ISSN No:-2456-2165

Analysis of Air Conditioner Precision (PAC) Machine Using Overall Equipment Efectiveness (OEE) Method (Case Study at Data Center XYZ Company Jakarta)

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Abstract:- Presicion Air Conditioning Equipment System (PAC) is important in operational activities to maintain the temperature and humidity of every company that has a large and critical server unit both banking, industrial and service companies. This research discusses to study and analyze the PAC engine by using the Overall Equipement Effectiveness (OEE) method. It is expected that using quantitative and qualitative methods can test the OEE values of each machine and what factors influence it by means of a fishbone Presicion Air Conditioning Equipment System (PAC) is important in operational activities to maintain the temperature and humidity of every company that has a large and critical server unit both banking, industrial and service companies. This research discusses to study and analyze the PAC engine by using the Overall Equipement Effectiveness (OEE) method. It is expected that using quantitative and qualitative methods can test the OEE values of each machine and what factors influence it with a fishbone diagram analysis and 5 why. The results showed that the value of OEE on each machine is still below world class standards of 85%.

Keywords:- *Presicion Air Conditioning (PAC), Overall Equementement Effectiveness (OEE), Fish Bone Diagram, 5 why Analysis.*

I. INTRODUCTION

Presence Air Conditioning Equipment System (PAC) is important in the operational activities of every company that has a large and critical server unit, both banking, industrial and service companies. Therefore a reliable Presence Air Conditioning (PAC) system is one of the factors that needs to be maintained on a regular performance and maintenance basis.

The Presicion Air Conditioning (PAC) equipment at the Data Center of XYZ Company Jakarta is over 10 years (installed in 2005) so that this becomes an obsolete issue that poses a risk to the availability of spare parts on the market, the performance and efficiency of the equipment. In addition to the service life of the equipment, along with the development of time there has been an increase in load requirements for the operational needs of the server unit, thus a system upgrade of the Presicion Air Conditioning (PAC) system as a whole is taking into account the reliability, efficiency, ease of maintenance and flexibility of the operating system. It is important to know that the Data Center at XYZ Company is a critical data Center for the sustainability of national transactions, because if the Data Center suffers from disruption it will become a state issue and there will be chaos related to banking transactions in this Country. So that the Data Center at XYZ Company needs to be maintained its effectiveness, availability, performance and quality both in terms of server and facility.

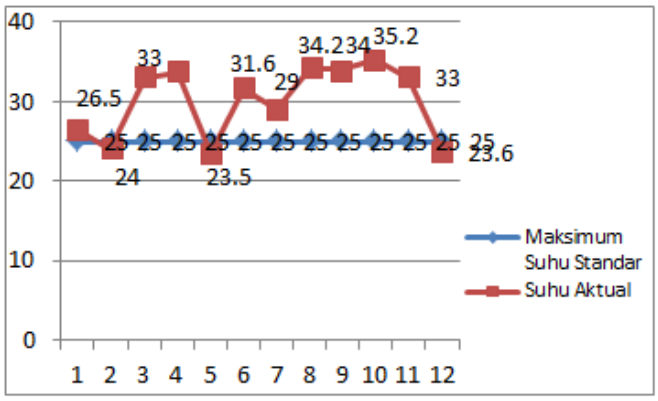

Fig 1:- Temperature Grafik of PAC 1 Machine

Based on the chart above, it was announced that the actual temperature of the PAC 1 engine from January to December 2018 was less than optimal because the actual temperature in the field exceeded the standard temperature of 25ºC, which was an average of 31ºC. Based on the facts in the field, the author will conduct research using OEE to determine the availability, performance and quality of PAC machines in the Data Center of XYZ Company.

Until now the implementation of routine maintenance and maintenance is carried out according to a predetermined schedule, this is in line with Dewanto (2013) the purpose of maintenance is to restore a system to its best condition so that it can function as it should, extend the machine's use and reduce failure as little as possible.

In this study, the Analysis of the Engine Condition of Air Conditioning (PAC) using the overall equipment effectiveness (OEE) method at the Data Center of XYZ Company Jakarta, the PAC system that the researchers will discuss is the performance of the engine in terms of temperature in PAC units 1 to PAC 17.

