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Preventive Maintenance Analysis of Komatsu OBS-25T Power Press Machine Using MTBF and MTTR Metrics

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Abstract.
Technological advancements in manufacturing have greatly improved production efficiency, particularly through the use of advanced machinery. As key components of industrial operations, machines must operate optimally to meet production targets, often requiring continuous use. To maintain performance and reliability, regular maintenance in accordance with Standard Operating Procedures (SOPs) is essential. This study analyzes the maintenance management system at PT. XYZ, focusing on the Komatsu OBS-25T Power Press machine. The research evaluates the Preventive Maintenance strategy using Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR) as key performance indicators. The results show that the monthly maintenance schedule is effective. Between January 1 and April 1, 2024, several component failures occurred, including lamp, roll feeder, hand sensor, oil flow, memory slide, alarm No. 11, conveyor belt, and uncoiler malfunctions. The total MTBF was 171.387 minutes (average 13.183 minutes), and the total MTTR was 1.950 minutes (average 150 minutes). The machine of availability rate reached 99%, demonstrating high operational efficiency and effective maintenance management.

Keywords *Maintenance, MTBF, MTTR, Availability, Power Press OBS-25T*

INTRODUCTION

In manufacturing industries, machine operation represents a fundamental aspect of the production process, where equipment is often required to function continuously over extended working periods. This is particularly true for the Komatsu OBS-25T Power Press machine, which operates under demanding conditions to meet production targets. Such circumstances necessitate that the machine consistently maintain an optimal and reliable performance state. Therefore, regular and systematic maintenance is essential to prevent potential breakdowns and avoid production downtime, ensuring the continuity and efficiency of manufacturing operations.

The continuously operating Extruder (ITE) machines are prone to frequent breakdowns and high downtime. To address this, preventive maintenance is carried out every two weeks on the AC panel and blower motor. Based on the analysis, with an MTBF of 259,04 minutes and an MTTR of 19.990,1 minutes, implementing this maintenance schedule improves machine performance to an average of 98% and ensures optimal operational efficiency (Abdul Muchlis, 2021; Fatma et al., 2020). This study

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evaluates the reliability of cold storage machines by calculating MTBF and MTTR. During February 2024–January 2025, 25 failures occurred, with an MTBF of 20.944,8 minutes (349,08 hours) and an MTTR of 130,4 minutes (2,17 hours) (Habibie & Sutrisno, 2025). Optimal maintenance is crucial for smooth production in a manufacturing company. This study of soda and dolomite bucket elevators using MTBF, MTTR, and FMEA found early preventive maintenance and suboptimal staff practices contributed to high RPN scores. Recommendations are provided to improve maintenance effectiveness and reduce unexpected failures (Alfionita & Alifin, 2023).

To ensure the machine remains in optimal condition and operates reliably, a preventive maintenance approach can be applied to the Komatsu OBS-25T Power Press. This method emphasizes proactive maintenance aimed at preventing equipment failures before they occur. n analyzing the Komatsu OBS-25T Power Press machine, the company utilizes several data variables, including machine operating hours, machine condition, electrical condition, hydraulic condition, pneumatic condition, operational performance, and workplace safety. By monitoring and evaluating these variables, the production output can be optimized to meet the company's required targets within the specified timeframe.

LITERATURE REVIEWS

The press machine is an industrial apparatus engineered to produce metal sheets and to form or bend those sheets at specific angles in accordance with operational requirements (Rubowo, 2019). Maintenance is a set of activities performed to restore or preserve the condition of machinery so that it remains fully operational (Ansori & Mustajib, 2013). It can also be defined as the process of sustaining plant facilities and equipment through necessary repairs, adjustments, or component replacements to ensure continued reliability and performance (Corder et al., 1988). Preventive maintenance is a maintenance strategy carried out to prevent the occurrence of failures or breakdowns in production facilities during operational processes. Performance maintenance is composed of three key components: reliability, maintainability, and availability (Dervitsiotis, 1981).

