DAMAGE ANALYSIS ENGINE COMPONENTS GOSS UNIVERSAL-50 USING THE FAILURE MODES AND EFFECT ANALYSIS (FMEA) IN PT PIKIRAN RAKYAT *BANDUNG*

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ABSTRACT

PT Pikiran Rakyat Bandung is one of the newspaper company. Since its establishment the People's Daily Thoughts declare themselves as local newspapers. The policy refers to the target readership consists of people in West Java. The ideals that underlies the existence of the People's Daily Thoughts can be read clearly from its motto "From the People For the People By the People".

The problems that occurred in PT Pikiran Rakyat Bandung is the machine *Goss Universal*-50 often there is damage erratic and have to undergo change of components that are not in accordance with the schedule routine *maintenance Cause-effect diagram* (*Fishbone*) used to determine cause and effect on engine component damage *Goss Universal*-50. While to analyze the damage using methods *Failure Mode And Effect Analysis* (FMEA) and makes scheduling maintenance and replacement of components and suggested as an improvement methods 5W-1H.

The results of this study showed that the cause of the damage consists of several factors, including humans, machines, materials, and methods. As for the actions to be carried out on the components of which are to be checked for wear and lubrication so that these components are always good in its use. Seeing the results of MTBF engine will be damaged average in operation during 166,67 hours (20,8 day) for damage to components *Plate Cylinder Eccentric*, 200 hours (25 day) for damage to components *Plate Cylinder Bearing*, 111,11 hours (13,9 day) for damage to components *Blanket Cylinder Eccentric*, and 142,86 hours (17,9day) for damage to components *Blanket Cylinder Bearing*.

Key word: *Cause Failure Mode Effect* (CFME), *Failure Mode And Effect Analysis* (FMEA), Damage Components, 5W-1H.

I. Preliminary

A. Background

PT Pikiran Rakyat Bandung is one of the newspaper company. Since its establishment the People's Daily Thoughts declare themselves as local newspapers. Therefore, in the implementation of both tasks relating to the collection, broadcasting, as well as statements and opinion polls, this newspaper has its own style which is different from a regular daily national. The policy refers to the target readership consists of people in West Java. The idealism that underlies the existence of the People's Daily Thoughts can be read clearly from its motto "From the People For the People By the People".

The problems that occurred in PT Pikiran Rakyat Bandung particularly in the production department is the engine *Goss Universal*-50 often there is damage erratic and have to undergo change of components that are not in accordance with the schedule of routine *maintenance*. Components that are damaged and replacement of components *Blanket Cylinder Eccentric Plate Cylinder Eccentric, Plate Cylinder Bearing* and *Blanket Cylinder Bearing*. This damage can lead to disruption of the production process of printing, such as the number of products that will be produced and production time. Therefore it is necessary to clearly identify the factors causing damage so make improvement efforts be focused.

Failure Modes And Effect Analysis (FMEA) It is a method that aims to evaluate the design of the system taking into account the various types of failure of the system consisting of the components, analyzing the effects on the reliability of the system to search the effects of component failure in accordance with the level of specific items of critical system can assessed and the necessary measures to improve the design and mengeleminiasi or reduce the probability of methods of critical failures.

B. Identification of problems

Referring description of the background of the problem, this study will try to answer it - the following:

1. How to determine cause and effect on engine component damage *Goss Universal*-50?
2. What is the appropriate recommendations to address damage to engine components *Goss Universal 50*?

C. Objective

The aim of the research is as follows:

1. Determining the causation of damage to components on the machine *Goss Universal*-50.
2. Make appropriate recommendations to overcome damage to the components of priority repairs.

D. Restricting The Problem

The boundary problem in this study to be more effective is as follows:

1. The components are observed only on components *Blanket Cylinder Eccentric, Plate Cylinder Eccentric, Plate Cylinder Bearing* dan *Blanket Cylinder Bearing.*
2. Data component damage *Blanket Cylinder Eccentric, Plate Cylinder Eccentric, Plate Cylinder Bearing* dan *Blanket Cylinder Bearing* investigated over the past year.
3. Proposed improvements are not up to the implementation phase.

II. Theoretical basis

A. Definition of FMEA (*Failure Mode and Effect Analysis*)

FMEA *(failure mode and effect analysis)* is a structured procedure to identify and prevent as much as possible modes of failure (*failure mode*). FMEA used to identify the sources and root causes of quality problems. A failure mode is what is included in defects or failures in the design, conditions beyond the limits established specifications, or changes in the product that causes disruption of the function of the product.

There are many variations in the details FMEA *(Failure Mode and Effect Analysis)*, but all of them aim to make improvements to the way:

1. Identify models of failure in components, equipment and systems.
2. Determine the potential effect on the equipment, the system associated with each model of failure.
3. Make a recommendation to increase the reliability of components, equipment and systems.

There are four main steps in the performance of FMEA as follows:

1. Defining the system, functions and components.
2. Identifying the cause of damage to the components.
3. Studying the effects of the cause of damage to the components.
4. Conclusions and suggestions.

As a result of each cause of failure in the functioning of a system as well as the components can be studied in a systematic and predictable. Result described can be assumed that there is one cause of the error and other components that can operate normally.

After performing all the steps above, the analysis will illustrate the conclusions in the research object. With the results shown in Table 2.1. as follows:

1. The whole picture of the causes and consequences of failure in the operating system has been taken into account in the design.
2. Can identify a defect..
3. The cause of the failure is widely reckoned from the impact in the functioning of the system.
4. Identifying both damage and other damages.
5. Designing treatment procedures relating between each cause of failure.

Table 1. *Failure Mode and Effect Analysis* (FMEA)

No	*Function*	*Function Failure*	*Failure Mode*	*Failure Effect*
1. 2.				

B. *Cause Failure Mode Effect* (CFME)

Cause Failure Mode Effect is the development of a causal diagram and used to detect the root cause of problems. Data for the manufacture CFME is the data used in a causal diagram. For every cause of the causal diagram searched again what the cause as the root cause, by continually asking why it happened until no answer can be given. CFME results will facilitate the making *Failure Mode and Effect Analysis*. CFME aims to help identify the effects, failure mode, and the root cause of the problem.

