

ABSTRAK

Analisis Metode *Unbalance Dielektrik* terhadap Keandalan Sistem Transmisi pada SUTT 150 kV Sambutan – Muara Badak
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Saluran Udara Tegangan Tinggi (SUTT) 150 kV Sambutan–Muara Badak merupakan salah satu saluran transmisi memiliki tingkat kerawanan gangguan tinggi akibat sambaran petir. Salah satu upaya teknis yang dilakukan adalah penggunaan metode *unbalance dielektrik*, yaitu membuat perbedaan jumlah keping isolator sirkit 1 menggunakan 11 keping isolator dan Sirkit 2 menggunakan 13 keping isolator. Analisis dilakukan melalui perhitungan *Critical Flashover (CFO)*, simulasi tegangan lebih akibat sambaran petir menggunakan aplikasi EMTP, serta evaluasi data historis gangguan. Hasil penelitian menunjukkan bahwa nilai CFO pada Sirkit 2 lebih tinggi dibandingkan Sirkit 1, yaitu sebesar 1.230 kV pada Sirkit 2 dan 1.076 kV pada Sirkit 1. Hasil simulasi EMTP dengan arus petir 30 kA, tegangan isolator sirkit 1 mencapai 1.154,86 kV yang melebihi CFO 1.076 kV, sedangkan tegangan isolator sirkit 2 hanya mencapai 96,241 kV jauh di bawah CFO 1.230 kV. Perbedaan nilai ini menyebabkan *flashover* akibat sambaran petir lebih berpeluang terjadi pada Sirkit 1, sehingga gangguan tidak terjadi secara bersamaan pada kedua sirkit. Data gangguan *double sirkit* sebelum penerapan metode *unbalance dielektrik* (2021) sebesar 33%, setelah *unbalance dielektrik* (2022-2025) gangguan *double sirkit* hanya 7,7 %. Berdasarkan hasil analisis, disimpulkan bahwa penerapan metode *unbalance dielektrik* efektif meningkatkan keandalan sistem dengan mengendalikan lokasi terjadinya *flashover* akibat sambaran petir.

Kata kunci: *Unbalance dielektrik*, *double sirkit*, sambaran petir, *CFO*, keandalan sistem transmisi

ABSTRACT

*Analysis of the Dielectric Unbalance Method on Transmission System Reliability in the 150 kV Sambutan – Muara Badak Overhead Transmission sirkit
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The 150 kV Sambutan–Muara Badak Overhead Transmission sirkit (SUTT) is one of the transmission sirkits with a high vulnerability to lightning disturbances. One technical effort implemented to improve system reliability is the unbalance dielectric method, which creates a difference in the number of insulator discs, where Circuit 1 uses 11 discs and Circuit 2 uses 13 discs. The analysis was conducted through the calculation of Critical Flashover (CFO), overvoltage simulation due to lightning strikes using the EMTP application, and evaluation of historical disturbance data. The results show that the CFO value of Circuit 2 is higher than that of Circuit 1, namely 1,230 kV for Circuit 2 and 1,076 kV for Circuit 1. Based on EMTP simulation with a 30 kA lightning current, the insulator voltage of sirkit 1 reached 1,154.86 kV, exceeding its CFO of 1,076 kV, whereas the insulator voltage of sirkit 2 only reached 96.241 kV, far below its CFO of 1,230 kV. This difference causes flashover due to lightning to occur more likely on Circuit 1, preventing simultaneous disturbances on both circuits. Historical data indicate that double-circuit disturbances decreased from 33% before implementation (2021) to 7.7% after the unbalance dielectric method (2022–2025). Therefore, the method is proven effective in improving system reliability by controlling the flashover location caused by lightning strikes.

Keywords: Unbalance dielectric, double sirkit, lightning strike, CFO, transmission system reliability.