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# Screw Press Machine Damage Analysis with Failure Mode and Effect Analysis (FMEA) Method in Palm Oil Factory PT. Socfindo Seunagan

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ABSTRACT

*PT. Socfindo is an industry engaged in the processing of Fresh Palm Fruit Bunches into crude palm oil or CPO (Crude Palm Oil). the day in the morning, therefore it is necessary to identify the presence of machine components that are prone to damage (critical components) and special actions are needed to take special actions against critical parts on the machine, by practicing the Predictive Maintenance Program or prevention. Simulation techniques, often known as Monte Carlo simulations, estimate reliability using random sampling of scenarios. Failure mode and effect analysis (FMEA) is defined as a process used to determine the actions that should be taken to ensure that each physical item or system can run properly according to the intended use by the user. Based on the information obtained, the RPN value of the Rubber Coupling Bush is 18, the RPN value of the Worm Screw is 126, the RPN value of the Press Cage is 72, the Adjusting Cone RPN value is 108, the Tie Rod Nut RPN value is 15, the Drive Shaft RPN value is 168, the Bearing RPN value is 12, the Motor Base RPN value is 15.*



## I. Introduction

Improving the performance of a machine in an industry engaged in oil palm processing is very important, in optimizing production activities to achieve good final results so as to increase company productivity. In improving machine performance, it is necessary to pay attention to machine maintenance, so that machines in the production process do not experience failure or damage that will have an impact on the production process.

The Screw Press machine is a machine that has the most important influence in the crude palm oil processing industry, a machine that has a good work function is a machine that is capable of pressing (pressing) with hydraulic pressure ranging from 50-60 Bar. [3]

PT. Socfindo Indonesia is a company engaged in the processing of Palm Oil FFB converted into crude palm oil or commonly called CPO (Crude Palm Oil), Kernel and Shell. This palm oil mill (PKS) has a production capacity of 23 tons/hour where raw materials are obtained from its own plantations.

Maintenance is a routine job where work must be done repeatedly to maintain the facilities and infrastructure owned by the factory so that they can still be used in optimal conditions without experiencing problems, can be used with appropriate efficiency and capacity.[5]

## II. The Proposed Method

Describes the steps that will be arranged in analyzing components.

The screw press machine uses the Failure fashion and effect analysis (FMEA) procedure. In this research, some of the following methods can be identified:

1. Criteria *for severity, occurrence,* and *detection.*

   Describes the level of the obstacle event based on the criteria of severity, occurrence and detection. Each criterion has 1 to 10 ratings. [5]

2. Table *Worksheet* FMEA

   proves that the machine cannot perform its function and cannot be operated due to the failure of the machine. Change information displays when the crash occurred and how long it took for revision. This information can be seen in table 1. [5]

Table 1. Damage and Repair Time of *the Screw Press Machine*

| **No** | **Damaged Components** | **Damage** | **Repair Time** | **Description** |
|---|---|---|---|---|
| 1 | *Rubber Coupling Bush* | Worn/eroded | 1 Hour | Replaced with a new unit |
| 2 | *Worm Screw* | Worn/eroded, Broken | 96 Hours | Replaced with new unit |
| 3 | *Press Cage* | Worn/eroded | 96 Hours | Repaired/ Indirectly replaced |
| 4 | *Adjusting Cone* | Broken | 24 Hours | Replaced with new unit |
| 5 | *Tie Rod Nut* | Worn/eroded, Loose | 1 Hour | Replaced with new unit |
| 6 | *Drive Shaft* | Broken, Worn | 96 Hours | Replaced with a new unit |
| 7 | *bearings* | cannot rotate maximally | 3 Hours | Replaced with a new unit |
| 8 | *Motor Base* | Motoran Scorched, V*Belt* broken/Loose | 4 Hours | Repaired/ Indirectly replaced |

Source: PT.Socfindo Indonesia

## III. Method

Failure Mode And Effect Analysis (FMEA) is one way to identify the damage that occurs in the system (System), design (Design), process (Process), service (service). Failure analysis is usually carried out using several methods, for example giving a score for each level of severity or failure that occurs based on the level of occurrence, severity, and detection. [5]

In conducting the analysis using FMEA it is used to identify the risks that will occur when the operation, maintenance and operational activities of the company. In analyzing this, there are 3 parts that will determine the disturbance, including [5]:

