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IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers

Sponsor
Transformers Committee
of the
IEEE Power Engineering Society

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IEEE Standards Board

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Abstract: Detailed procedures for analyzing gas from gas spaces or gas-collecting devices as well as gas dissolved in oil are described. The procedures cover: (1) the calibration and use of field instruments for detecting and estimating the amount of combustible gases present in gas blankets above oil, or in gas detector relays; (2) the use of fixed instruments for detecting and determining the quantity of combustible gases present in gas-blanketed equipment; (3) obtaining samples of gas and oil from the transformer for laboratory analysis; (4) laboratory methods for analyzing the gas blanket and the gases extracted from the oil; and (5) interpreting the results in terms of transformer serviceability. The intent is to provide the operator with positive and useful information concerning the serviceability of the equipment. An extensive bibliography on gas evolution, detection, and interpretation is included.
Keywords: gas analysis, oil, oil-filled transformers, transformers

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CLAUSE PAGE

IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers

1. Introduction

The detection of certain gases generated in an oil-filled transformer in service is frequently the first available indication of a malfunction that may eventually lead to failure if not corrected. Arcing, corona discharge, low-energy sparking, severe overloading, pump motor failure, and overheating in the insulation system are some of the possible mechanisms. These conditions occurring singly, or as several simultaneous events, can result in decomposition of the insulating materials and the formation of various combustible and noncombustible gases. Normal operation will also result in the formation of some gases. In fact, it is possible for some transformers to operate throughout their useful life with substantial quantities of combustible gases present. Operating a transformer with large quantities of combustible gas present is not a normal occurrence but it does happen, usually after some degree of investigation and an evaluation of the possible risk.

In a transformer, generated gases can be found dissolved in the insulating oil, in the gas blanket above the oil, or in gas collecting devices. The detection of an abnormal condition requires an evaluation of the amount of generated gas present and the continuing rate of generation. Some indication of the source of the gases and the kind of insulation involved may be gained by determining the composition of the generated gases.

1.1 Scope

This guide applies to mineral-oil-immersed transformers and addresses:

1) The theory of combustible gas generation in a transformer
2) The interpretation of gas analysis
3) Suggested operating procedures
4) Various diagnostic techniques, such as key gases, Dornenberg ratios, and Rogers ratios
5) Instruments for detecting and determining the amount of combustible gases present
6) A bibliography of related literature