Cause and Effect Diagram this diagram is also called a fishbone diagram because of its shape like a fish. In addition it is also called Ishikawa diagram because that finding is Prof. Ishikawa from Japan.

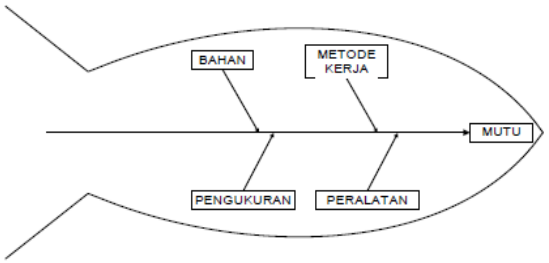


Image 1. *Cause and Effect Diagram* (Ishikawa, 1998).

C. Function Reliability (*Realibility*)

Mathematically the magnitude of the reliability of the machine processing time (t) obtained from one particular reduced the probability of occurrence of damage during the operation time t. The function of reliability is (Blanchard, 1994):

$$R(t) = e^{-\lambda.t} \quad (2.1)$$

$$R(t) = 1-f(t) \quad (2.2)$$

Where: R(t) = Reliability function
t = Overall operating time
F(t) = The probability of damage
f = The amount of damage
λ = The rate of destruction

If t toward infinity, then R (t) to zero. F (t) is the distribution function of damage or unreliability function.

Function unreliability F (t)

$$F(t) = 1-e^{-\lambda t} \quad (2.3)$$

D. Calculating The Average Time Between Maintenance

The average time between maintenance, namely:
Include the need for preventive maintenance (scheduled) and corrective maintenance (unscheduled).

$$MTBM = \frac{Total\ Waktu\ Efektif\ Oprasi\ Mesin}{Frequensi\ Pemeliharaan\ Preventif+Korektif} \quad (2.4)$$

$$fpt = \frac{1-(\lambda x MTBM)}{MTBM} \quad (2.5)$$

$$MTBF = \frac{1}{\lambda} \quad (2.6)$$

Where:
MTBM = The average time between maintenance (*Mean Time Between Maintenance)*
λ = The rate of destruction
fpt = The rate of preventive maintenance
MTBF = The average time between failures (*Mean Time Between Failure*)

$$M = MTBM\ (\lambda \times Mct) + (fpt \times Mpt) \quad (2.7)$$

Where: Mct = Average time corrective maintenance
Mpt = Average time preventive maintenance
M = Active maintenance time

E. Damage rate function (*Hazard Function*)

The rate of breakdown (failure rate) is the rate at which the damage occurs at set time intervals. The rate of decay (λ) is formulated as follows (Blanchard, 1994):

$$\lambda = \frac{f}{t} \quad (2.8)$$

Where: λ = The rate of destruction
f = The amount of damage that occurred
t = Overall operating time

F. Method 5W-1H

5W-1H is a method used to find out the problems that happened in detail. In the form of some questions, namely: what, who, where, when, why and how, is usually presented in tabular form, we can see in table 2.2. and 2.3. about 5W and 1H.

Table 2. Metode 5W-1H Problems To Find Out What Happens In Detail

No	Who (Siapa)	What (Apa)	Where (Dimana)
1.	Siapa yang melaksanakan ?	Apa yang harus dilaksanakan ?	Dimana melaksanakannya ?
2.	Siapa yang sedang melaksanakan ?	Apa yang sedang dilaksanakan ?	Dimana sedang dilaksanakan ?
3.	Siapa yang seharusnya melaksanakan ?	Apa yang seharusnya dilaksanakan ?	Dimana seharusnya dilaksanakan ?
4.	Siapa lagi yang dapat melaksanakan ?	Apa lagi yang dapat dilaksanakan ?	Dimana lagi dapat dilaksanakan ?
5.	Siapa lagi yang harus melaksanakan ?	Apa lagi yang seharusnya dilaksanakan ?	Dimana lagi seharusnya dilaksanakan ?
6.	Siapa yang melaksanakan 3-MU ?	3-MU mana yang sedang dilaksanakan ?	Dimana 3-MU sedang dilaksanakan ?

Tabel 3. (Continued) Method 5W-1H Problems To Find Out What Happens In Detail

No	When (Kapan)	Why (Mengapa)	How (Bagaimana)
1.	Kapan melaksanakannya ?	Mengapa ia melaksanakan ?	Bagaimana melaksanakannya ?
2.	Kapan dilaksanakan ?	Mengapa melaksanakannya ?	Bagaimana dilaksanakan ?
3.	Kapan seharusnya melaksanakannya ?	Mengapa melaksanakannya disana ?	Bagaimana seharusnya dilaksanakan ?
4.	Kapan lagi dapat dilaksanakan ?	Mengapa melaksanakannya saat itu ?	Dapatkah metode ini digunakan dibidang lain ?
5.	Kapan lagi seharusnya dilaksanakan ?	Mengapa dilaksanakan dengan cara itu ?	Apakah ada cara lain untuk melaksanakannya ?
6.	Apakah setiap waktu ada 3-MU ?	Apakah ada 3-MU dalam cara berpikir ?	Apakah ada 3-MU dalam metode itu ?

Can we look at some questions, namely: what, who, where, when, why dan how (apa, siapa, dimana, kapan, mengapa dan bagaimana):

- What (apa), a question which aims to find out something happened.
- Who (siapa), a question which aims to find out the person or subject doing something.
- Where (di mana), a question which is aimed at finding out the scene of an event that occurred.
- When (kapan), a question that seeks to know the time of occurrence of an event.
- Why (mengapa), a question which aims to find out the background or the cause of the occurrence of the event occurred.
- How (bagaimana), a question which aims to find out the process it happened.

III. Results and Discussion

A. Determining Component Damage

This stage aims to identify the information on the application of these companies PT Pikiran Rakyat by using a *flowchart* as a basis for analyzing the major issues.

