Title

Indoor distribution transformers oil temperature prediction using new electro-thermal resistance model and normal cyclic overloading strategy: an experimental case study

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Abstract

In the energy distribution networks, the most important and valuable equipment is oil-immersed distribution transformers. Besides, due to the key role of these transformers and their multiplicity, their lifetime monitoring is inevitable. The life of a transformer depends on the weakest solid insulation material (i.e. paper insulation). On the other hand, monitoring the transformer insulation status requires accurate information to be available about the oil temperature at every moment. Therefore, it is important to control and predict the oil temperature rise in the transformer. In this study, a new model based on fundamental heat transfer theory is proposed for thermal behaviour prediction of top oil of indoor distribution transformers using the concept of thermal resistance, namely electro-thermal resistance model (E-TRM). In E-TRM, the thermal resistance network is formed by following three-dimensional heat transfer path and assigning thermal resistance to each path. To evaluate the proposed E-TRM, the results of this model are verified with experimental results. Moreover, the E-TRM is used to predict the thermal behaviour of the indoor transformer in the overloading condition. At the end, the transformer loss of life is estimated based on the oil temperature and a normal cyclic overloading strategy is presented for overloading management.

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