The 18th IERE General Meeting and Japan Forum
May 21-24, 2018, Kyoto, Japan

Interpretation of Types of Faults in Power Transformers through Dissolved Gas Analysis

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Keywords: *Dissolved Gas Analysis, Power Transformer, Turn-Turn Insulation Fault, Types of failures, Types of faults*

Abstract

Dissolved Gas Analysis (DGA) is widely used in the power utilities to detect incipient faults in oil-filled power transformers. IEEE C57.104, IEC 60599, and Electric Technology Research Association – Japan (ETRA) are typical standards for evaluating fault types in transformers through DGA. Fault types in transformers that can be detected with DGA are classified as thermal and discharge faults in traditional standards. But, the percentage of faults identified during internal inspection of transformers through DGA was only 28% in experiences of KEPCO. The reason why faults could not be accurately identified is that fault types in transformers indicated in traditional standards are difficult to relate to types of faults and failures that occur in actual transformers. Therefore, operators cannot easily estimate the types of faults and failures in transformers with DGA. In this study, key gas method in IEEE and gas pattern method in ETRA are improved for evaluating fault types in transformers through DGA. And Duval Triangle and Duval Pentagon graphics are also improved. Especially, the types of faults and failures in transformers are suggested to determine the location and risk of faults. Turn-to-turn insulation faults in windings are classified as of the degradation type and breakdown type. These faults inside transformers are difficult to identify visually during internal inspection, and have a high possibility of failure. Urgent decisions and actions are thus required to avoid failures. This study also presents a typical example of a turn-to-turn insulation fault. Based on the findings of this work, operators can determine by DGA if transformers can be operated with or without an internal inspection, or disposed of when a fault has not been identified during internal inspection.