Abstract

Technologies reshaping the electricity supply industry
2017 IERE-TNB Putrajaya Workshop
November 20-23, 2017

Early Detection and Localization of Thermal Faults from Acoustic Emission Measurement for TNB In-Service Power Transformers

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Keywords: *Power transformer, Acoustic Emission measurement, Dissolve Gas Analysis, Thermal faults, Partial Discharge, Fault detection*

Abstract

Power transformers are major equipment in a power system. Their reliability does not only affect the electric energy availability within a supplied area, but also the economical operation of a utility. The failure of a distribution transformer may leave thousands of homes without light. Hence, fault detection at the early stage is essential for an in-service power transformer.

The occurrence of incipient faults, which deteriorate the insulation in a power transformer, can be due to thermal and electrical stresses. The most favourable tests for the assessment of a power transformer are the online types, where shutdowns of the transformers are not required throughout the period of the measurement. These tests are partial discharge (PD) monitoring using acoustic emission (AE) technique and dissolved gas analysis (DGA). The application of AE measurement to detect and locate the occurrence of PD has been well established and applied in many utilities including TNB. Once PD detected, the transformer will be untanked for repairing work.

Besides PD, thermal faults, can also be commonly found to affect the normal operation of a power transformer. DGA test has been used widely to detect the faults. Unlike AE measurement, DGA cannot provide any information on the location of the faults diagnosed. Studies have shown that the signal detected from AE testing technique has its own characteristics, which can be investigated further. Hence, AE measurement was acquired from four in-service power transformers of the same manufacturer that were detected to have thermal faults. Firstly, statistical analysis was applied to the parameters from the AE measurement named as AE Descriptors to eliminate outliers in the data. Then, the range of

values of the AE Descriptors associated with thermal faults were determined and analysed. The values were further validated to be within the range that was different from PD.

As such, the characteristics of thermal faults from AE measurement data were obtained in this research for the type of transformers commonly used in TNB. The finding can benefit the TNB diagnostic and maintenance team by improving their maintenance strategy through early thermal fault detection and localization using the AE measurement technique. In addition, this study has also demonstrated that AE data from a power transformer testing that was beyond the established range for PD occurrence cannot be ignored as it can also give indication to other type of faults such as thermal fault.