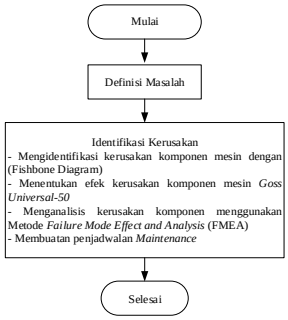


Image 2. Image Troubleshooting Flowchart

Data component is most frequent damage in the past year, 2014.

Table 4. Data Destruction Engine Components *Goss Universal*-50

N. Komponen	Bulan												Total
	Jan	Feb	Mrt	Apr	Mei	Juni	Juli	Agst	Sep	Oct	Nov	Des	
Plate Cylinder Eccentric	2	1	1	1	1	2	1	1	1	1	1	1	14
Plate Cylinder Bearing	1	1	1	1	1	1	1	1	1	1	1	1	12
Blanket Cylinder Eccentric	2	2	1	2	2	2	2	2	2	2	2	2	23
Blanket Cylinder Bearing	2	1	1	2	1	2	2	1	1	2	1	1	17

The following data is effective when the number of hourss the engine *Goos Universal-50*.

Table 5. Data Effective Machine Working Hourss *Goos Universal-50*

Bulan	Hari Kerja	Jam Kerja	Total Jam Kerja Efektif (Jam)
Januari 2014	27	8	216
Februari 2014	24	8	192
Maret 2014	26	8	208
April 2014	26	8	208
Mei 2014	27	8	216
Juni 2014	26	8	208
Juli 2014	27	8	216
Agustus 2014	26	8	216
September 2014	27	8	208
Oktober 2014	27	8	216
November 2014	26	8	208
Desember 2014	27	8	216
Jumlah			2528

The following corrective maintenance data engine components *Goos Universal*-50.

Table 6. Data Corrective Maintenance Engine Goos Universal-50

Jenis Komponen	Total Waktu Pemeliharaan Korektif (Jam)	Banyaknya Pemeliharaan Korektif (Kali)
Plate Cylinder Eccentric	28	14
Plate Cylinder Bearing	24	12
Blanket Cylinder Eccentric	46	23
Blanket Cylinder Bearing	34	17
Jumlah	132	66

$$\text{MCT} = \frac{Total\ Waktu\ Pemeliharaan\ Korektif}{Banyaknya\ Pemeliharaan\ Korektif} = \frac{132}{66} = 2 \text{ jam}$$

The following preventive maintenance data engine *Goos Universal*-50.

Table 7. Data Preventive Maintenance Engine Goos Universal-50

Jenis Pemeliharaan	Total Waktu Pemeliharaan Preventif (Jam)	Banyaknya Pemeliharaan Preventif (Kali)
Pemeliharaan Mingguan	8	1

Based on Table 4.2. over 1 year ie 2014. In PT Pikiran Rakyat Bandung There are 4 types of components that often damage or replacement is *Blanket Cylinder Eccentric, Plate Cylinder Eccentric, Plate Cylinder Bearing* and *Blanket Cylinder Bearing*.

B. Cause-effect diagram (*Cause and Effect Diagram*)

In determining the damage taken from four possible factors affecting the components resulting in non sesuian or damage whether factors (machinery, people, the environment and methods). In identifying the root cause of the problem of component damage and help in this study, we used a fishbone diagram (*Cause and Effect Diagram*). As for the causes that affect component damage *Blanket Cylinder Eccentric, Plate Cylinder Eccentric, Plate Cylinder Bearing* and *Blanket Cylinder Bearing*. Can be seen in the diagram below:

1. The causal influence component damage *Blanket Cylinder Eccentric.*

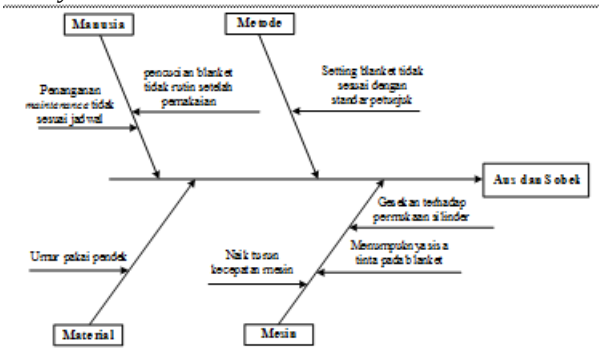


Image 2. Cause and Effect Diagram Component *Blanket Cylinder Eccentric* Wear and tear

2. The causal influence component damage *Plate Cylinder Eccentric.*

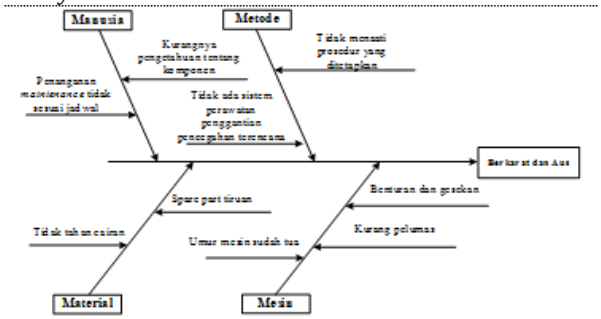


Image 3. Cause and Effect Diagram Component *Plate Cylinder Eccentric* Rusted and worn

3. The causal influence component damage *Blanket Cylinder Bearing.*

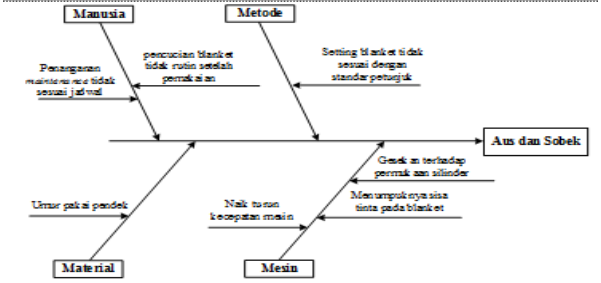


Image 4. Cause and Effect Diagram Component Blanket Cylinder *Bearing* Wear and tear

