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Dielectric Response Analysis Measurement for Diagnostic Oil-Paper Insulation System on Aged Inter Bus Transformer 3x10 MVA

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Abstract : Condition assessment of oil-paper-insulated power transformers, particularly of water content, is becoming increasingly important for aged transformers. As insulation ages, it can produce water, which reduces its dielectric strength, accelerates the cellulose ageing process, and causes gas bubbles to form at high temperatures. This paper mainly assesses the life condition of oil-paper insulation system of Inter Bus Transformer (IBT) 30 MVA, 150/30 kV in PT PLN-Substation Jelok that has been operating for 41 years, since 1974. Valuable information about the condition of high voltage insulation may be obtained by measuring its dielectric response. This paper describes in detail the interpretation of Dielectric Response Analysis (DIRANA) measurements and the test result compared to other insulation tests to get deep information for diagnostic, such as Tan delta test, oil characteristic test and Dissolve Gas Analysis (DGA) test. This paper mainly discusses the parameter relationship between moisture content, water content, acidity, oil conductivity and dissipation factor. The result and analysis show that IBT 30 MVA Jelok phase U and W had just been ageing due to high acidity level (>0.2 mgKOH/g) which cause high moisture in cellulose/paper (%) are in wet category about 4.7% and 5% and water content in oil (ppm) about 3.13 ppm and 3.33 ppm at temperature 20°C. High acidity level can make oxidation process and produce water in paper and particle which can decrease the value of Interfacial Tension (IFT) below 22 mN/m (poor category) for both phase U and W. Even if paper insulation of transformer are in wet condition, dissipation factor and capacitance at the same frequency (50 Hz) from both measurement DIRANA test and Tangent delta test give the same result (almost), the results are 0.69% and 0.71% (<1%), it may be acceptable and should not be investigated. The DGA results show that TDCG are in level one (1) condition and there are no found a Key Gases, it means that transformers had no failure during operation like arching, partial discharge and thermal in oil or cellulose.

Keywords : diagnostic, inter-bus transformer, oil-paper insulation, moisture, dissipation factor
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