II. THEORETICAL REVIEW

A. Maintenance Management

Maintaining the production capability of an industry is an important function in the production system, in order to maintain production machines so that they are able to operate properly, there is a need for machine maintenance. According to Hasnida (2011), Maintenance includes all activities related to maintaining facilities and equipment in good condition and making necessary repairs when damage occurs so that the system can run as expected.

Companies must understand that poor maintenance can be disruptive, inconvenient, wasteful, and very expensive, even exceeding the cost of living. Good maintenance requires the need for links between operators, machines and mechanics as well as proper procedures (Heizer & Render, 2014: 751).

➢ *Types of machine maintenance :*

Engine maintenance is an important factor in maintaining the condition of the machine in order to stay fit. This is intended so that the production process is not constrained due to machine conditions that are damaged and not prime. The maintenance activities carried out in the company / factory can be divided into two types, namely Preventive Maintenance and Breakdown Maintenance / Corrective Maintenance (Heizer & Render, 2014: 757).

➢ *Classification of Maintenance*

According to Kurniawan (2013), maintenance is classified into several classifications including:

- Maintenance is carried out to prevent damage to the engine and so that the use life of the machine can last a long time.
- Maintenance is carried out at any time to avoid errors in the performance of the machine.
- Maintenance is carried out suddenly, due to ignorance of the existence of the machine.
- Maintenance carried out when production activities are taking place.
- Maintenance carried out when production activities are stopped
- Routine maintenance, periodic maintenance and predictable maintenance
- Corrective maintenance, namely maintenance activities by checking industrial facilities which aim to improve the reliability and capability of these machines and facilities
- Preventive maintenance, namely maintenance that is intentionally carried out to prevent damage in the future.

From the theory that has been explained before, it can be concluded that maintenance is an activity that is able to maintain the performance of production machines so that they remain in top condition, therefore there is a need for good maintenance management to manage all maintenance activities including the maintenance schedule, spare parts, total main power that will perform maintenance, types of maintenance both in the form of preventive maintenance and corective maintenance and the cost for each maintenance of the machine.

B. Overall Equipment Effectiveness (OEE)

OEE was originally a modified form of Total Productive Maintenance (TPM) developed by Seiichi Nakajima at the Japan Institute of Plan Maintenance to achieve ideal performance and avoid losses. In other words, there is no scrap or production defects, no breakdowns, no accidents, no waste / waste in the production process or changeover.

One of the main objectives of the OEE program is to reduce or eliminate the so-called Six Big Losses that are the most common causes of loss of efficiency in manufacturing. Six big losses are known as downtimelosses which are useful for calculating engine availability (Wakjira & Singh, 2012). Availability is a ratio of operation time, by setting aside machine downtime.

C. Cause and Effect Diagrams (Fishbone Diagrams)

Cause and effect diagrams are images of changes in lines and symbols that are designed to represent meaningful relationships between effects and causes. Developed by Dr. Kaoru Ishikawa in 1943 and sometimes known as the Ishikawa diagram (Kurniawan, 2013).

Cause and effect diagram is a structured approach that allows a more detailed analysis to find the causes of a problem, discrepancies and gaps. Cause and effect diagrams can be used if a discussion meeting using brainstorming to identify why a problem occurs, a more detailed analysis of the problem is needed and there is difficulty in separating cause and effect. The occurrence of deviations in the quality of work results so people will always find that there are 5 main factors causing significant significant, namely:

- Human (man)
- Work methods
- Other work machinery / equipment (machine / equipment)
- Raw Materials
- Work environment

Cause and effect diagrams like in Figure 2.1 can be used for the following:

- To deduce the causes of variations in the process.
- To identify the categories and sub-categories of causes that affect a certain quality characteristic.

The use of cause and effect diagrams can be done with the following steps:

➢ Get agreement on the problem that occurred and express the problem as a question (problem question).
➢ Awaken a set of possible causes by using reasoning techniques or by forming team members who have ideas relating to the problem being faced.
➢ Draw a diagram of the problem questions placed on the right side (forming the head of the fish) with the main categories such as humans, machines, methods, raw

materials and the environment. The main categories are placed on the main branches (forming large bones of fish) where the main categories can be changed as needed.

