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CORRECTIVE MAINTENANCE ON DEFLECTOR ROLL USING BREAKDOWN METHOD AT PT PELAT TIMAH NUSANTARA (LATINUSA), TBK.

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Graphical abstract

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Abstract

Deflector Roll plays an essential role in the manufacturing of tinplate at PT Pelat Timah Nusantara (Latinusa), Tbk. This research examines the corrective maintenance procedure by employing the breakdown method to pinpoint repeated problems and their resolutions. The primary issues noted include degraded bearings, soiled surfaces, and uneven rollers, all of which hinder production continuity. The maintenance procedures consist of disassembling, examining, replacing, cleaning, balancing, and reassembling. Analyzing 55 documented damage occurrences from 2015 to 2024 reveals that surface-related problems were predominant, with 9 instances (16.36%) of glossy smooth surfaces, followed closely by surface buckling (14.55%) and dirty surfaces (14.55%). The outcome indicates that organized maintenance enhances efficiency and extends roll life span.

Keywords : Breakdown method, Corrective Maintenance, Deflector Roll

Abstrak

Deflector Roll adalah elemen krusial dalam proses pembuatan tinplate di PT Pelat Timah Nusantara (Latinusa), Tbk. Studi ini mengkaji proses pemeliharaan korektif menggunakan metode breakdown guna menemukan masalah serta solusi dari kerusakan yang umum terjadi. Kerusakan utama terjadi pada bearing yang habis pakai, permukaan roll yang kotor, serta ketidakseimbangan pada roll. Tahapan pemeliharaan terdiri dari pembongkaran, pemeriksaan, penggantian, pembersihan, penyeimbangan, dan pemasangan kembali. Dari analisis terhadap 55 kejadian kerusakan deflector roll antara 2015–2024, terungkap bahwa jenis kerusakan yang paling sering terjadi adalah permukaan licin mengkilap sebanyak 9 kasus (16,36%), diikuti oleh kerusakan surface buckle (14,55%) dan permukaan kotor (14,55%). Temuan penelitian ini menunjukkan bahwa perawatan yang terencana dapat meningkatkan efisiensi dan memperpanjang masa pakai roll.

Kata kunci : Deflector Roll, Metode Breakdown, Perawatan Korektif

1.0 INTRODUCTION

The creation of tinplate entails a sequence of complex mechanical processes that need to be carried out with accuracy and uniformity to guarantee compliance with global quality standards. Central to these operations is the Deflector Roll, an essential mechanical component whose main role is to ensure the correct path and tension of slender steel strips as they move through the electroplating and coating processes. In places like PT Latinusa, where production levels are elevated and time-critical, any disruption from roll failure can jeopardize not only output but also the structural stability and surface finish of the end product. Due to the seriousness of these outcomes, it is essential to create maintenance strategies that are both reactive and adaptable to the operational conditions. Conventional corrective methods, particularly those based on breakdown maintenance, offer a quick but often reactive response to equipment failure. This study aims to deliver a comprehensive assessment of breakdown-oriented corrective maintenance implemented on Deflector Rolls, focusing on defining the characteristics of repeated failures, analyzing the maintenance decision-making process, and suggesting data-informed enhancements that comply with industrial reliability benchmarks.

2.0 METHODOLOGY

This study adopts a quantitative approach to examine patterns of equipment failure and the impact of corrective maintenance on deflector roll performance at PT Latinusa. The research relies on numerical analysis derived from company maintenance records spanning 2015 to 2024. A total of 55 data entries were extracted, each representing individual failure events including parameters such as installation and replacement dates, surface condition, roll lifespan, diameter, and hardness.

Data were collected through structured observation during corrective maintenance activities, alongside technical documentation and logbook reviews. The following quantitative metrics were analyzed: failure frequency, distribution of failure types, component lifespan, and percentage contribution of each defect to total failure occurrences. Tools utilized during maintenance include hoist cranes, dial indicators, torque wrenches, and balancing machines. Maintenance steps consisted of:

1. Fault isolation and lock-out tagging
2. Disassembly and inspection
3. Cleaning, measurement and condition grading
4. Replacement of bearings and seals
5. Roll balancing and realignment

The data were processed using descriptive statistical techniques and presented in the form of frequency tables, Pareto charts, and summary matrices to highlight the dominant types of failure and their operational consequences.