METHODS

The effectiveness of this approach is assessed using key reliability indicators, namely Mean Time Between Failure (MTBF), Mean Time To Repair (MTTR), and availability, which collectively provide a comprehensive evaluation of the machine's performance and maintenance efficiency. By examining the monthly maintenance schedule, machine failure records, and the calculated values of MTBF, MTTR, and availability, a comparative analysis will then be conducted to evaluate the conditions before and after the implementation of preventive maintenance. This comparison serves as a key indicator of the effectiveness of the maintenance activities performed on the press machine. The data were collected from maintenance report as ilustrated from Figure 1.

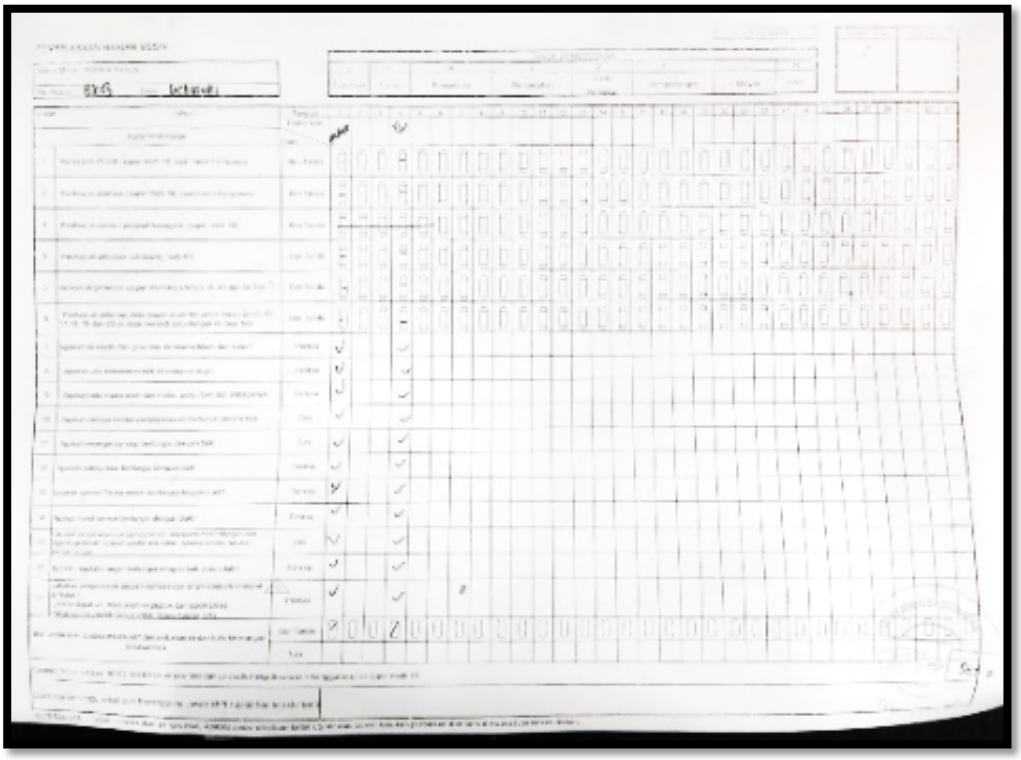

Figure 1. Maintenance report book.

RESULTS AND DISCUSSIONS

Machine Maintenance Schedule.

Based on the data collected from Table 1, the maintenance schedule for the Komatsu OBS-25T power press machine was obtained**.** It can be observed from the table above that the maintenance activities for the power press machine were carried out once every month during the 2024 period.

Table 1. Machine Maintenance Schedule.

NO	Activity	January				February				March				April			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Maintenance																

Machine Failure Data.

The failure data for the power press machine, with machine identification number BP-30, were collected during the internship period based on company records from January to April 2024. The machine failure data are presented in Table 2.

Table 2. Machine Failure Data.