- Determine each cause in the appropriate main category by placing it in the appropriate branch.
- For every possible cause, ask why? To find the root cause, then register the roots in the branches that correspond to the main categories forming the bones of small fish. To determine the root cause, you can use the technique five times.
- Interpret the diagram by looking at the causes that emerge repeatedly.
- Determine the results of the analysis using these cause and effect diagrams by developing and implementing corrective actions and monitoring results to ensure that the corrective actions taken are effective in removing the root cause of the problem at hand.

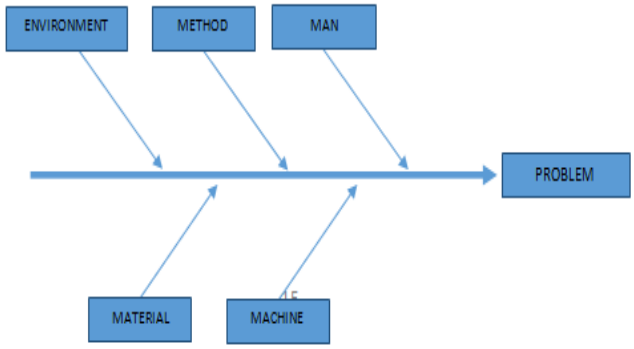

Fig 2:- Cause and Effect Diagrams

D. Root Cause Analysis (5 Why Analysis)

Root couse analysis is one of the pressure methods to find the root cause of a problem by asking "Why" / "Why" five times. Not always five times, sometimes more than five times or less than five times, the point is to keep asking "why" until it can be understood what must be done to solve a problem. Usually a problem shows the root cause with the question "why" in the fifth question (Yuniawan, 2014). The corrective action for every cause other than the root cause of the problem is temporary, while the corrective action for the root cause is permanent so that all problems that occur are not re-imagined (Stamatis, 2010).

E. Theoretical Framework

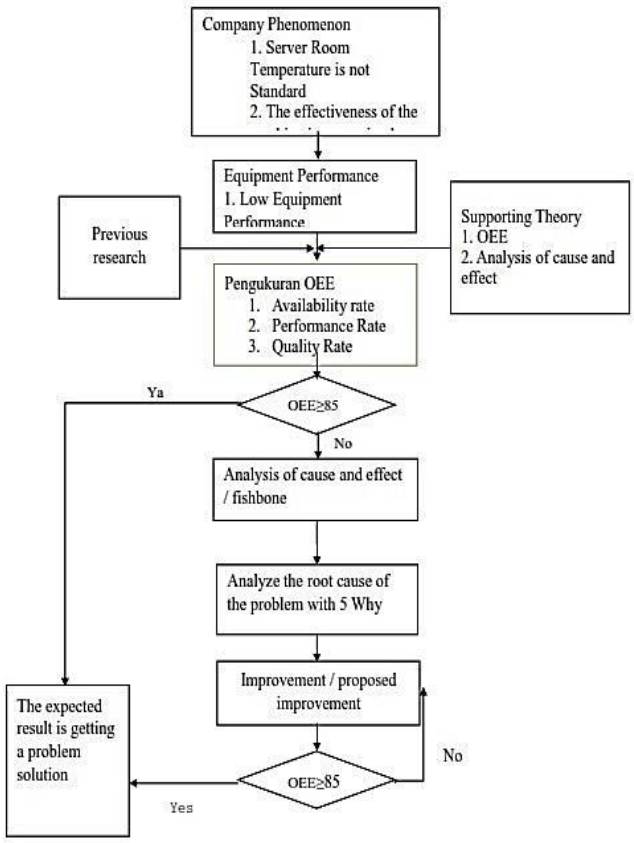

Fig 3:- Inter-Variable Relationship Model

III. RESEARCH METHODOLOGY

This research is a type of descriptive quantitative research that is a case study that is research conducted by finding data and information from a problem to obtain a deep understanding that aims to solve the problem.

