speed. From the data processing that has been done, the average value of performance rate is 56,16%. According to Nakajima (1988) the ideal performance score of 95%. From this result, it can be concluded that the performance rate of Soehnel L1 machine is still not good because the performance rate value is still below the standard. This is because the performance of Soehnel L1 engine that is below the standard determination of the ideal speed that has been set.

➢ *Value Quality Rate Analysis*

In the analysis of the quality rate describes how much the ratio of the ability of the equipment in producing the product. From the data processing, the average value of the quality rate is 96.50%. According Nakajima (1988) ideal value quality of 99%. From this result it can be concluded that the value of quality rate of Soehnel L1 machine is still not good where the result is less than standard. This is because at the time of production there are parts on the machine is damaged or not working, causing the product reject on the product.

➢ *Value Analysis of Overall Equipment Effectiveness (OEE)*

In the analysis of Overall Equipment Effectiveness (OEE) value describes how much effectiveness of Soehnel L1 machine usage. From the results of data processing has been done, in the average value of OEE Soehnel L1 engine of 46.21%.

According to Nakajima (1988) the ideal value of OEE is 85%, the value is taken from each ideal value of availability of 90%, performance of 95%, and quality of 99.9%. From OEE results obtained can be concluded that the OEE value of Soehnel L1 machine is still not good. The next step is to analyze the root diagram of fishbone problem to find out the main cause of low OEE value on Soehnel L1 machine.

➢ *Fishbone Diagram Analysis*

This analysis explains in detail the root cause of the problem of low OEE values. And in doing this analysis need to interview the maintenance technician and operator related in this research. The result of the interview is one of the possible causes of the difficulty of achieving the desired target value of OEE.Ishikawa diagram from the interview that has been done can be seen in Figure 4.4 below.

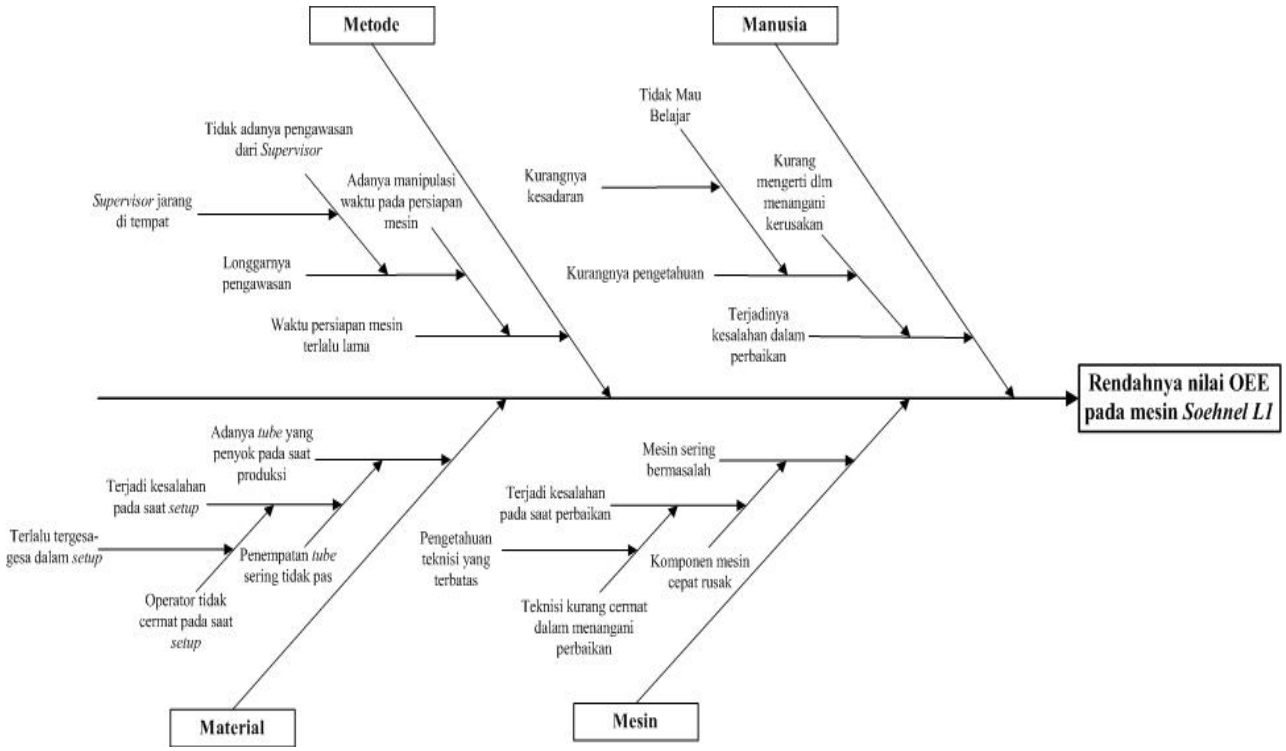

Fig 1:- Ishikawa diagram

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➢ *Human*

The technicians in fixing the machine sometimes still make mistakes in repairing machine damage, this is because the technicians are less understanding in dealing with the damage that occurs in the machine. The lack of knowledge from these technicians that caused technicians to understand less about damage and also the technicians had no desire to want to learn, this was due to the lack of awareness of the technicians who were not aware that the impact of their lack of knowledge could result in a hasty machine condition.

➢ *Method*

Before the production of the operator takes a long time in preparation of the machine. In this case the engine preparation performed by the operator is too long, this is done deliberately by the operator in the preparation of the machine. The operators manipulate the time for the preparation of the machine to be long, but the time required to prepare the machine does not require a long time. This lax oversight makes the operator can easily manipulate the time in the absence of supervisory supervision. And the root of this problem is that supervisors are rarely in place because supervisors often hold impromptu meetings without notice to operators.

➢ *Machine*

In production activities, the machine is often problematic due to the rapidly damaged engine components. Machine components are easily damaged quickly because at the time of component replacement, the installation is not fitting so that the component becomes quickly worn out. In this case the technician is not careful in installing the components because the knowledge of the technician to fix the machine is very limited.

➢ *Material*

In the engine setup all the preparations have been made including preparing the tube for production, but at the time of production there was found a dented tube at the time of production. This is because the placement on the tube position does not fit. Things like this happen because at the time of the engine setup an error caused by the operator is not careful at the time of setup. And the root cause of this problem is the operator is too hasty in the engine setup so the occurrence of tube dented due to tube position does not fit in position.

IV. CONCLUSION

From the research that has been conducted from January 1 to January 31, 2015 obtained the average value of the availability of 85.30%, the average performance value of 56.16%, and the average value of quality of 96.50% . Having obtained the value of the OEE factor, obtained OEE value of 46.21% means that the OEE value is still less than the standard where the world standard value of OEE is 85%. The OEE value of the Soehnel L1 machine is still poor. And the factors that cause significant failures that affect the effectiveness of the Soehnel L1 machine are:

- The human factor: the lack of awareness of the technician over his or her knowledge, if the technician lacks the knowledge in dealing with the damage it will adversely affect the engine being repaired.
- Factor method: the supervisor is rarely in place resulting in the absence of supervision of operator work. This will affect the mistakes that are not in want where the error is a separate loss.
- Engine Factor: Limited technician knowledge makes the technician does not know how to properly handle damage to the component. If an error occurs during the installation of component replacement will affect the waste of spare parts because too often replace.
- Material factor: too hasty in this setup can result in dented tubes, because if at setup time there is a mistake then the machine work will not match the desired.

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