No.	Descriptions	Problem	Repair time	
			Start	Finished
1	The table lamp was off	Broken lamp	02/01/2024 09.53	02/01/2024 11.53
2	Roll feeder off	The electrical cable is broken	05/01/2024 06.48	05/01/2024 08.48
3	Hand sensor off	Change Position	25/01/2024 06.00	25/01/2024 08.00
4	Roll feeder error	Loose control panel socket	29/01/2024 07.30	29/01/2024 09.20
5	Memory slide error	Loose Bolts	06/02/2024 06.40	06/02/2024 09.00
6	Oil does not flow	Leak in the Air Hose	16/02/2024 06.30	16/02/2024 09.30
7	Memory slide error	Loose Bolts	22/02/2024 11.00	22/02/2024 14.00
8	Alarm no. 11 cannot be reset	Hand sensor settings changed	20/03/2024 11.00	20/03/2024 12.00
9	Conveyor belt broken	*Conveyor belt broken*	01/04/2024 20.00	01/04/2024 00.40
10	Roll feeder error	The electrical socket is loose	19/04/2024 15.00	19/04/2024 19.20
11	Roll feeder off	Loose cable	23/04/2024 11.50	23/04/2024 12.50
12	Roll feeder off	Loose cable	23/04/2024 16.30	23/04/2024 19.50
13	Uncoiler Machine was off	Loose cable	25/04/2024 15.00	25/04/2024 17.00

Based on the recorded failure data, it was found that during the period from January to April 2024, the power press machine experienced a total of 13 failures, with 5 recurring failures occurring on the roll feeder component.

MTBF and MTTR Calculation.

In determining the MTBF, MTTR, and Availability values for each machine failure event listed in the power press BP-30 failure data table above, cumulative calculations are applied to obtain the total MTBF, MTTR, and Availability for all failures occurring during the period from January to April 2024.

The result of Mean Time Between Failure (MTBF).

As an example of the calculation based on the power press BP-30 failure data table above, the repair completion time for the "Roll Feeder Failure" was recorded on January 5, 2024, at 08:48, while the start time of the third failure event, "Hand Sensor Failure," was on January 25, 2024, at 06:00. Therefore, the MTBF calculation for the "Roll Feeder Failure" event is as follows:

MTBF incidents = 01/01/2024 from 08.48 to 25/01/2024 06.00.

= 477,2 hour

= 28.632 minute.

The result of Mean Time to Repair (MTTR).

As an example of the calculation based on the power press BP-30 failure data table above, the repair start time for the "Roll Feeder Failure" was recorded on January 5, 2024, at 06:48, while the repair completion time was on January 5, 2024, at 08:48. Therefore, the MTTR calculation for the "Roll Feeder Failure" event is as follows:

MTTR Incidents = 05/01/2024 from 06.48 - 05/01/2024 at 08.48

= 120 minute.

MTTR and MTBF Data and Graph Results.

Based on the MTTR and MTBF calculations, a table and corresponding graph of the obtained data can be created. The total MTTR and MTBF durations can then be summed, as presented in Table 3.

Table 3. MTBF and MTTR Calculations.

No.	Descriptions	Problem	MTBF	MTTR
1	The table lamp was off	Broken lamp	4.015	120
2	Roll feeder off	The electrical cable is broken	28.632	120
3	Hand sensor off	Change Position	5.730	120
4	Roll feeder error	Loose control panel socket	11.360	110
5	Memory slide error	Loose Bolts	14.250	140
6	Oil does not flow	Leak in the Air Hose	8.730	180
7	Memory slide error	Loose Bolts	38.700	180
8	Alarm no. 11 cannot be reset	Hand sensor settings changed	17.760	60
9	conveyor belt broken	*conveyor belt broken*	26.810	280
10	Roll feeder error	The electrical socket is loose	5.270	260
11	Roll feeder off	Loose cable	220	60
12	Roll feeder off	Loose cable	2.590	200
13	Uncoiler Machine was off	Loose cable	7.320	120
TOTAL			171.387	1.950

The qualitative calculations of MTBF and MTTR for each machine failure event can be seen in the MTBF and MTTR calculation table above. Based on the cumulative calculations, the total MTBF for machine failures occurring during the period from January to April 2024 is 171.387 minutes. The total MTTR for the same period is 1.950 minutes.

The calculation of Mean Time Between Failures (MTBF) for the period from January to April 2024 is as follows:

$$\textbf{MTBF}= \frac{171.387}{13} = 13.183 \text{ min}$$

The average time between machine failure events was calculated to be 13.183 minutes.

Similarly, the calculation of Mean Time To Repair (MTTR) for the same period is as follows:

$$\textbf{MTTR}= \frac{1.950}{13} = 150 \text{ min}$$

The average repair time per failure event was determined to be 150 minutes.

The graphical results of component damage from the MTTR and MTTB data calculations are as follows in Figure 2.