The method used is the analysis method, which is to analyze the Overall Equipment Effectiveness (OEE) by calculating the availability, performance and quality values to identify any dominant factors that can affect the OEE value on the Presicion Air Conditioning (PAC) machine by using a fishbone diagram / because akibar. Overall Equipment Effectiveness is calculated based on data from the results of periodic maintenance checks in January 2018 - December 2018 and then identifies the machines / equipment that are considered priorities for maintenance improvements based on existing data from the checking results.

A. Types of Variables

The Following Types of Variables in Research as shown in the table below :

Variabel	Dimension	Indicator	Data	Data Source
Overall Equipment Effectiveness (Stamatis, 2010)	*Availability*	*Operating time*	Quantitative	Periodic Checklist
	Performance	*Aktual Output*	Quantitative	Periodic Checklist
Overall Equipment Effectiveness (Stamatis, 2010)	*Quality*	*Produk sesuai spesifikasi*	Quantitative	Periodic Checklist
Analysis of Cause and Effect	Man	Competent	Qualitative	*Brain Storming*
	Machine	Reliable	Qualitative	*Brain Storming*
	Method	Following SOP	Qualitative	*Brain Storming*
	Environment	According to the needs	Qualitative	*Brain Storming*

Table 1
Source : Periodic Checklist

B. Population and Sample

The population that will be discussed is about the equipment that will be analyzed related to OEE, so that in this company the population to be used is 17 units of precision air conditioner (PAC) machines / equipment.

The sample used in this study was the performance of PAC machines / equipment using only the same types / specifications and capacities.

C. Method Analysis

Data analysis methods used in this study are things that are directly related to the data that is processed by Logistics Management Division, Building Management and Engineers and Technical / Electrical Technicians by calculating a number of key variables to get the final results.

Data analysis will be carried out using a number of standard OEE variables by carrying out an ideal approach and actual conditions in the field including: Performing calculations of (Availability, Performance and Quality rate of Equipment) as well as conducting analysis related to causal factors using fishbone / cause and effect diagrams.

The data analysis technique used in this study is descriptive quantitative data analysis, namely by calculating OEE variables in accordance with data collected from January 2018 – December 2018.

IV. RESULTS AND DISCUSSIONS

❖ *Result*

The machine tools that are the object of research are 17 Precision AC units (PAC) which are the main equipment in the process of maintaining temperature and humidity stability in the data Center server room at XYZ Company Jakarta which requires continuous cooling where if the temperature in the server room is problematic then it can causing the server system to down and will disrupt operations on banking transactions nationwide. Noting the investment value and important functions of the equipment, the Precision AC equipment in the data Center needs to be maintained and maintained so that XYZ Company's data Center system operations can continue to function properly and optimally.

In obtaining the effectiveness of the use of Precision AC equipment (PAC) optimally, first the level of effectiveness of the machine / equipment is measured using the OEE (Overall Equipment Effectiveness) indicator.

Measurement of the effectiveness of this PAC equipment requires data sourced from maintenance reports. The data used are data in the period 2018, namely:

➢ *Planned Downtime*

Planned downtime is a long time to stop production that has been determined by the company.

➢ *PAC Operational Data Include:*

- The total available time or Planned Operating Time is the total time available for the PAC machine to carry out the production process in hours.
- Total Product Processed, which is the temperature produced by the PAC engine in ^{o}C units.
- Operation Time is the total actual operating time at the PAC in hours.

A. Measurement results of Equipment Effectiveness

After all data has been collected, data processing will then be processed using the Overall Effectiveness Equipment (OEE) formula.

According to Maulana (2015) in his research using the OEE method, the OEE value can follow the ideal world class standard with the standard availability value of 90%, Performance Efficiency 95%, Rate of Quality 99% and OEE 85%.

➢ *Measurement Availability*

Availability indicates the level of availability or readiness of production machines to be used in the production process. A machine with a high level of availability indicates that the machine is always in a ready-made condition if at any time it is used. While the equation used to calculate availability is in accordance with equation as follows.