3.0 RESULTS AND DISCUSSION

Table 1. Summary of Deflector Roll Surface Failures (2015–2024)

Roll Code	Install Date	Replace Date	Lifespan (Days)	Diameter (mm)	Hardness (mm)	Surface Condition
RM 3-301	12-Nov-15	09-May-16	179	239	70	Roll Wobble
RM 3-302	23-Dec-20	26-May-21	154	239	72	Surface Buckling
RM 3-303	08-Aug-18	04-Mar-20	574	240	72	Surface Dirty
RM 3-304	18-Jan-18	28-May-18	130	239	70	Scratched Surface
RM 3-305	25-Sep-19	12-Feb-20	140	239	70	Unbalanced, Dusty
RM 3-306	30-Apr-20	12-Oct-20	165	239	70	Surface Contamination
RM 3-307	16-Oct-17	21-Feb-18	128	239	71	Contaminated Surface
RM 3-308	03-Jul-15	11-Aug-16	405	240	72	Shiny Surface
RM 5-501	08-Nov-16	18-Jan-18	436	240	72	Buckled, Scratched
RM 5-502	21-Apr-16	06-Jul-17	441	240	72	Clean Surface
RM 5-503	02-Mar-20	20-Jul-20	140	239	71	Buckled Surface
RM 5-504	16-Jan-19	22-Apr-19	96	239	71	Groove Indications
RM 5-505	07-Jul-21	01-Nov-21	117	239	71	White Dust Accumulation
RM 5-506	26-Jun-17	21-Dec-17	178	240	72	Clean Surface
RM 5-507	19-Aug-19	24-Oct-19	66	239	71	Surface Dullness
RM 3-301	12-Nov-15	09-May-16	179	239	70	Roll Wobble

Table 2. Damage sheet on deflector roll period 2015-2024

Failure Type	Frequency	Percentage %
Shiny Smooth Surface	9	16.36 %
Surface Buckling	8	14.55 %
Surface Contamination	8	14.55 %
Surface Scratches	8	14.55 %
Surface Dullness	7	12.73 %
Dust Contamination	6	10.91 %
Unbalance	3	5.45 %
Roll Wobble	3	5.45 %
Groove Indications	1	1.82 %
White Dust Accumulation	1	1.82 %

Examination of the gathered data shows that of the 55 recorded roll failures, almost half were clearly due to defects related to the surface—specifically excessive gloss, mechanical buckling, and contamination from particles. Though these defects appear minor, they have significant effects on the roll's mechanical performance, especially regarding slippage, vibration, and misalignment. The most frequent failure mode—glossy smooth surface (16.36%)—was often associated with heat-related micro-abrasion due to insufficient lubrication cycles. Buckling (14.55%) was commonly seen in rolls that underwent extended use without rebalancing, while failures due to contamination (14.55%) were closely linked to shortcomings in daily cleaning practices.

In contrast, infrequent but more severe events included structural imbalance and fatigue wear, which frequently required total component replacement and caused production interruptions lasting over 24 hours. The longest-lasting roll (RM 3-303) exhibited a working life of 574 days, credited to excellent alloy formulation and enhanced rotation cycles. These results support a transition to predictive maintenance, highlighting the importance of sensor monitoring, vibration assessment, and sophisticated data analysis to prevent significant failures.

Additionally, Pareto-based prioritization indicated that tackling the top 20% of failure modes could reduce over 80% of operational interruptions, validating the effectiveness of strategic resource distribution.

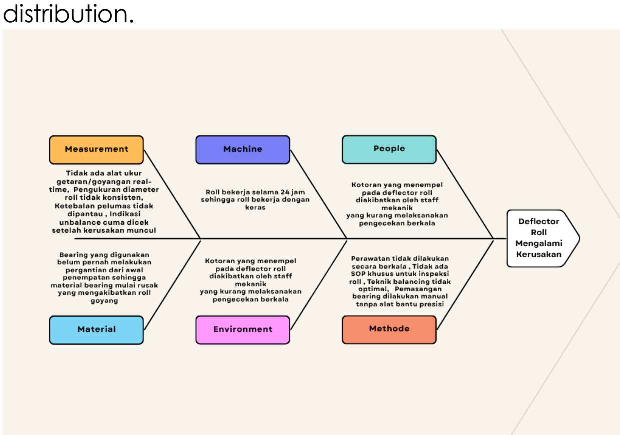

Figure 2. Fishbone Diagram

This fishbone diagram visualizes the root causes that contribute to deflector roll failures at PT Latinusa. The causes are grouped into six major categories: Measurement, Machine, People, Material, Environment, and Method.

