

ABSTRAK

Proses verifikasi isolator thermocouple secara eksisting masih memiliki keterbatasan dalam keteraturan konfigurasi pengujian, konsistensi hasil pengukuran, dan efisiensi waktu. Penelitian ini bertujuan merancang dan membangun media uji berbasis panel modular untuk mengoptimalkan proses verifikasi isolator thermocouple.

Metode penelitian meliputi perancangan dan pembangunan panel modular, pengujian menggunakan metode eksisting dan panel modular, serta analisis komparatif hasil pengukuran. Pengujian dilakukan pada rentang suhu 0 °C hingga 600 °C dengan konversi sinyal 4–20 mA, masing-masing sebanyak 10 kali percobaan pada setiap titik temperatur. Parameter yang dianalisis meliputi deviasi arus keluaran terhadap nilai nominal, konsistensi dan repeatability hasil pengukuran, serta efisiensi waktu verifikasi.

Hasil penelitian menunjukkan bahwa media uji berbasis panel modular menghasilkan nilai arus keluaran yang lebih stabil dengan selisih rata-rata sebesar 0,004 mA dan selisih maksimum sebesar 0,006 mA terhadap nilai nominal, serta sebaran data yang lebih sempit dibandingkan metode eksisting. Dari aspek waktu, proses verifikasi berkurang dari rata-rata 20 menit menjadi 6,7 menit atau meningkat efisiensinya sebesar 66,5%.

Dengan demikian, media uji berbasis panel modular terbukti meningkatkan keteraturan konfigurasi, konsistensi hasil, dan efisiensi pengujian. Sistem ini dirancang mengacu pada standar IEC 60584-2 dan ASTM E230 sehingga lebih terstruktur dan berpotensi digunakan sebagai alternatif media uji yang lebih andal di laboratorium maupun industri.

Kata kunci: Verifikasi isolator thermocouple; panel modular; sinyal 4–20 mA; repeatability pengukuran; efisiensi verifikasi

ABSTRACT

The eksisting thermocouple insulator verification process still faces limitations in terms of test configuration regularity, measurement result consistency, and time efficiency. This research aims to design and build a modular panel-based test platform to optimize the thermocouple insulator verification process.

The research methods included designing and building a modular panel, testing using the eksisting method and the modular panel, and comparative analysis of measurement results. Testing was conducted over a temperature range of 0°C to 600°C with a signal conversion of 4–20 mA, with 10 trials at each temperature point. Parameters analyzed included the output current deviation from the nominal value, the consistency and repeatability of the measurement results, and verification time efficiency.

The results showed that the modular panel-based test platform produced more stable output current values with an average difference of 0.004 mA and a maximum difference of 0.006 mA from the nominal value, along with a narrower data spread compared to the eksisting method. In terms of time, the verification process was reduced from an average of 20 minutes to 6.7 minutes, representing a 66.5% increase in efficiency.

Thus, modular panel-based test media have been shown to improve configuration regularity, result consistency, and test efficiency. This system, designed in accordance with the IEC 60584-2 and ASTM E230 standard, is more structured and has the potential to be used as a more reliable alternative test media in both laboratories and industry.

Keywords: *Thermocouple isolator verification; modular panel; 4–20 mA signal; measurement repeatability; verification efficiency*