Availability = (Operating time) / (Loading Time) x 100%

Loading time is the time available per day or per month reduced by planned downtime. Calculation of loading time can be written in the following formula :

Loading time = total Availability time – Planned downtime
Operation time is the total effective processing time. In this case the operation time is the result of reducing loading time with engine downtime. The mathematical formula:
Operation time = loading time – downtime
Downtime = Breakdown + set up

Calculation of the availability of PAC 1 equipment machines for the period of January 2018 is as follows:
Plan downtime = 0
Loading time = 744 Hours – 0 Hours = 744 Hours
Downtime = 0 hours
Operation time = 744 Hours – 0 Hours = 744 Hours
Availability = (744/744) x 100% = 100%

With the same calculation to calculate availability during the 2018 period for each machine can be seen the table below :

Machine	Month	*Avalaible Time* (Hour)	*Loading Time* (jam)	*Down time* (jam)	*Operation Time* (jam)	*Availability* (%)
Precision AC No.1	January	744	744	0	744	100
	February	672	672	0	672	100
	March	744	744	0	744	100
	April	720	720	0	720	100
	May	744	744	0	744	100
	June	720	720	0	720	100
	July	744	744	0	744	100
	August	744	744	0	744	100
	September	720	720	0	720	100
	October	744	744	0	744	100
	November	720	720	0	720	100
	December	744	744	0	744	100

Table 2

B. Performance Efficiency Measurement

Performance efficiency measurement is done to see the extent of the efficiency of the equipment used. Performance efficiency is the ratio of the quality of the product produced then multiplied by the ideal cycle time to the time available to carry out the production process (Operation time). To calculate the value of performance efficiency can use equation :

PE = Net Operation x operating cycle time
= (processed amount x actual cycle time) / (operating time) x (Ideal cycle time) / (actual cycle time) x 100%

PE = (processed amount x ideal cycle rate) / (operation time) x 100%

Ideal cycle time is the process cycle time that is expected to be achieved in optimal conditions or not experience obstacles. Ideal cycle time on PAC machine tools is the process cycle time achieved by the machine in the production process at optimal conditions or the machine does not experience obstacles in production.

The following is the Performance Efficiency Value Data table :

Machine	Month	Process Amount	Ideal Cycle Rate	Operation Time	Performance (%)
Precision AC No.1	January	26.5	22.5	744	80.14
	February	24	22.5	672	80.36
	March	33	22.5	744	99.80
	April	33.7	22.5	720	105.31
	May	23.5	22.5	744	71.07
	June	31.6	22.5	720	98.75
	July	29	22.5	744	87.70
	August	34.2	22.5	744	103.43
	September	34.0	22.5	720	106.25
	October	35.2	22.5	744	106.45
	November	33.0	22.5	720	103.13
	December	23.6	22.5	744	71.37

Table 3

C. Measurement of Rate of Quality Product

Rate of Product Quality is the ratio of a good product (good product) in accordance with the specified product quality specifications to the number of products processed. Calculation of Rate of Quality Product uses the data in research. In calculating this Rate of Quality Product, the process amount is the total product processed while the defect amount is the total broke product.

RQP = (process amount-defect amount) / (process amount) x 100%
Rate of Product Quality 1 PAC Machine in January 2018
RQP = (26.5- (4)) / 26.5 x 100%
RQP = 84.91%

With the same calculation, the Value of Quality value for the January 2018 to December 2018 period can be seen in table 4. Based on the value of the calculation of the Rate of Quality Product for machine tools PAC 1 to PAC 17 ranges from 63.92% to 100%.

D. Calculation of Overall Equipment Effectiveness (OEE)

After the availability value, performance efficiency and product quality rate on the PAC machine are obtained, the overall equipment effectiveness (OEE) calculation is performed to determine the effectiveness of the use of PAC machines in the XYZ Company Data Center building.

OEE calculation is the multiplication of the availability, performance efficiency and product quality values obtained in accordance with equation.