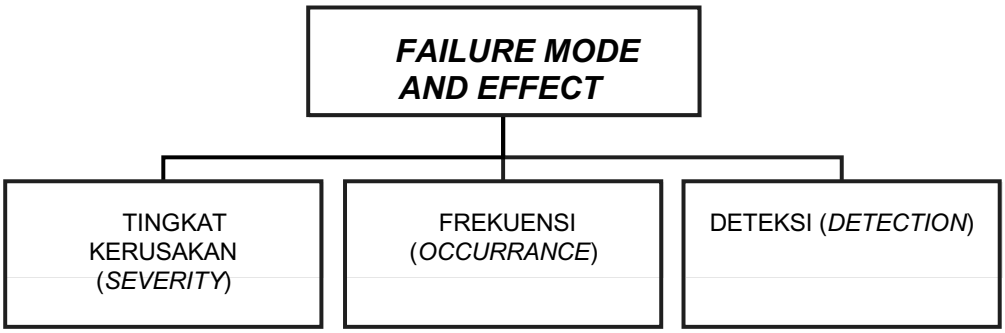


Fig 1. FMEA Parameter Scheme

1. Frequency *Occurrence*

   In ensuring this occurrence, it can be determined how many obstacles can cause a failure in maintenance surgery and factory operational activities.

2. Severity

   In determining the level of damage (severity) it can be determined how serious the damage is caused by the formation of process failures in terms of surgery, maintenance and industrial operational activities.

3. Detection Level (Detection)

   In ensuring this detection level can be determined how the failure can be recognized before it occurs.

Table 2. Determination of *Occurrence*

| ***Occurrence*** | **Criteria** | **Ranking** |
|---|---|---|
| *Extremely unlikely* | Failure will not occur | 1 |
| *Remote Likelihood* | Infrequent failure | 2 |
| *Very low likelihood* | Very few failures will occur | 3 |
| *low likelihood* | will occur. | 4 |
| *Moderately low likelihood* | probability of failure | 5 |
| *Medium likelihood* | probability of failure | 6 |
| *Moderately High likelihood High* | probability of failure | 7 |
| *High Likelihood* | probability of failure | 8 |
| *Very High likelihood* | Possible failure | 9 |
| *Extremely unlikely* | Almost certain failure | 10 |

Source: (Puspitasari, Arianie & Wicaksono 2017).

Table 3. Determination of *Severity*

| Effects | Criteria | Ranking |
|---|---|---|
| *Maximum severity* | Failures that occur will certainly cause Danger | 10 |
| *Extreme severity* | Failures that occur may cause danger, work safety must be considered | 9 |
| *Very high severity* | Downtime increases significantly and results in financial, Product cannot be used but comfortable, Consumers very dissatisfied | 8 |
| *High severity* | *Downtime* increased *significantly*, Product performance has greatly decreased, Consumers are very dissatisfied | 7 |
| *Severe* | , Production is running but performance is shrinking, Consumers are not satisfied | 6 |
| *Moderate* | Effect is visible through the production process Performance is about to decrease slowly Customers are not Satisfied | 5 |
| *Minor* | Smooth creation may be disturbed Consumers notice a small effect on the product | 4 |
| *Slight* | Users may be aware of the impact on production but the effect is very small (Process and consumers) | 3 |
| *Very slight* | Does not affect the smoothness of production Does not affect significant effect on product | 2 |
| *None* | Realized by operator not realized by Consumer | 1 |

Source : (Puspitasari, Arianie & Wicaksono 2017)

Table 4. Determination of *Detection*

| ***Detection*** | **Criteria** | **Ranking** |
|---|---|---|
| *Extremely likely* | Control will be needed to realize *Defect* | 1 |
| *Very high likelihood* | Control is needed to detect *Failure* | 2 |
| *High likelihood* | Control has high effectiveness for detecting | 3 |
| *Moderately high likelihood* | Control has moderately high effectiveness for detecting | 4 |
| *Medium likelihood* | Control has moderate effectiveness for detecting | 5 |
| *Moderately low* | Control has moderately low effectiveness for detecting | 6 |

| | | |
|---|---|---|
| *likelihood* | | |
| *Low likelihood Low* | probability of detection | 7 |
| *Very low likelihood* | Very low probability of being detected | 8 |
| *Remote likelihood* | Control has little effect on detecting *defect* | 9 |
| *Extremely unlikely* | Control will not be able to detect *defect* | 10 |

Source : (Puspitasari, Arianie & Wicaksono 2017)