4. The causal influence component damage *Plate Cylinder Bearing*.

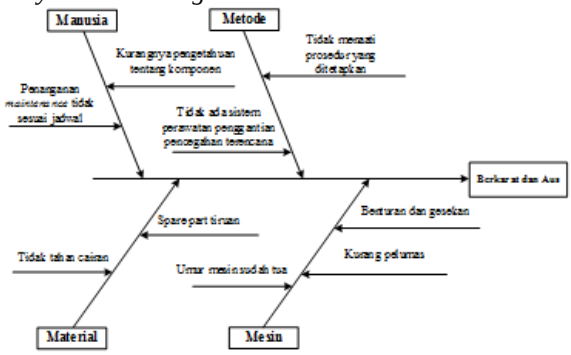


Image 5. Cause and Effect Diagram Component *Plate Cylinder Bearing* Rusted and worn

1. The cause damage to components affecting Blanket Cylinder Eccentric wear and tear as follows :
   - Material factor which is caused by the short lifespan of the components so that the use of components not long.
   - Factors that current methods of setting *blanket* is not in accordance with the standard instructions.
   - The human factor is often delayed *blanket* washing after use or the production and handling unscheduled maintenance.
   - Factors engine is friction *blanket* against the surface of the cylinder, the engine speed fluctuations at work or production, and the friction against the surface of the *blanket*.

2. Causes affecting component damage *Plate Cylinder Eccentric* rusted and worn as follows:
   - The material factors that are not a component plate is not waterproof, and the number of imitation spare parts..
   - Factors methods that do not obey the established procedure, and no preventive maintenance system replacement planned.
   - The human factor is the lack of knowledge about the components and handling unscheduled maintenance.
   - Factors that impact or friction machine with other components, lack pelumasaan on the surface of the plate, and the life of the engine that is old or older.

3. Causes affecting component damage *Blanket Cylinder Bearing* wear and tear as follows:
   - Material factor which is caused by the short lifespan of the components so that the use of components not long.
   - Factors that current methods of setting blanket is not in accordance with the standard instructions.
   - Faktor The human factor is often delayed *blanket* washing after use or the production and handling unscheduled maintenance.
   - Factors engine is friction blanket against the surface of the cylinder, the engine speed fluctuations at work or production, and the friction against the surface of the blanket.

4. Causes affecting component damage *Plate Cylinder Bearing* rusted and worn as follows :
   - The material factors that are not a component plate is not waterproof, and the number of imitation spare parts.
   - Factors methods that do not obey the established procedure, and no preventive maintenance system replacement planned.
   - The human factor is the lack of knowledge about the components and handling unscheduled maintenance.
   - Factors that impact or friction machine with other components, lack pelumasaan on the surface of the plate, and the life of the engine that is old or older.

C. FMEA (*Failure Mode and Effect Analysis*)

FMEA is a method that aims to evaluate the design of the system taking into account the various types of damage from the system consisting of components, analyzing the effects on the reliability of the system to search the effects of damage to the components of a critical system can be assessed and the necessary action to improve design and mengeleminiasi or reduce the probability of methods of critical damage that can be seen in table 4.9. the following:

Table 8. Failure Mode and Effect Analysis (FMEA) For engine components *Goos Universal*-50

Komponen	Function	Funcional Failur	Failur Mode	Failur Effect
Blanket Cylinder Eccentric	Menerima tinta dan air dari pelat cetak dan mentransferkan ke permukaan kertas	• Tidak bisa menerima tinta. • Tidak bisa memindahkan tinta ke kertas.	• Pori-pori pada permukaan kain karet tertutup karena tinta kering. • *Blanket* sobek. • *Blanket* aus.	• Tinta tidak terserap oleh blanket berakibat hasil cetakan blobor • Perpindahan tinta ke kertas tidak maksimal.
Blanket Cylinder Bearing	Menerima tinta dan air dari pelat cetak dan mentransferkan ke permukaan kertas	• Tidak bisa menerima tinta. • Tidak bisa memindahkan tinta ke kertas.	• Pori-pori pada permukaan kain karet tertutup karena tinta .kering. • *Blanket* sobek • *Blanket* aus.	• Tinta tidak terserap oleh blanket berakibat hasil cetakan blobor • Perpindahan tinta ke kertas tidak maksimal.
Plate Cylinder Bearing	Mentransfer tinta dan air ke *blanket*	Tidak bisa mentranser tinta dan air ke *blanket*.	• *Plate clinder bearing* berkarat dan aus.	• Tidak terdapat hasil cetakan karena tinta tidak menepel di *blanket*
Plate Cylinder Eccentric	Mentransfer tinta dan air ke *blanket*	Tidak bisa mentranser tinta dan air ke *blanket*.	• *Plate clinder bearing* berkarat dan aus.	• Tidak terdapat hasil cetakan karena tinta tidak menepel di *blanket*

Analysis of failure mode and effect analysis was done to see the different types of damage from a system consisting of components, analyzing the effects on the reliability of the system to search the effects of damage to the components of a critical system can be

assessed and the necessary measures to repair the damage components critical.

In the corrective actions taken, the components were damaged resulting in engine work was not optimal. From processing FMEA defective component replacement must be done immediately. In this replacement as soon as possible should be done so that the faulty component does not make the other components were damaged. The action should be taken against these four components which are: *Blanket Cylinder Eccentric, Plate Clinder Eccentric, Blanket Cylinder Bearing, and Plate Clinder Bearing* must be checked for wear and lubrication so that these components are always good in its use, the components *Blanket Cylinder Eccentric, Plate Clinder Eccentric, Blanket Cylinder Bearing, and Plate Clinder Bearing* the need for planned maintenance and regular replacement and always cleaned to prevent damage to these components.

D. The pace of Damage

The pace of damage (λ) engine parts Goos Universal-50

Mathematical equation used to find the rate of destruction using the formula:

$$\lambda = \frac{Banyaknya\ Pemeliharaan\ Korektif}{Jumlah\ jam\ Efektif\ Operasi\ Mesin}$$

Example: For component *Plate Cylinder Eccentric* will be damaged as much as 0,006 damage / hours.

