

INTISARI

Keandalan generator sangat penting dalam sistem kelistrikan industri karena gangguan padanya dapat menyebabkan *blackout* yang berdampak pada kerugian operasional dan finansial industri. Salah satu gangguan paling serius adalah gangguan tanah pada stator (*stator ground fault*), yang mencakup sekitar 23% dari total kasus kegagalan generator. Gangguan ini dapat berkembang menjadi *arc fault* serta memicu lonjakan potensial tanah yang membahayakan peralatan dan keselamatan. Penelitian ini bertujuan mengevaluasi dampak konfigurasi sistem pentanahan eksisting dan membandingkan karakteristik antara *Single Point Neutral Grounding* dan *Hybrid Neutral Grounding*, terutama terhadap perilaku arus gangguan tanah berdasarkan titik lokasi gangguan serta efektivitas kinerja relai *ground overcurrent*. Hasil pengujian menunjukkan bahwa sistem pentanahan solid menghasilkan arus gangguan sangat besar hingga 60 kA dan menimbulkan kegagalan koordinasi proteksi, sedangkan konfigurasi *low neutral grounding resistance* mampu meredam arus gangguan namun berisiko terhadap kondisi sistem *floating*. Adapun konfigurasi *hybrid neutral grounding* terbukti dapat mengatasi kekurangan kedua pendekatan sebelumnya dengan menjaga koordinasi proteksi secara optimal, meskipun masih memerlukan evaluasi tambahan pada proteksi cadangan. Oleh karena itu, *hybrid neutral grounding* direkomendasikan sebagai solusi sistem pentanahan yang optimal bagi sistem distribusi industri khususnya pada sistem penelitian ini adalah sistem distribusi industri kilang minyak 13,8 kV.

Kata kunci: Sistem Pentanahan Generator, *Single Point Neutral Grounding*, *Hybrid Neutral Grounding*, Sistem Proteksi, Koordinasi Proteksi.

ABSTRACT

The reliability of generators is crucial in industrial power systems, as any disturbances can lead to blackouts, resulting in significant operational and financial losses. One of the most critical disturbances is a stator ground fault, which accounts for approximately 23% of total generator failure cases. This type of fault can escalate into an arc fault and trigger sudden ground potential rises, posing serious risks to equipment and personnel safety. This study aims to evaluate the impact of the existing grounding system configuration and compare the characteristics of Single Point Neutral Grounding and Hybrid Neutral Grounding, particularly in terms of ground fault current behavior based on fault location and the effectiveness of ground overcurrent relay performance. Test results indicate that a solid grounding system generates extremely high fault currents—up to 60 kA—leading to protection coordination failure. Meanwhile, a low neutral grounding resistance configuration effectively limits the fault current but poses a risk of a floating system condition. The hybrid neutral grounding configuration has been proven to overcome the shortcomings of the previous approaches by maintaining optimal protection coordination, although further evaluation of backup protection is still required. Therefore, hybrid neutral grounding is recommended as the optimal grounding system solution for industrial distribution systems, particularly in this study's context of a 13.8 kV oil refinery industrial distribution system.

Keywords : *Generator Grounding System, Single Point Neutral Grounding, Hybrid Neutral Grounding, Protection System, Protection Coordination.*