1. Determination of *Risk Priority Number* (RP) N)
   *Risk Priority Number* is something form Mark who want to show priorities that must be tried for *improvement / revision* of a system so that failure does not occur. There is also an *RPN* obtained by the following formula*.[5]*

   RPN = *Severity* x *Occurrence* x *Detection* (1)

   Description:

   *Severity* : Causes Potential failures taken from interview data

   *Occurrence* : Effects caused by failures taken from interview

   *Detection* : Controlling failures taken from interview data

2. Determine actions to minimize the risk of failure.

***Visual analysis of the screw press***

Fig 2. Screw press

The following is a picture when analyzing parts of the screw press, in this section wears and tear caused by friction that occurs, when the *screw press* works for a long period of time, the material on the screw press is scratched.

## IV. Results and Discussion

The following are the results of the analysis.

1. Assessments based on Severity, Occurrence and Detection are obtained from the following:

a) Rank Severity 7 value (Downtime increased significantly, product performance was greatly decreased, consumers were very dissatisfied) found in the Drive Shaft component,
b) Rank Severity 6 (Smooth production was disrupted, production was running but performance decreased, consumers are not satisfied) found in components of Worm Screw, Press Cage and Adjusting Cone,
c) Ranking Severity 2 (No effect on smooth production, no significant effect on product) found in Rubber Coupling Bush component
d) Ranking Severity 1 value (Recognized by operator, not realized by consumers) is found in the components of the Tie Rod Nut, Bearing and Motor Base.
e) Occurrence value 8 (very high probability of failure rate) is obtained on the Drive Shaft component,
f) Occurrence value of 7 (high probability of failure rate) is found in the Worm Screw component,
g) Occurrence value of 6 (high probability of failure) is found in the Adjusting Cone component,
h) Occurrence value of 5 and 4 (Medium probability of failure, slightly possible failure) on the Tie Rod Nut, Motor Base and Press cage components.
i) Detection value in each component/part is Rank Detection 3 value (Control has high effectiveness for detecting).

2. Implementing the high-risk measurement, RPN is obtained for Recommendations from corrective action, the highest level to prioritize repairs is on the Drive Shaft with an RPN value of 168 and the low level is found in Bearings with an RPN value of 12, thus the company is expected to carry out strict supervision on the Screw Press machine. Number 2.

## V. Conclusion

The conclusions obtained from the results of the internship report at PT. Socfindo Indonesia Assessment of Severity, Occurrence and Detection of 8 components / parts that experience problems for the highest Severity level are in the Drive Shaft component / part with a value of 7, The highest Occurrence rating is found in the Drive Shaft component/part with a value of 8 and the Detection assessment has the same value for each component/part with a value of 3. The Risk Priority Number from the Severity, Occurrence and Detection calculations obtained the highest value on the Drive Shaft component/part with value 168, s while the lowest Risk Priority Number value is found in the component/part Bearing with a value of 12.

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## References

[1] Anleitner, MA, 2010. The Power of Deduction: Failure Modes and Effects Analysis for Design. United States of America: Quality Press.

[2] dyadem. 2009. Guidelines for Failure Mode and Effects Analysis for Automotive, Aerospace and General Manufacturing Industries. New York washington DC: CRC Press.

[3] Hasballah, T., and EWB, Siahaan. 2018. The Effect of Screw Press Pressure on the Process of Pressing Fruit Flesh into Crude Palm Oil. *The Great Dharma Journal.* Vol. 26, No. 1, p. 722-729.

[4] Nasution, M, Bakhori, A & Novarika, W 2021, 'BENEFITS OF THE NEED FOR MAINTENANCE MANAGEMENT FOR WORKSHOP OR INDUSTRY', *Print) Main Bulletin of Engineering*, vol. 16, Online, no. 3, p. 2021.

[5] Puspitasari, NB, Arianie, GP & Wicaksono, PA 2017, 'PROBLEM IDENTIFICATION ANALYSIS USING FAILURE MODE AND EFFECT ANALYSIS (FMEA) AND RISK PRIORITY NUMBER (RPN) METHODS IN SUB ASSEMBLY LINE (Case Study: PT.

Toyota Motor Manufacturing : PT. Indonesia)', *J@ti Undip: Journal of Industrial Engineering*, vol. 12, no. 2, pp. 77–84, viewed 16 February 2022.

[6] Santoso, R., et al., 2021. Optimization of Press Machine Maintenance Using the Failure Mode Effect Analysis (FMEA) Method. *Jambura Industrial Review*. Volume 1, Number 1, p. 1-6.