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INDICATOR FOR EVALUATION OF INSULATION AGING RATES IN WINDING LAYERS OF OIL-IMMERSED POWER TRANSFORMER

The technical condition and the decision to decommission a power transformer largely depends on the it's windings cellulose insulation wear degree. As a result of previous studies, uneven wear of insulation layers along the vertical axis of the winding of an oil-immersed transformer was revealed. At the same time, the well-known methods for assessing insulation ageing are based on using the hot-spot temperature, which is located in the upper layer of the winding.

The purpose of the work is to estimate the error in determining the insulation wear degree without taking into account the possibility of accelerated wear of the intermediate layers. An indicator R is proposed to estimate such an error in the form of the ratio of the relative wear rates of cellulose insulation in the upper and some intermediate layer. The conditions under which the error occurs and the method for determining its value under given conditions are determined. These conditions include the number of layers into which the winding is mentally divided, the temperature of the hot-spot and the humidity of the least humid point, the coefficients of change in temperature and humidity by layers relative to the upper layer. Analytical expressions are proposed for determining the indicator for estimating the error in the degree of wear of winding insulation layers. It is shown that the greatest error is achieved at the minimum value of the index $R = R_{min}$.

The conditions under which R_{min} is reached are found using the genetic algorithm method, which is implemented in the *ga* Matlab function. Let the winding be mentally divided into 10 layers, the oil temperature varies in the range from 20 to 60 °C, the absolute humidity of the upper layer can take values from 0.3 to 1.0%, and range of absolute humidity change of in layers from 0 to 1.5%. Under these conditions, $R_{min} = 0.5652$ was obtained for the third layer. This means that the prediction of the critical wear time of the winding cellulose insulation, which is obtained by a known method, should be reduced by more than 40%.

Thus, the application of the proposed indicator and the method for refining the insulation wear rate makes it possible to clarify the time of completion of the transformer operation and the conditions for its accelerated aging.