ABSTRACT

Failure of hoist cylinder in Caterpillar 773 Off-Highway Truck (OHT) units often leads to unscheduled breakdowns, significantly impacting mining operational productivity. This study aims to analyze the root causes of hoist cylinder failure using the Root Cause Analysis (RCA) method and experimental validation. Damage identification revealed various failure phenomena such as gaps, jamming, low power, and drifting, with internal leaks identified as the most dominant failure based on actual field data. RCA results indicated that the primary root cause was overloading, reaching 85 tons compared to the standard 55 tons, which triggered a drastic pressure surge up to 2,967 psi. This high-pressure condition is exacerbated by operational abuse, specifically non-compliance with Standard Operating Procedures (SOP) during dumping activities, which disrupts pressure distribution between the hoist and brake cooling systems. Experimental validation of the wear ring components demonstrated that excessive pressure and increased operating temperatures accelerate the wear rate of the composite material. Hardness testing of the failed components showed a 4-5 times decrease in hardness levels below the 18-25 HV standard; the component's durability is only maintained if operational pressure remains within the standard limit of 2,500–2,575 psi. As a mitigation step, this study recommends a maintenance strategy that includes seal kit replacement every 6,000 HM for units operating beyond 30,000 HM, alongside strict supervision of payload capacity and adherence to operational procedures.

Keywords: Hoist Cylinder, Hydraulic System, Internal Leak, Off-Highway Truck

INTISARI

Kegagalan *hoist cylinder* pada unit *Off-Highway Truck* (OHT) Caterpillar 773 sering kali mengakibatkan *unscheduled breakdown* yang berdampak signifikan pada produktivitas operasional tambang. Penelitian ini bertujuan untuk menganalisis akar penyebab kegagalan *hoist cylinder* dengan menggunakan metode *Root Cause Analysis* (RCA) dan validasi eksperimental. Identifikasi kerusakan menunjukkan berbagai fenomena kegagalan seperti *gap, jammed, low power,* dan *drift*, dengan *internal leak* sebagai kerusakan paling dominan berdasarkan data aktual di lapangan. Hasil analisis RCA mengungkap bahwa akar permasalahan utama adalah beban muatan berlebih yang mencapai 85 ton dari standar 55 ton, sehingga memicu lonjakan tekanan drastis hingga 2.967 psi. Kondisi *high pressure* ini diperparah oleh *operational abuse* berupa ketidakpatuhan terhadap SOP saat aktivitas *dumping*, yang mengganggu distribusi tekanan antara sistem *hoist* dan *brake cooling*. Validasi eksperimental terhadap komponen *ring wear* menunjukkan bahwa tekanan berlebih dan peningkatan temperatur kerja mempercepat laju keausan material komposit. Hasil uji kekerasan material yang telah mengalami kegagalan menunjukkan terjadi penurunan tingkat kekerasan 4-5x lipat dibawah standar 18-25 HV, ketahanan komponen tersebut hanya tercapai jika tekanan operasional terjaga pada batas standar 2.500–2.575 psi. Sebagai langkah mitigasi, penelitian ini merekomendasikan strategi perawatan yang mencakup penggantian *seal kit* setiap 6.000 HM pada unit yang sudah beroperasi melebihi 30.000 HM serta pengawasan ketat terhadap kapasitas muatan dan kepatuhan prosedur operasional.

Kata kunci: *Hoist Cylinder*, Sistem Hidrolik, Kebocoran Internal, *Off-Highway Truck*