The pace of damage of each type of component:

1. The rate of damage to components *Plate Cylinder Eccentric.*

$$\lambda = \frac{Banyaknya\ Pemeliharaan\ Korektif}{Jumlah\ jam\ Efektif\ Operasi\ Mesin} = \frac{14}{2528} = 0{,}006$$

damage / hours

2. The rate of damage to components *Plate Cylinder Bearing.*

$$\lambda = \frac{Banyaknya\ Pemeliharaan\ Korektif}{Jumlah\ jam\ Efektif\ Operasi\ Mesin} = \frac{12}{2528} = 0{,}005$$

damage / hours

3. The rate of damage to components *Blanket Cylinder Eccentric.*

$$\lambda = \frac{Banyaknya\ Pemeliharaan\ Korektif}{Jumlah\ jam\ Efektif\ Operasi\ Mesin} = \frac{23}{2528} = 0{,}009$$

damage / hours

4. The rate of damage to components *Blanket Cylinder Bearing.*

$$\lambda = \frac{Banyaknya\ Pemeliharaan\ Korektif}{Jumlah\ jam\ Efektif\ Operasi\ Mesin} = \frac{17}{2528} = 0{,}007$$

damage / hours

E. MTBF Machine Component *Goos Universal-50*

Mean time between failure. (The average time between failures) mathematical equation used is:

$$MTBF = \frac{1}{\lambda}$$

Example: For component *Plate Cylinder Eccentric*, components will be damaged after operating for 20.8 days.

1. MTBF for components *Plate Cylinder Eccentric.*

$MTBF = \frac{1}{0{,}006}$ = 166,67 hours (20.8 days)

2. MTBF for components *Plate Cylinder Bearing.*

$MTBF = \frac{1}{0{,}005}$ = 200 hours (25 days)

3. MTBF for components *Blanket Cylinder Eccentric.*

$MTBF = \frac{1}{0{,}009}$ = 111,11 hours (13,9 days)

4. MTBF for components *Blanket Cylinder Bearing.*

$MTBF = \frac{1}{0{,}007}$ = 142,86 hours (17,9 days)

F. Function Unreliability F (t)

Unreliability function can be interpreted chances components will be damaged at the time (t).

Mathematical equation is used:

$F(t) = 1\text{-}e^{-\lambda t}$

Example: The amount of possible damage that occurs in the component *Plate Cylinder Eccentric* 4,7 % in percentages.

1. For components *Plate Cylinder Eccentric.*

   For t = 8 hours Then

   $F(8) = 1\text{-}e^{-0{,}006\ .\ 8}$

   = 0,047 = 4,7 %

2. For components *Plate Cylinder Bearing.*

   For t = 8 hours Then

   $F(8) = 1\text{-}e^{-0{,}005\ .\ 8}$

   = 0,039 = 3,9 %

3. For components *Blanket Cylinder Eccentric.*

   For t = 8 hours Then

   $F(8) = 1\text{-}e^{-0{,}009\ .\ 8}$

   = 0,069 = 6,9 %

4. For components *Blanket Cylinder Bearing.*

   For t = 8 hours Then

   $F(8) = 1\text{-}e^{-0{,}007\ .\ 8}$

   = 0,054 = 5,4 %

1. Component *Plate Cylinder Eccentric*

   a. The pace of damage (λ) = h (t) = 0,006 hours. so the machine *Goos Universal-50* will suffer damage to the components *Plate Cylinder Eccentric* damage 0.006 / hours.

   b. The average time between failures/Mean Time Between Failure (MTBF) or expectations of the average lifetime of components = 166.67 hours, which means that the components were damaged after an average beroprasi for 166.67 hours and this value also shows the operating life of the components.

   c. Reliability R (t = 8) = 0.953 = 95.3% to the value of the above-mentioned components are often classified as damaged and reability high.

   d. The cumulative distribution function F (t) or also called unreliability function (distribution damage) or the chance components will be damaged at time t = 8 hours was 4.7%. so components *Plate Cylinder Eccentric* for operating 8 hours the opportunity to experience damage to the components is 4.7%, so the machine *Goos Universal-50* chances will suffer considerable damage.

2. Component *Plate Cylinder Bearing*

   a. The pace of damage (λ) = h (t) = 0,005 hours. so the machine *Goos Universal-50* will suffer

damage to the components *Plate Cylinder Bearing* 0,005 damage / hours.

b. The average time between failures/Mean Time Between Failure (MTBF) or expectations of the average lifetime of components = 200 hours, which means that the components were damaged after an average of all operating for 200 hours and this value also shows the operating life of the components.
c. Reliability R (t = 8) = 0.961 = 96.1% to the value of the above-mentioned components are often damaged and relatively high reability.
d. The cumulative distribution function F (t) or also called unreliability function (distribution of damage) or the chance components will be damaged at time t = 8 hours is 3.9% so components *Plate Cylinder Bearing* for operating 8 hours the opportunity to experience damage to the components is 3.9%, so the machine *Goos Universal-50* chances will suffer considerable damage.

3. Component *Blanket Cylinder Eccentric.*
   a. The pace of of damage (λ) = h (t) = 0,009 hour. So the machine *Goos Universal-50* will suffer damage to the components *Blanket Cylinder Eccentric* of damage 0.009 / hours.
   b. The average time between of damage/Mean Time Between Failure (MTBF) or expectations of the average lifetime of components = 111.11 hours, which means that the components were damaged after an average beroprasi for 111.11 hours and this value also shows age operating components.
   c. Reliability R (t = 8) = 0.931 = 93.1% to the value of the above-mentioned components are often damaged and relatively high reability.
   d. The cumulative distribution function F (t) or also called unreliability function (distribution of damage) or the chance components will be damaged at time t = 8 hours is 6.9% so components *Blanket Cylinder Eccentric* for operating 8 hours the opportunity to experience damage to the components is 6.9%, so the machine *Goos Universal-50* chances will suffer considerable damage.