1. Measurement
   Lack of real-time vibration sensors and inconsistent diameter measurement resulted in undetected unbalance. Lubrication thickness was not monitored regularly, and imbalance was only identified after failures had already occurred.
2. Machine
   The deflector roll operates continuously for 24 hours, subjecting it to high operational stress and accelerated wear.
3. People
   Roll surface contamination was often caused by mechanical staff who failed to carry out regular cleaning and inspection routines.
4. Material
   Bearings had not been replaced since initial installation, causing material fatigue and mechanical instability that led to roll vibrations.
5. Environment
   Contaminants from the surrounding environment adhered to the roll surface due to insufficient cleaning, further accelerating wear.
6. Method
   There was no standardized operating procedure (SOP) for roll inspection, balancing techniques were suboptimal, and bearing installation was conducted manually without precision tools.

These findings emphasize the need for comprehensive maintenance strategies that not only focus on reactive repairs but also incorporate preventive and predictive measures addressing each root cause domain.

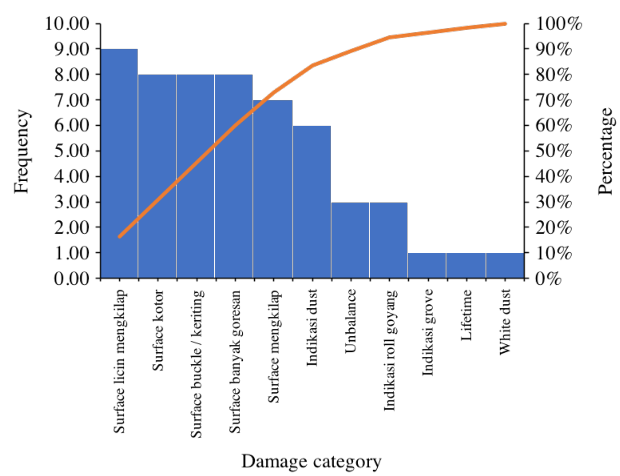

Figure 3. Graphic of percentage deflector roll

The Pareto chart above presents the distribution of failure types on Deflector Roll No. 20 (#122) based on their frequency and cumulative percentage. The bar graph displays the most common defects—shiny surface, dirty surface, buckling, scratches, and dullness—while the orange line indicates the cumulative impact of these defects. The analysis reveals that a small group of dominant failure types (the first 4–5 categories) account for more than 80% of all issues. Specifically, the shiny surface defect appears as the most frequent issue, followed closely by dirt buildup and structural buckling. These types of failures are consistent with those identified in the fishbone diagram and highlight the urgent need to improve surface monitoring, cleaning practices, and mechanical inspection routines. The chart confirms the applicability of the Pareto principle (80/20 rule), suggesting that focusing on a limited number of failure modes can significantly enhance overall system reliability and reduce downtime.

4.0 CONCLUSION

The use of corrective maintenance through the breakdown method has shown to be successful in resolving urgent failures in deflector rolls at PT Pelat Timah Nusantara (Latinusa), Tbk. Yet, the repeated occurrence of certain failure categories like glossy surfaces, dirt buildup, and surface warping—which collectively represent more than 60% of all failures—suggests fundamental systemic flaws. A quantitative analysis of 55 failure incidents, supplemented by fishbone and Pareto assessments, reveals that the majority of problems arise from inconsistencies in measurements, absence of standard operating procedures (SOP), extended bearing usage, and poor environmental control.

These elements emphasize the importance of shifting from solely reactive maintenance to a more proactive and data-informed approach. To improve long-term reliability of equipment and operational efficiency, it is advised that the company adopts preventive and predictive maintenance strategies. This involves applying real-time vibration assessment, creating standard operating procedures for regular inspections, enhancing balancing methods, and providing adequate training for mechanical personnel. By addressing the underlying issues identified in this study, PT Latinusa can anticipate a decrease in unplanned downtime, an increase in roll lifespan, and enhanced overall production quality.

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