INTISARI

Sistem grounding penting untuk keselamatan dan keandalan jaringan listrik. Kinerja sistem grounding diukur melalui resistansi grounding. Namun, dalam aplikasi yang lebih kompleks, impedansi grounding—yang mencakup resistansi, induktansi, dan kapasitansi—lebih relevan untuk diukur. Tantangan pengukuran impedansi grounding mencakup pemilihan rasio jarak, frekuensi arus, dan metode yang tepat untuk akurasi hasil. Penelitian ini bertujuan untuk mengetahui pengaruh variasi frekuensi, rasio jarak, serta metode pengukuran terhadap hasil impedansi grounding.

Metode yang digunakan dalam penelitian ini adalah metode 3 pole, 4 pole, dan impuls impedansi. Pengukuran dilakukan dengan menempatkan probe arus pada jarak 37,1 m dari grounding bangunan, sementara probe tegangan ditempatkan pada variasi rasio jarak masing-masing 56% (jarak 21 m), 59% (jarak 22 m), 62% (jarak 23 m), 65% (jarak 24 m), dan 68% (jarak 25 m) dari grounding bangunan). Frekuensi yang digunakan setiap metode berkisar antara 55 Hz hingga 15.400 Hz, kecuali untuk metode impuls impedansi yang tidak memerlukan pengaturan frekuensi.

Hasil penelitian menunjukkan bahwa impedansi meningkat seiring kenaikan frekuensi dan jarak. Impedansi naik dari 1,87 Ω hingga 7,36 Ω saat frekuensi meningkat dari 55 Hz hingga 15,4 kHz. Impedansi naik dari dari 1,66 Ω hingga 2,78 Ω saat rasio jarak meningkat dari 56% ke 68%. Puncak impuls impedansi menunjukkan kenaikan dan penurunan nilai akibat gangguan lingkungan. Selain itu, metode 4 pole secara umum menghasilkan impedansi yang lebih rendah dibanding metode 3 pole. Penelitian ini menekankan pentingnya mempertimbangkan frekuensi arus dan rasio jarak untuk meningkatkan akurasi pengukuran impedansi grounding. Selain itu, metode 4 pole terbukti lebih akurat dan menghasilkan nilai yang lebih rendah dibandingkan metode 3 pole.

Kata kunci : Grounding, Pengukuran Impedansi, Pengukuran Frekuensi, Pengukuran Jarak, Teknik Pengukuran

ABSTRACT

The grounding system is essential for the safety and reliability of electrical networks. The performance of the grounding system is typically measured through ground resistance. However, in more complex applications, ground impedance—encompassing resistance, inductance, and capacitance—is more relevant for measurement. Challenges in measuring ground impedance include selecting the appropriate distance ratio, current frequency, and measurement method to ensure accurate results. This study aims to determine the effects of frequency variation, distance ratio, and measurement methods on ground impedance results.

The methods used in this study are the 3-pole, 4-pole, and impulse impedance methods. Measurements were conducted by placing the current probe at a distance of 37.1 meters from the building's grounding, while the voltage probe was positioned at various distance ratios of 56% (21 meters), 59% (22 meters), 62% (23 meters), 65% (24 meters), and 68% (25 meters) from the building's grounding. The frequencies used in each method ranged from 55 Hz to 15,400 Hz, except for the impulse impedance method, which did not require frequency adjustment.

The results showed that impedance increased with the rise in both frequency and distance. Impedance rose from 1.87 Ω to 7.36 Ω as the frequency increased from 55 Hz to 15.4 kHz. Impedance also increased from 1.66 Ω to 2.78 Ω as the distance ratio rose from 56% to 68%. The impulse impedance peaks showed an increase and decrease in values due to environmental disturbances. Additionally, the 4-pole method generally produced lower impedance values than the 3-pole method. This study emphasizes the importance of considering current frequency and distance ratio to improve the accuracy of grounding impedance measurements. Furthermore, the 4-pole method proved to be more accurate, yielding lower values compared to the 3-pole method.

Keywords : Grounding, Impedance Measurement, Frequency Measurement, Distance Measurement, Measurement Techniques