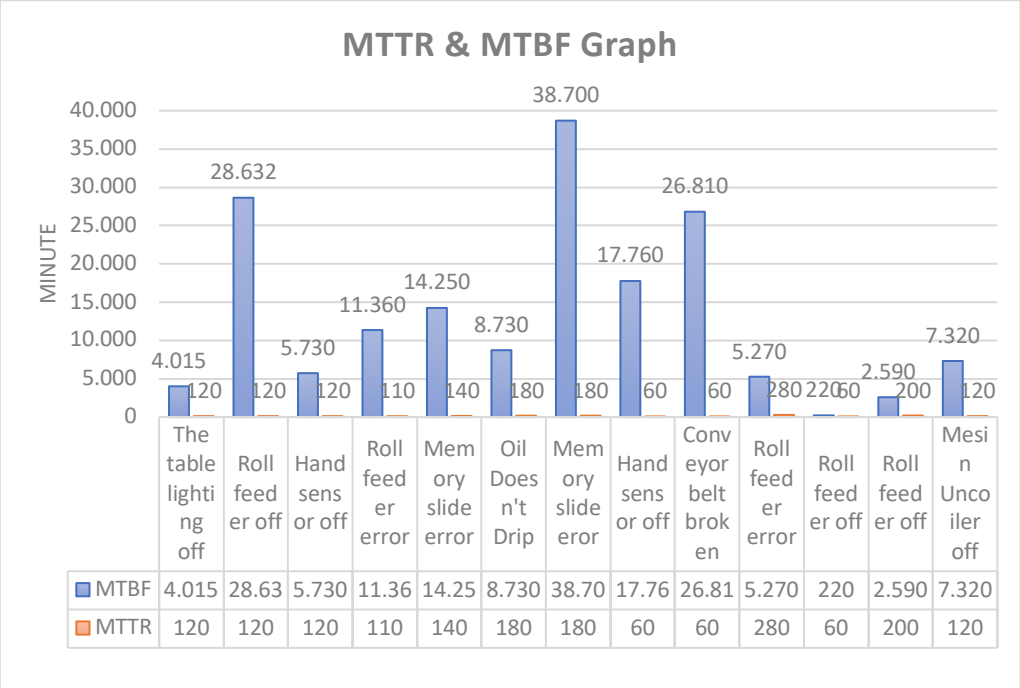

Figure 2. Component failure graph with MTBF and MTTR.

As observed from the Figure 2, the highest MTBF value occurs between the end of the “Oil does not flow” failure and the start of the “Memory Slide Error” component failure, with a duration of 38.700 minutes. Conversely, the lowest MTBF value occurs between the onset of the “Roll Feeder Failure” and the subsequent recurrence of the same “Roll Feeder Failure,” with a duration of 220 minutes.

Regarding MTTR, the highest value was recorded for the repair of the “Roll Feeder Error,” at 280 minutes, while the lowest MTTR value corresponds to the repairs of the “Conveyor Belt is Broken” and “Roll Feeder Failure,” each taking 60 minutes

Availabilty Calculations.

The power press machine operates 24 hours a day for 120 days. During a four-month period, the machine was in operation for a total of 107 days, resulting in a total operating time of 154.080 minutes. Assuming the machine was non-operational for 13 days, the

total downtime amounts to 18.720 minutes. The calculation of Availability, representing the optimal operational condition of the machine for the period from January to April 2024, is as follows:

$$\textbf{Availability} = \frac{(171.387 - 18.720)}{154.080} \text{ x } 100\% = 99\%.$$

Based on the availability calculation, a value of 99% was obtained. The standard for a machine to operate optimally is 98%, indicating that the power press machine is already functioning at an optimal level. Therefore, it is essential to maintain and consistently implement a well-structured preventive maintenance schedule to ensure better management and care of the machine.

CONCLUSION

Preventive maintenance for the Komatsu OBS-25T machine involves several stages, including cleaning the machine areas, inspecting all machine components, performing oil changes, and replacing damaged components. Based on the calculations of MTBF, MTTR, and availability, the results obtained from the failure data of the Power Press OBS-25T over a four-month period are as follows: total MTBF of 13.183 minutes, total MTTR of 150 minutes, and an availability value of 99%.

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