OEE (%) = Availability (%) x Performance (%) x Quality (%)
OEE PAC 1 units in January 2018 are:
OEE (%) = 100% x 80.14% x 84.91% = 68.05%

Following is the Calculation of Overall Equipment Effectiveness (OEE) of PAC Machines

Machine	*Avaibility Rate*	*Performance Rate*	*Quality Rate*	*OEE Rate*
PAC 1	100	92.81	76.46	69.41
PAC 2	100	71.70	94.9	67.94
PAC 3	100	70.51	93.56	65.98
PAC 4	100	65.76	92.76	65.98
PAC 5	100	68.52	94.97	65.02
PAC 6	100	58.15	82.87	48.25
PAC 7	100	60.09	86.66	52.14
PAC 8	100	68.82	94.64	65.07
PAC 9	100	68.23	93.01	63.31
PAC 10	99.97	77.89	86.61	66.89
PAC 11	100	64.66	88.66	57.65
PAC 12	100	61.69	87.04	54.02
PAC 13	100	79.45	86.20	68.10
PAC 14	100	81.34	99.93	81.28
PAC 15	100	79.05	86.38	68.10
PAC 16	100	59.80	86.06	51.50
PAC 17	100	60.13	86.48	52.15

Table 4

Based on table 4 the calculation analysis can be explained as follow:

PAC 1 equipment has a 100% avaibilty value. This shows that the PAC 1 machine can be available at any time for use because it has a value above the ideal standard value of ≥ 90%. Having a performance value of 92.81%, this shows that the PAC 1 engine has poor engine reliability because it has a value below the ideal standard of ≥ 95%. Has a quality value of 76.46%, this shows that the PAC 1 engine has a poor quality engine because it has a value below the ideal standard of ≥ 99%. Has an OEE value of 69.41%, this shows that the PAC 1 engine has an overall effectiveness of the system that is not good because it has a value below the ideal standard of ≥ 85%.

E. Cause and Effect Diagram Analysis

This analysis is carried out by direct observation to the field and conducting interviews and discussions with related parties in this research, including mechanical / electrical and engineering operational / maintenance teams. The results of the interviews and discussions aim to find out the cause of the unfulfilled OEE standards. To obtain the results of the analysis in accordance with the objectives of this study, data and tools needed in the field that are relevant to the data that have been collected, so as to facilitate the identification of it, a causal diagram was made and plans for improvement will be formulated.

Cause and effect diagrams are based on the low value of the world class standard of performance efficiency, quality of product and OEE because they contribute to the loss, reliability and quality of the XYZ Company Data Center so that it is necessary to address these losses. In the

interviews obtained as well as the results of field observations taken parameters that affect the occurrence of these losses include machinery, humans, materials, methods and the environment which will be made in the cause and effect diagram below.

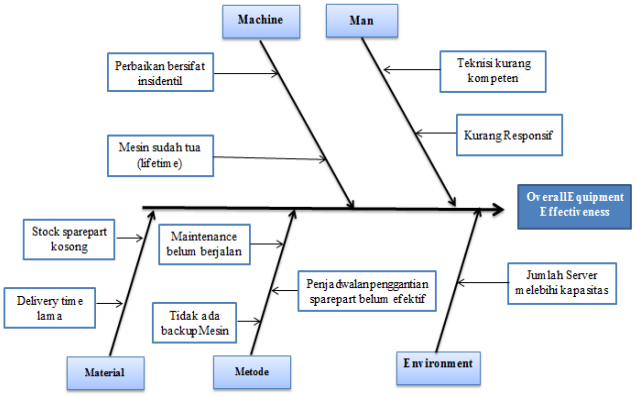

Fig 4:- Cause and Effect Diagram Analysis\

❖ *Discussion*

A. Man / Human

- Based on interviews and observations in the field that the lack of knowledge / competence of technicians regarding the operation and repair of PAC machines, especially if the damage occurred is the main components such as module boards, display controllers, and sensors.
- In some cases of damage, technicians are often slow in handling repairs. In the event of a failure, the technician provides a temporary analysis of the cause of the damage and is often slow to make improvements both in the replacement of spare parts and equipment settings.

B. Machine / Machine

- Repairing the machine or replacing the main spare parts is only done when the machine is broken, not when it is indicated damaged. This happens because the server room is not allowed to heat so the PAC engine is not allowed to go out.
- Based on interviews and observations in the field that the equipment has been installed since 2005. Because of this it can affect the effectiveness of the equipment.
- PAC machine tools in DC are difficult to repair because they are in the server room, so when it will be drained or repaired the pipe it is difficult to get permission because it is feared that the pipe leakage will damage the server.