4. Component *Blanket Cylinder Bearing.*
   a. The pace of of damage (λ) = h (t) = 0,007 hour. So the machine *Goos Universal-50* will suffer damage to the components *Blanket Cylinder Bearing* 0,007 of damage / hours.
   b. The average time between of damage/Mean Time Between Failure (MTBF) or expectations of the average lifetime of components = 142.86 hours, which means that the components were damaged after an average beroprasi for 142.86 hours and this value also shows age operating components.
   c. Reliability reliability R (t = 8) = 0.946 = 94.6% to the value of the above-mentioned components are often damaged and relatively high reability.
   d. The cumulative distribution function F (t) or also called unreliability function (distribution of damage) or the chance components will be damaged at time t = 8 hours is 5.4%. so components *Blanket Cylinder Bearing* for operating 8 hours the opportunity to experience damage to the components is 5.4%, so the machine *Goos Universal-50* chances will suffer considerable damage.

G. Reliability Components Mesin *Goos Universal-50*

The equation used to calculate the reliability of the engine components *Goos Universal-50* is:

$R(t) = 1-F(t)$

Probability components continue to operate properly in accordance with the expected function in the interval of time and under certain conditions.

1. Reliability components *Plate Cylinder Eccentric.*
   For t = 8 hours then
   $R(8) = e^{-0,006 \cdot 8}$
   $= 0,953 = 95,3\ \%$
2. Reliability components *Plate Cylinder Bearing.*
   For t = 8 hours then
   $R(8) = e^{-0,005 \cdot 8}$
   $= 0,961 = 96,1\ \%$
3. Reliability components *Blanket Cylinder Eccentric.*
   For t = 8 hours then
   $R(8) = e^{-0,009 \cdot 8}$
   $= 0,931 = 93,1\ \%$
4. Reliability components *Blanket Cylinder Bearing.*
   For t = 8 hours then
   $R(8) = e^{-0,007 \cdot 8}$
   $= 0,946 = 94,6\ \%$

H. Average Time Between Maintenance (MTBM) In the Machine Component *Goos Universal*-50.

The average time between maintenance includes maintenance (scheduled) and corrective maintenance (unscheduled). The formula used is:

$$MTBM = \frac{Total\ Waktu\ Efektif\ Oprasi\ Mesin}{Frequensi\ Pemeliharaan\ Preventif + Korektif}$$

Example: Components *Plate Cylinder Eccentric* treatment should be done once every 40.77 hours, or every 5.09 days 1 times.

1. MTBM for components *Plate Cylinder Eccentric.*
   $MTBM = \frac{2528}{48+14} = 40,77$ hours (5.09 days)
2. MTBM for components *Plate Cylinder Bearing.*
   $MTBM = \frac{2528}{48+12} = 42,13$ hours (5.26 days)
3. MTBM for components *Blanket Cylinder Eccentric.*
   $MTBM = \frac{2528}{48+23} = 35,6$ hours (4.45 days)
4. MTBM for components *Blanket Cylinder Bearing.*
   $MTBM = \frac{2528}{48+17} = 38,89$ hours (4,86 days)

I. Fpt Each Damage Machine Component *Goos Universal-50*.

FPT is active maintenance frequency, the equation used:

Fpt = $\frac{1-(MTBMx\lambda)}{MTBM}$

Example: Components *Plate Cylinder Eccentric* preventive maintenance should be done as much as 0.0185 maintenance / hours.

1. Fpt for components *Plate Cylinder Eccentric.*
   Fpt = $\frac{1-(40,77x0,006)}{40,77}$= 0,0185 Maintenance / hours
2. Fpt for components *Plate Cylinder Bearing.*
   Fpt = $\frac{1-(42,13x0,005)}{42,13}$= 0,0187 Maintenance / hours
3. Fpt for components *Blanket Cylinder Eccentric.*
   Fpt = $\frac{1-(35,6x0,009)}{35,6}$= 0,0190 Maintenance / hours
4. Fpt for components *Blanket Cylinder Bearing.*
   Fpt = $\frac{1-(38,89x0,007)}{38,89}$= 0,0187 Maintenance / hours

J. Mean Maintenance Time (Mct) Each type Component Damage

Mct = $\frac{Total\ waktu\ pemeliharaan\ korektif)}{Banyaknya\ Pemeliharaan\ korektif}$

The time required for corrective maintenance / replacement for one component.

Example: to replace one component *Plate Cylinder Eccentric* it takes an average time over 2 hours.

1. For components *Plate Cylinder Eccentric.*
   Mct = $\frac{28}{14}$= 2 hours
2. For components *Plate Cylinder Bearing.*
   Mct = $\frac{24}{12}$= 2 hours
3. For components *Blanket Cylinder Eccentric.*
   Mct = $\frac{46}{23}$= 2 hours
4. For components *Blanket Cylinder Bearing.*
   Mct = $\frac{34}{17}$= 2 hours

K. The average time Active Maintenance (M)

M= $\frac{(\lambda xMct)+(FptxMpt)}{\lambda+fpt}$

The time needed to perform preventive and corrective maintenance.

To perform preventive and corrective maintenance routine maintenance + replacement *Plate Cylinder Eccentric* the time required for 6.53 hours.

1. The average time for the active maintenance of components *Plate Cylinder Eccentric.*
   M= $\frac{(0,006x2)+(0,0185x8)}{0,006+0,0185}$= 6,53 hours
2. The average time for the active maintenance of components *Plate Cylinder Bearing.*
   M= $\frac{(0,005x2)+(0,0187x8)}{0,005+0,0187}$= 6,73 hours
3. The average time for the active maintenance of components *Blanket Cylinder Ecentric.*
   M= $\frac{(0,009x2)+(0,0190x8)}{0,009+0,00190}$= 6,07 hours
4. The average time for the active maintenance of components *Blanket Cylinder Bearing.*
   M= $\frac{(0,007x2)+(0,0187x8)}{0,007+0,0187}$= 6,36 hours

Maintainability are factors that indicate a property of systems engineering and have the characteristics to facilitate the maintenance, accuracy, safety and economic factors in exercising its functions. Maintainability Analysis functions include:

1. Component *Plate Cylinder Eccentric.*
   a. The average time corrective maintenance or corrective maintenance mean time (Mct) = 2 hours.
   b. The average time prevention / preventive maintenance mean time (Mpt) = 8 hours.
   c. The average time between maintenance (including corrective and preventive) Mean Time Between Maintenance (MTBM) = 40.77 hours. so the machine *Goos Universal-50* maintenance must be held for damage to components *Plate Cylinder Eccentric* 40.77 per hours.
   d. The frequency of individuals scheduled maintenance / frequency of preventive time (Fpt) = 0.0185 hours.
   e. The average time an active maintenance / maintenance mean (M) = 6.53 hours.

