

RINGKASAN

ANALISIS KOORDINASI PROTEKSI GENERATOR DAN TRANSFORMATOR TERHADAP GANGGUAN ARUS HUBUNG SINGKAT DI PT. PLN INDONESIA POWER MRICA

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Proteksi pada generator dan transformator merupakan aspek penting untuk menjamin keandalan dan keselamatan sistem pembangkit. Sistem proteksi harus mampu mendeteksi gangguan hubung singkat dan mengisolasi bagian yang terganggu secara cepat untuk mencegah kerusakan peralatan dan pemadaman. Namun, sering terjadi permasalahan koordinasi antar unit proteksi khususnya antara rele diferensial, rele arus lebih (OCR), dan rele gangguan tanah (GFR) yang dapat menyebabkan operasi rele menjadi tidak selektif atau terlambat. Penelitian ini bertujuan mengevaluasi dan mengoptimalkan koordinasi proteksi pada unit generator dan transformator di PT PLN Indonesia Power Mrica dengan acuan standar PLN/IEC.

Hasil penelitian menunjukkan sistem eksisting telah memiliki struktur proteksi primer-cadangan, namun masih terdapat ketidaksesuaian *grading time* antar-rele. Setelah optimasi, diperoleh rekomendasi slope diferensial sekitar 13% dengan pickup sekunder 0,0438 A, Iset OCR sekitar 10 A dengan TMS 0,273 s, serta pengurangan waktu definite GFR menjadi 0,4 s. Verifikasi melalui TCC dan simulasi ETAP menunjukkan peningkatan selektivitas dengan margin waktu $\geq 0,2$ s dan penurunan risiko mal-trip. Implementasi hasil ini diharapkan meningkatkan keandalan sistem proteksi serta menjaga kontinuitas operasi pembangkit secara keseluruhan.

Kata kunci : Rele Diferensial, *Overcurrent Rele*, *Ground-fault Rele*, Koordinasi Proteksi, Gangguan Hubung Singkat, Generator, Transformator

SUMMARY

Analysis of Generator and Transformer Protection Coordination Against Short Circuit Current Disturbances at PT. PLN Indonesia Power Mrica Substation

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Protection of generators and transformers is an important aspect of ensuring the reliability and safety of power generation systems. Protection systems must be able to detect short-circuit faults and quickly isolate the affected parts to prevent equipment damage and power outages. However, coordination problems often occur between protection units, particularly between differential relays, overcurrent relays (OCR), and ground-fault relays (GFR), which can cause relay operation to be non-selective or delayed. This study aims to evaluate and optimize protection coordination in generator and transformer units at PT PLN Indonesia Power Mrica with reference to PLN/IEC standards.

The results of the study show that the existing system already has a primary-backup protection structure, but there are still discrepancies in the grading time between relays. After optimization, the recommended differential slope is around 13% with a secondary pickup of 0.0438 A, Iset OCR around 10 A with TMS 0.273 s, and a reduction in GFR definite time to 0.4 s. Verification through TCC and ETAP simulation shows an increase in selectivity with a time margin of ≥ 0.2 s and a reduction in the risk of mal-trip. The implementation of these results is expected to improve the reliability of the protection system and maintain the overall continuity of power plant operations.

Keywords: Differential Rele, Overcurrent Rele, Ground-fault Rele, Protection Coordination, Short Circuit Fault, Generator, Transformer