

INTISARI

Kegagalan berulang pada baut *track roller non-genuine* pada *bulldozer* menyebabkan lepasnya track roller dan mengganggu operasional alat berat. Penelitian ini bertujuan menganalisis karakteristik baut *track roller genuine* dan *non-genuine* serta menentukan perlakuan panas yang paling optimal untuk meningkatkan sifat mekanik baut *non-genuine*. Penelitian dilakukan menggunakan variasi perlakuan panas berupa *quenching* oli 900°C, *quenching-tempering* 300°C, dan *normalizing*. Pengujian meliputi uji komposisi kimia, kekerasan *Vickers*, impak *Charpy*, keausan *Ogoshi*, dan analisis struktur mikro. Hasil penelitian menunjukkan bahwa baut *genuine* menggunakan baja 20MnB5, sedangkan baut *non-genuine* menggunakan baja 45S20. Perlakuan *quenching* meningkatkan kekerasan dan ketahanan aus paling tinggi, tetapi material menjadi lebih getas. Perlakuan *quenching-tempering* menghasilkan kombinasi kekerasan, ketangguhan, dan ketahanan aus yang paling seimbang melalui pembentukan *tempered martensite*. Sementara itu, *normalizing* meningkatkan homogenitas struktur mikro, namun peningkatannya tidak setinggi perlakuan berbasis *quenching*. Perlakuan *quenching-tempering* 300°C menjadi metode paling optimal untuk aplikasi baut *track roller* yang menerima beban dinamis dan berulang. Hasil penelitian ini menunjukkan bahwa optimasi perlakuan panas dapat meningkatkan performa baut *track roller non-genuine* dan berpotensi mengurangi kegagalan serta *downtime* alat berat.

Kata kunci: baut *track roller*, *heat treatment*, kekerasan, keausan, *quenching*, *tempering*

ABSTRACT

Repeated failure of non-genuine track roller bolts in bulldozers can cause track roller detachment and disrupt heavy equipment operations. This study aimed to analyze the characteristics of genuine and non-genuine track roller bolts and determine the most effective heat treatment method to improve the mechanical properties of non-genuine bolts. The study applied several heat treatment variations, including oil quenching at 900°C, quenching-tempering at 300°C, and normalizing. The tests conducted included chemical composition analysis, Vickers hardness testing, Charpy impact testing, Ogoshi wear testing, and microstructure analysis. The results showed that the genuine bolt was made of 20MnB5 steel, while the non-genuine bolt used 45S20 steel. The quenching treatment produced the highest hardness and wear resistance but increased brittleness. The quenching-tempering treatment provided the best balance of hardness, toughness, and wear resistance through the formation of tempered martensite. Meanwhile, the normalizing treatment improved microstructure uniformity, although the improvement was lower than quenching-based treatments. Overall, the quenching-tempering treatment at 300°C was the most optimal method for track roller bolt applications subjected to dynamic and repetitive loading. This study shows that heat treatment optimization can improve the performance of non-genuine track roller bolts and potentially reduce failures and equipment downtime.

Keywords: track roller bolt, heat treatment, quenching, tempering, hardness, wear resistance