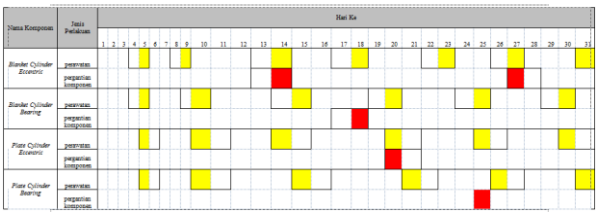
2. Component *Plate Cylinder Bearing.*
   a. The average time corrective maintenance or corrective maintenance mean time (Mct) = 2 hours.
   b. The average time prevention / preventive maintenance mean time (Mpt) = 8 hours.
   c. The average time between maintenance (including corrective and preventive) mean time between maintenance (MTBM) = 42.13 hours. So the machine *Goos Universal-50* maintenance must be held for damage to components *Plate Cylinder Bearing* 42.13 every hours.
   d. The frequency of individuals scheduled maintenance / frequency of preventive time (Fpt) = 0.0187 hours.
   e. The average time an active maintenance / maintenance mean (M) = 6,73 hours.
3. Component *Blanket Cylinder Eccentric.*
   a. The average time corrective maintenance or corrective maintenance mean time (Mct) = 2 hours.
   b. The average time prevention / preventive maintenance mean time (Mpt) = 8 hours.
   c. The average time between maintenance (including corrective and preventive) mean time between maintenance (MTBM) = 35,6 hours. So the machine *Goos Universal-50* maintenance must be held for damage to

components *Blanket Cylinder Eccentric* 35,6 every hours.

d. The frequency of individuals scheduled maintenance / frequency of preventive time (Fpt) = 0,0190 hours.
e. The average time an active maintenance / maintenance mean (M) = 6,07 hours.

4. Component *Blanket Cylinder Bearing.*
   a. The average time corrective maintenance or corrective maintenance mean time (Mct) = 2 hours.
   b. The average time prevention / preventive maintenance mean time (Mpt) = 8 hours.
   c. The average time between maintenance (including corrective and preventive) mean time between maintenance (MTBM) = 38,89 hours. So the machine *Goos Universal-50* maintenance must be held for damage to components *Blanket Cylinder Bearing* 38,89 every hours.
   d. The frequency of individuals scheduled maintenance / frequency of preventive time (Fpt) = 0,0187 hours.
   e. The average time an active maintenance / maintenance mean (M) = 6,36 hours.

Tabel 9. Scheduling Maintenance and Replacement Parts Mesin *Goos Universal-50*



Description: (Yellow) For the fourth component, there are two types of treatment items, namely maintenance (preventive) and corrective maintenance (replacement parts), for components *Blanket Cylinder Eccentric* perform routine maintenance / preventive on day 4 or 5, day 8 or 9, later to 13 or 14 ff. This is based on the calculation (MTBM). (Red) To component Eccentric Blanket Cylinder replacement of components derived from calculations (MTBF).

At In determining when to do preventive maintenance to use the analysis as follows:

1. If you see the results of MTBF engine will be damaged average in operation for 166.67 hours (20.8 days) for damage to components *Plate Cylinder Eccentric*, 200 hours (25 days) for damage to components *Plate Cylinder Bearing*, 111,11 hours (13.9 days) for damage to components *Blanket Cylinder Eccentric*, and 142.86 hours (17.9 days) for damage to components *Blanket Cylinder Bearing*. So that the engine should receive maintenance before the time of the above operations. Or rather the engine should be treated after surgery for 40.77 hours of time for component *Plate Cylinder Eccentric*, 42.13 hours for components *Plate Cylinder Bearing*, 35,6 hours for components *Blanket Cylinder Eccentric*, and 38.89 hours for components *Blanket Cylinder Bearing*. Where the above time is MTBM or the average time maintenance.
2. If look at the results F (t) or opportunities to be damaged machine to machine operated for 8 hours by 4.7% for the component *Plate Cylinder Eccentric*, 3,9 % for components *Plate Cylinder Bearing*, 6,9 % for components *Blanket Cylinder Eccentric*, and 5,4 % for components *Blanket Cylinder Bearing*.

L. Proposed Machine Repair

5W-1H is a method used to find out the problems that happened in detail. In the form of some questions, namely: what, who, where, when, why and how (What, who, where, when, why and how) and presented in tabular form, the following is a table of 5W and 1H:

Table 10. Component Repairs Blanket Cylinder Eccentric Using Methods 5W-1H.

5W1H		Deskripsi	Jawaban	Usulan
Tujuan utama	What (Apa)	Apa yang harus dilakukan?	- Melakukan perawatan komponen setiap hari ke 4-5	- Pergantian komponen Blanket Cylinder yang rusak pada mesin.
Aksan kegunaan	Why (Mengapa)	Mengapa harus dilakukan?	- Jika tidak dilakukan Berakibat pada rejectnya produk dan menghambat proses produksi.	- Perawatan komponen dengan cara membersihkan komponen setelah mesin digunakan agar proses produksi lancar serta mencapai kualitas yang diinginkan.
Lokasi	Where (Dimana)	Dimana terjadi kerusakannya?	- Pada mesin *Goos Universal-50*. Komponen *Blanket Cylinder*	- Ketebalan blanket dan lebar bantalan sesuai ketentuan. - Pemasangan blanket harus berada pada sisi dalam bearer. - Pemasangan blanket harus dilakukan secara bertahap.
Urutan	When (Kapan)	Kapan dilaksanakan perawatan komponen?	- Perawatan komponen dilakukan setiap hari ke 4-5 hari	- Bersihkan kotoran yang tertinggal di dalam pori-pori blanket menggunakan Blanket cleaner.
Orang	Who (Siapa)	Siapa yang melakukan perawatan	- Bagian *maintenance*	- Permasalahan kerusakan komponen sering ditangani terlambat oleh bagian *maintenance* sehingga menyebabkan waktu perbaikannya menjadi lama. - Operator turut menjaga serta merawat komponen, tidak harus menunggu bagian maintenance melakukan perbaikan.
Metode	How (Bagaimana)	Bagaimana cara melakukan perbaikannya?	Sesuai dengan prosedur yang diterapkan oleh perusahaan	- Diadakan tindakan perawatan penggantian pencegahan yang terjadwal dan terencana.