C. Method

- Routine maintenance and shutdown schedules were not reached because some parties had difficulty giving permission. This makes the work methods that have been made are not optimal because they need to wait for the equipment off first.
- The process of replacing spare parts is often hampered because the replacement schedule that has been made has not been fully effective.
- The backup machine method does not yet exist. Because the backup machine that was installed at this time has become the main machine due to the development of the addition of servers. So that the room temperature increases, therefore the backup machine is operationalized as the main machine.

D. Material

- Spare part stock is not available, because spare part stock is at the distributor / product principal. So when there is damage the technician must contact the principal in advance to check the stock of spare parts in their warehouse.
- When there is damage to the main engine components such as module board and display controller, if there is no warehouse in the warehouse, it is necessary to order from outside Indonesia and requires a long delivery time can be more than 1 month.

E. Environment

As a result of the continued development of additional servers, the available PAC capacity is inadequate. At this time machine backups have also been used as operational machines.each employee especially other service work employees.

Calculation of the percentage of causes for the value of Overall equipement Effectiveness (OEE) under the Standard is as follow:

$$\text{Percentage}(\%) = \frac{Same\ Solution\ of\ problem}{Total\ of\ solution\ of\ problem}$$

$$\text{Technician Training}(\%) = \frac{1}{10} x\ 100\% = 10\%$$

From the above calculation, it is found that the percentage for the technician training schedule is made to increase competency, awareness and responsibility for the condition of the PAC machine is 10%. To get a percentage value on the cause of OEE values under other standards, you can use the same calculation method.

➢ *Problem Solving*

- *Human Factor*

In the problem of human factors, the results of the field research found several problems in the form of a lack of ability and knowledge of technicians in carrying out the operation and repair of PAC machines, where we can make improvements to it with corrective actions in the form of making training schedules and implementation with the aim to increase the capabilities and knowledge of technicians and also routinely checks training needs, direct training from principals for technicians with the aim of maintaining and increasing technician competency.

For technician problems that are less responsive to existing problems, the results of research and discussion conclude the need to create SOP (Standard Operating Procedure) on specific problems to provide guidance to technicians in the field in order to quickly find out and resolve existing problems. The addition of an alarm system or a monitoring system also needs to be done to increase the awareness of the technician in operational monitoring when there is a sudden engine trouble. This is in accordance with Anggraini et.al (2017) where improvements to the less skilled, undisciplined and less responsive human factors are carried out by conducting operator training on the machines handled and providing a supervisory system to the operator to be more responsive. Make schedule technician training and implementing it with routine Make SOP and operating standards and trouble shooting that is easy to understand

- *Engine Factor*

On the engine factor, a problem that often occurs is the habit of repairs carried out when damage has occurred or is incidental. This happens because of several causes, namely the first maintenance schedule that is still unclear, secondly often does not get a work permit because the area is a restricted area and is not allowed off and the third is not having a backup PAC unit so that if the PAC unit is off there is no backup to help cooling in the server room.

To improve the state of machine factors above the solution that can be done is to make SOPs and routine maintenance schedules that have been agreed between the equipment maintainer and the server equipment owner so that there are no more unscheduled maintenance and work permits that are not allowed. In addition it is necessary to propose to procure a new PAC unit as a backup that can be used when carrying out maintenance or when another unit is damaged. Procurement needs to be done unit to back up the system as needed so that backing up the PAC system can be used when done off the unit for scheduled maintenance work Procurement needs to be done a new unit as a whole by increasing capacity as well as system backups as needed

