CONDITION MONITORING AND ASSESSMENT OF POWER TRANSFORMERS USING SWEEP FREQUENCY RESPONSE ANALYSIS AND DISSOLVE GAS ANALYSIS.

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DECLARATION OF THE CANDIDATE AND SUPERVISORS

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ABSTRACT

Power transformer can be considered as the key element in an electricity power system. Cost and the time of installation of a power transformer are significantly higher than the installation of other equipment. Applied electrical and thermal stresses due to various factors always deteriorate the condition of transformers. In this sense, it is important to monitor and assess the condition of Power Transformers to ensure longer operation as well as to maintain a reliable operation of a power system.

Sweep Frequency Response Analysis (SFRA) can be used to assess the mechanical integrity of transformers. The test measures the transfer function response of the active part of the transformer. The three frequency responses of three phases should be identical except to inherited variations, and therefore, it can be considered as a fingerprint for a transformer. If any physical changes occur within and between the elements of the transformer, it will affect the frequency response, which can be used to detect any abnormality. However, correct interpretation of the measured response in determining the transformer condition is a critical challenge, as interpretation of frequency response is still not fully established.

On the other hand, Dissolve Gas Analysis (DGA) can be used to assess the possible stresses that could have been applied on the oil immersed transformers based on the concentration of specific gases dissolved in oil. Several diagnosis tools recommended by international standards are available and they have been using by utilities over a period of time with reasonable reliability.

In this study, SFRA and DGA measurement data were collected from set of power transformers in operation, and analyzed those approaching to develop a methodology to assess the condition of power transformers, correlating outcomes from SFRA and DGA. For this, transformers taken for the study were categorized based on their SFRA data by analyzing behavior of the response of the three phases and their

similarity. Several indices were introduced to quantify the similarity. In the other hand, the selected transformers were categorized based on their DGA data considering the recommendations provided by available standards and diagnosis tools. Further, a Computing Tool was developed using MATLAB, for the easy evaluation of the SFRA and DGA measurements.

Finally, several case studies were carried out justifying the proposed methodology verifying the benchmarking of the introduced indices against several faulty and good transformers.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CCF	Cross Correlation Coefficient
CEB	Ceylon Electricity Board
DGA	Dissolve Gas Analysis
DGAI	Dissolve Gas Analysis Index
GS	Grid Substation
HV	High Voltage
LV	Low Voltage
SFRA	Sweep Frequency Response Analysis
TDCG	Total Dissolved Combustible Gas

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