Table 11. Component Repairs *Plate Cylinder Bearing* Using Methods 5W-1H.

5W1H		Deskripsi	Jawaban	Usulan
Tujuan utama	What (Apa)	Apa yang harus dilakukan?	- Melakukan perwatan komponen setiap hari ke 5-6.	- Pergantian komponen *Plate Cylinder* yang rusak pada mesin
Alasan kegunaan	Why (Mengapa)	Mengapa harus dilakukan?	- Jika tidak dilakukan pembersihan berakibat pada fungsi *blanket* karna tinta dan air tidak akan tertransfer ke *blanket*.	- Perawatan komponen dengan cara membersihkan komponen setelah mesin digunakan agar proses produksi lancar serta mencapai kualitas yang diinginkan.
Lokasi	Where (Dimana)	Dimana terjadi kerusakannya?	- Pada mesin *Goos Universal-50*. Komponen *Plate Cylinder*.	- Pemasangan *plate clinder* harus berada pada posisi yang benar agar saat mesin berjalan tidak ada gesekan yang terlalu berat. - Pemasangan *plate clinder* harus dilakukan secara bertahap agar transfer air dan tinta tidak tersendat.
Urutan	When (Kapan)	Kapan dilaksanakan perawatan komponen?	- Perawatan komponen dilakukan setiap hari ke 5-6	- Bersihkan kotoran sisa-sisa tinta dan air yang tertinggal di permukaan plate menggunakan cairan atau pelumas supaya tidak berkarat.
Orang	Who (Siapa)	Siapa yang melakukan perawatan	- Bagian *maintenance*	- Permasalahan kerusakan komponen sering ditangani terlambat oleh bagian *maintenance* sehingga menyebabkan waktu perbaikannya menjadi lama. - Operator turut menjaga serta merawat komponen, tidak harus menunggu bagian maintenance melakukan perbaikan.
Metode	How (Bagaimana)	Bagaimana cara melakukan perbaikannya?	Sesuai dengan prosedur yang diterapkan oleh perusahaan	- Diadakan tindakan perawatan penggantian pencegahan yang terjadwal dan terencana.

IV. Conclusions and Suggestions

A. Conclusion

Based on analysis of data obtained, it can be concluded as follows:

1. The production system contained in PT Pikiran Rakyat Bandung through 4 production machines, namely: Machine *Megtec* (*Reelstand / Flying Faster*) is feeding paper to the printing machine unit. Then the output of the engine *Megtec* be input on the next machine ie machines *Goss Universal*-50 which serves to print images or written on paper, after the paper printed it will then go through the next stage on the machine Rima (*Counter Stacker*) which serves as a calculating machine and compiler pile of newspapers that have been finished and the last pile of newspapers that have been calculated are processed on a machine Mosca (*Straping Machine*) which serves as a binder machine pile of newspapers.

2. Damage often occurs in the machine *Goss Universal*-50 especially on components *Plate Cylinder Eccentric, Plate Cylinder Bearing, Blanket Cylinder Eccentric,* and *Blanket Cylinder Bearing* caused by several factors such as humans due to lack of care and delays in the handling of damage to components, machine factor because the age of the machine is old and many obstacles such as friction are caused by fluctuations in engine speed, the material factors due to more frequent use of spare parts mock perishable factor method because the methods used are often not in accordance with the work instructions that have been set. The majority of of damage the component is worn, rusted and torn blanket. This can result in decreased quantity and quality of the products can even lead to defective products.
3. Based on the FMEA method is obtained is known that the effects of failure as follows:
- The ink is not absorbed by the blanket resulting printout bleed.
- Ink transfer to the paper is not maximal.
- There are no prints because the ink does not stick in *blanket*.

4. Based on the results of the calculation of the reliability of the machine *Goos Universal-50* have a low reliability of components *Plate Cylinder Eccentric* sebesar 95,3 %, component *Plate Cylinder Bearing* as big as 96,1 %, component *Blanket Cylinder Eccentric* as big as 93,1 %, and component *Blanket Cylinder Bearing* as big as 94,6 %. So the machine *Goos Universal-50* The often broken or have a high frequency of damage, it can be seen from the MTBF components that are low on components *Plate Cylinder Eccentric* 166,67 hours, component *Plate Cylinder Bearing* 200 hours, componen *Blanket Cylinder Eccentric* 111,11 hours, and componen *Blanket Cylinder Bearing* 142,86 hours. So that the implementation of maintenance performed should be more effective.

B. Saran

Seeing the results of the analysis of the above conclusions, the suggestions to be conveyed:

1. The company carries out total production maintenance, which will involve all employees PT Pikiran Rakyat Bandung either production or maintenance parts to perform maintenance in the form of lubrication and cleaning action on all existing machines in PT Pikiran Rakyat Bandung.
2. Each before operator of the machine or set up the machine operator must pay attention to or check the hygiene conditions of the engine because if it gets damaged engine amid beroprasi the quality of the product will be ugly.
3. Machinery *Goos Universal-50* by numbering based on the condition of the engine, which is visible from the distribution and frequency of damage that will ease in handling treatment.
4. The period of preventive maintenance should be performed before time MTBF.

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