- *Method Factor*

The method factor which is a problem that is often faced in the form of engine repair schedules and spare part replacements is delayed due to the difficulty of setting off schedule with the need for use in the field, PAC repair which is a special machine that requires special expertise of technicians provides obstacles in setting the repair schedule due to the need to wait for technicians from the principal came. In addition, the schedule for annual shutdown is not yet running because it does not have a backup unit to use at shutdown. In addition to this, the development of needs and the addition of servers also affects because the total capacity of existing PAC units is maximum and if there are additional servers it should be accompanied by the addition of PAC units as well. Procurement needs to be done unit to backup the system as needed so that backing up the PAC system can be used when the annual shutdown is done according to good methods and safety Procurement needs to be done unit to back up the system as needed so that backing up the PAC system can be used when done off the unit for scheduled spare part replacement work because of indicated lifetime or damage Procurement needs to be done unit to backup the system as needed so that when something happens to one of the units, the backup unit inside is available for use

- *Material Factors*

Material factors are caused by several factors such as high-priced spare parts, being in principal's warehouse because XYZ Company itself is not permitted to have spare parts warehouses so that all spare parts are in partner warehouses, and do not yet have spare parts unit prices with product principals. In addition, the causal factor in material problems is the good delivery time because procurement needs to be done first because Procurement needs to be done unit to backup the system as needed so that when something happens to one of the units, the backup unit inside is available for use

- *Environmental Factor*

Environmental factors can be influenced by the increase in servers in the area, so that the existing capacity cannot optimally provide cooling to servers in the area. The existing backup unit has been used as the main operational machine, so a new backup unit is needed to support the operation of PAC operations at the Old Data Center of XYZ Company

Based on the results of interviews and surveys in the field, analysis can be made using a causal diagram and 5 why as explained in tables 4.13 to 4.17. Proportionally the cause of disruption in the operation of the machine system / equipment air conditioner presicion (PAC) which makes a decrease in the value of the overall equipement

Based on the results of interviews and surveys in the field, analysis can be made using a causal diagram and 5 why as explained , the cause of disruption in the operation of the engine system / equipment air conditioner presicion (PAC) which makes the value of the Overall Equipement Effectiveness (OEE) below the standard.

Calculation of the percentage of causes for the value of Overall equipement Effectiveness (OEE) under the Standard according to table 4.18 is as follows:

Percentage (%) = (The same number of resolutions) / (Total problem resolution)
Training Schedule (%) = (1) / 10 x 100% = 10%

From the above calculation, it is found that the percentage for the technician training schedule is made to increase competency, awareness and responsibility for the condition of the PAC machine is 10%. To get a percentage value on the cause of OEE values under other standards, you can use the same calculation method.

ISSN No:-2456-2165

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the analysis of the discussion and some conclusions above, the suggestions that can be given to complete the results of this study are as follows:

A. Conclusions

The conclusions that can be drawn from this study are:

- The Overall Equipments Effectiveness (OEE) value of the machine / presenter air conditioner (PAC) is as follows:

- PAC 1 of 69.41	- PAC 10 of 66.89
- PAC 2 of 67.94	- PAC 11 of 57.65
- PAC 3 is 65.98	- PAC 12 is 54.02
- PAC 4 is 65.98	- PAC 13 is 68.10
- PAC 5 is 65.02	- PAC 14 is 81.28
- PAC 6 is 48.25	- PAC 15 is 68.10
- PAC 7 for 52.14	- PAC 16 for 51.50
- PAC 8 is 65.07	- PAC 17 is 52.15
- PAC 9 of 63.31	

- From the analysis of cause and effect diagrams, proportionally the cause of disruption in the operational system of the machine / equipment air conditioner presicion (PAC) which makes the value of the Overall Equipments Effectiveness (OEE) below the standard is as follows:
  - Technician Training is 10%
  - No SOP for PAC engine maintenance is 10%
  - Do not have a PAC system backup is 60%
  - Don't have a spare part contract with a 20% principal vendor

B. Suggestions

Based on the results of research that has been done need some advice that needs to be considered include:

- The need for procurement and installation of a backup PAC unit. This right is intended to ensure that during PAC maintenance, shutdown and trouble shooting, the backup unit can be used.
- Making Standard Operating Procedure (SOP) standard, easy to understand and in accordance with the conditions on the ground. So that technicians can easily take the first action if trouble occurs quickly according to the SOP instructions.
- Cooperation or contract of spare parts is needed with the principal's vendor so that when there is a need for spare parts, the company can immediately check and ask the principal's warehouse to immediately replace it.

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