

ANALISIS KONDISI TRANSFORMATOR TENAGA DAN REKOMENDASI TINDAK LANJUT BERBASIS HEALTH INDEX

I Made Gusmara Nusaman, 202210040

Di bawah bimbingan Dr. Musa Partahi Marbun, ST., MT

ABSTRAK

Transformator merupakan peralatan utama dalam sistem transmisi tenaga listrik yang berfungsi menyesuaikan level tegangan sesuai kebutuhan sistem. Seiring waktu operasi, kinerja transformator dapat menurun akibat faktor usia, pembebanan, dan frekuensi gangguan, sehingga berpotensi menurunkan keandalan pasokan listrik. Penelitian ini dilakukan pada 22 unit transformator 150 kV tipe GIS berkapasitas 60 MVA yang berada di 8 GIS tersebar dengan metode analisis berbasis *Health Index*. *Health Index* dihitung dengan perkalian setiap faktor penilaian dengan bobotnya, kemudian dikonversi ke skala 0 -100. Hasil penerapan *Health Index* menunjukkan bahwa 19 unit transformator (86,36%) berada pada kategori *Good - Very Good*, sedangkan 3 unit (13,64%) berada pada kategori *Caution - Very Poor*. Validasi dilakukan pada sampel yang mewakili kategori *Very Good*, *Poor*, dan *Very Poor*, dan menunjukkan kesesuaian yang baik antara nilai *Health Index* dengan hasil *Inside Check*, pengujian laboratorium, serta riwayat operasional dan pengujian lanjutan, sehingga mengonfirmasi bahwa *Health Index* mampu merepresentasikan kondisi aktual transformator secara akurat. Analisis korelasi memperlihatkan hubungan negatif yang kuat antara *Health Index* dan usia operasi dengan $r = -0,821$, menandakan bahwa pertambahan usia operasi berkontribusi signifikan terhadap penurunan nilai *Health Index*. Berdasarkan hasil perhitungan *Health Index*, validasi, dan analisis korelasi, maka dapat direkomendasikan tiga tindak lanjut, yaitu pengoperasian normal, operasi dengan pemantauan intensif dan berkala, serta penggantian transformator yang merupakan representasi dari tingkat kesehatan transformator pada keseluruhan sampel.

Kata Kunci: *Health Index, Korelasi, Transformator*

ANALYSIS OF POWER TRANSFORMER CONDITION AND FOLLOW-UP RECOMMENDATIONS BASED ON THE HEALTH INDEX

I Made Gusmara Nusaman, 202210040

Supervised by Dr. Musa Partahi Marbun, ST., MT

ABSTRACT

Transformers are essential equipment in electric power transmission systems that function to adjust voltage levels according to system requirements. Over the course of operation, transformer performance may degrade due to aging, loading conditions, and the frequency of disturbances, which can potentially reduce the reliability of power supply. This study examined 22 units of 150 kV GIS-type power transformers with a capacity of 60 MVA located across 8 GIS substations, using a Health Index-based analysis method. The Health Index was calculated by multiplying each assessment factor by its corresponding weight and then converting the result to a 0–100 scale. The application of the Health Index showed that 19 transformers (86.36%) were in the Good–Very Good category, while 3 units (13.64%) were in the Caution–Very Poor category. Validation was carried out on samples representing the Very Good, Poor, and Very Poor categories, and it demonstrated strong agreement between the Health Index values and the results of inside check, laboratory tests, as well as operational history and further in-depth testing, confirming that the Health Index can accurately represent the actual condition of transformers. Correlation analysis indicated a strong negative relationship between the Health Index and transformer operating age ($r = -0.821$), suggesting that increasing operation age significantly contributes to a decrease in the Health Index value. Based on the Health Index calculation, validation results, and correlation analysis, three follow-up actions are recommended: normal operation, operation with intensive and periodic monitoring, and transformer replacement, representing the overall health levels of the transformers in the study sample.

Keywords: *Correlation, Health Index, Transformer*