

ABSTRACT

This study investigates the premature failure of swing machinery in a post-rebuild 125-ton excavator using a Root Cause Analysis (RCA) approach. The unit operated for only 3,642 service hours (HM), far below the fleet average of 18,872 HM. Three analytical methods were applied: Ishikawa Diagram, 5 Whys, and Fault Tree Analysis (FTA). Findings reveal that the failure originated from three interacting factors. First, swing bearing clearance was installed at 3.4 mm, exceeding the allowable range of 0.5–2 mm. Second, the excessive clearance caused misalignment between the pinion shaft gear and swing circle, producing edge loading and uneven load distribution across the contact surface. Third, repeated jack swing actions at the same position without component disassembly further concentrated the load. The progressive interaction of these factors triggered concentrated chipping, shaft deflection, and ultimately torsional fatigue fracture. Lubrication and contamination were eliminated as contributing causes, as oil analysis program data confirmed normal conditions throughout the operating period. This study highlights the critical importance of strict adherence to installation standards and proper operational response procedures in preventing premature failure of post-rebuild components.

Keywords: *premature failure, swing machinery, root cause analysis, bearing clearance, torsional fatigue fracture*

INTISARI

Penelitian ini mengkaji *premature failure* pada *swing machinery* excavator kelas 125 ton pasca-*rebuild* menggunakan pendekatan *Root Cause Analysis* (RCA) melalui Diagram Ishikawa, analisis 5 *Whys*, dan *Fault Tree Analysis* (FTA). Unit hanya beroperasi selama 3.642 jam meter (HM), jauh di bawah rata-rata umur pakai armada sebesar 18.872 HM. Hasil analisis mengidentifikasi tiga faktor penyebab yang saling berinteraksi. Pertama, *clearance swing bearing* terpasang sebesar 3,4 mm, melebihi rentang standar 0,5–2 mm. Kedua, *clearance* berlebih menyebabkan *misalignment* pada kontak gigi *pinion shaft* dan *swing circle*, sehingga terjadi *edge loading* dan distribusi beban tidak merata. Ketiga, tindakan *jack swing* berulang pada posisi yang sama tanpa pembongkaran komponen memperparah konsentrasi beban. Interaksi ketiga faktor tersebut secara progresif mengakibatkan *chipping* terkonsentrasi, defleksi *shaft*, dan akhirnya *torsional fatigue fracture*. Faktor pelumasan dan kontaminasi dieliminasi sebagai penyebab berdasarkan data Program Analisa Pelumas yang menunjukkan kondisi normal sepanjang periode operasi. Temuan ini menegaskan pentingnya kepatuhan terhadap standar pemasangan dan prosedur penanganan keluhan operasional dalam mencegah kegagalan prematur pada komponen pasca-*rebuild*.

Kata Kunci: *premature failure, swing machinery, root cause analysis, clearance, torsional fatigue fracture*