

ABSTRAK

Keandalan mesin produksi merupakan faktor kunci dalam menjaga kelancaran operasional dan kualitas produk di industri manufaktur. Penelitian ini dilakukan di PT. XYZ, perusahaan manufaktur komponen kedirgantaraan, yang mengalami *downtime* signifikan pada mesin CNC selama periode Juli 2023 hingga Juli 2024. Total waktu *breakdown* mencapai 2.886 jam, dengan komponen *Electrical Parts* menyumbang 70% dari total *downtime*. Penelitian ini bertujuan untuk mengidentifikasi penyebab utama *downtime* serta menyusun strategi pemeliharaan berbasis analisis reliabilitas. Metode yang digunakan adalah *Reliability Centered Maintenance* (RCM) yang dikombinasikan dengan *Failure Mode and Effect Analysis* (FMEA), *Logic Tree Analysis* (LTA), serta analisis MTTR, MTBF, dan distribusi *Weibull*. Hasil FMEA menunjukkan bahwa *Electrical Parts* merupakan komponen paling kritis dengan nilai RPN tertinggi sebesar 384, sedangkan analisis LTA mengkategorikannya sebagai *safety issue*. Analisis *Weibull* menunjukkan bahwa sebagian besar komponen memiliki nilai $\beta < 2$, termasuk *Electrical Parts* ($\beta = 1,46$) yang mencerminkan pola *wear-out failure*. Berdasarkan temuan tersebut, strategi pemeliharaan disusun berdasarkan hasil analisis keandalan dan tingkat risiko dari tiap komponen, dengan penerapan *Scheduled Restoration* (SR), *Scheduled Discard* (SD), *Condition Directed* (CD), *Time Base Maintenance* (TBM), *Failure Finding* (FF), dan *Time- Directed* (TD). Penelitian ini menghasilkan jadwal pemeliharaan tahunan yang mencakup interval inspeksi dan penggantian komponen, disesuaikan dengan tingkat kritikalitas dan karakteristik distribusi kegagalan masing-masing komponen. Diharapkan, penerapan strategi ini dapat menurunkan frekuensi *downtime*, meningkatkan keandalan mesin CNC, serta mendukung kelancaran dan mutu proses produksi di PT. XYZ.

Kata Kunci: CNC, *downtime*, *Maintenance*, *Reliability Centered Maintenance* (RCM), *Failure Mode and Effect Analysis* (FMEA)

ABSTRACT

The reliability of production machinery is a key factor in maintaining smooth operations and product quality in the manufacturing industry. This study was conducted at PT. XYZ, an aerospace component manufacturing company, which experienced significant downtime on CNC machines from July 2023 to July 2024. The total breakdown time reached 2,886 hours, with Electrical Parts accounting for 70% of the total downtime. The aim of this research is to identify the main causes of downtime and develop a maintenance strategy based on reliability analysis. The method employed is Reliability Centered Maintenance (RCM), combined with Failure Mode and Effect Analysis (FMEA), Logic Tree Analysis (LTA), as well as MTTR, MTBF, and Weibull distribution analysis. The FMEA results indicate that Electrical Parts are the most critical components, with the highest RPN value of 384, while LTA categorizes them as a safety issue. The Weibull analysis shows that most components have a β value < 2 , including Electrical Parts ($\beta = 1.46$), which reflects a wear-out failure pattern. Based on these findings, the maintenance strategy was developed according to the reliability and risk level of each component, applying Scheduled Restoration (SR), Scheduled Discard (SD), Condition Directed (CD), Time-Based Maintenance (TBM), Failure Finding (FF), and Time-Directed (TD) actions. This research results in an annual maintenance schedule covering inspection intervals and component replacement, tailored to the criticality and failure distribution characteristics of each component. The implementation of this strategy is expected to reduce downtime frequency, improve the reliability of CNC machines, and support the continuity and quality of the production process at PT. XYZ.

Keywords: CNC, downtime, maintenance, Reliability Centered Maintenance (RCM), Failure Mode and Effect Analysis (FMEA)