

IEEE Guide for Moisture Measurement and Control in SF₆ Gas-Insulated

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Abstract: Guidelines for moisture level measurement, moisture data interpretation, and moisture control in gas-insulated transmission class equipment (GIE) are provided.

Keywords: circuit breakers, gas-insulated equipment (GIE), gas-insulated substations (GIS), moisture measurement, SF₆

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Introduction

(This introduction is not part of IEEE Std 1125-1993, IEEE Guide for Moisture Measurement and Control in SF₆ Gas-Insulated Equipment.)

The objectives of this guide are to introduce the importance of moisture in the design, manufacture, installation, operation, and maintenance of transmission class gas-insulated equipment and to provide guidance for measurements of moisture in gas-insulated equipment.

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IEEE Guide for Moisture Measurement and Control in SF₆ Gas-Insulated Equipment

1. Overview

Moisture measurement and control constitute a major part of an effective maintenance program for gas-insulated equipment (GIE). Moisture, particularly in the liquid phase, affects the dielectric withstand strength of GIE [B9].¹ Therefore, moisture in GIE shall be maintained at a level such that it does not condense into liquid for the entire range of the expected operating temperatures. Additionally, excessive moisture in the enclosed equipment accelerates the formation of hydrofluoric (HF) acid, a result of reactions between SF₆ arc by-products and water [B2], [B6]. Because of the importance of moisture in controlling insulation strength and aging mechanisms of the epoxy insulating spacers, most users periodically measure moisture levels in their SF₆ insulated equipment. However, results of a North American survey conducted in 1984 by the IEEE Insulated Conductors Committee indicate that utility personnel have experienced difficulties in carrying out moisture measurement and interpretation in GIE [B6], [B3]. The experience has shown that although hygrometry is an established science, techniques and procedures for moisture measurement in GIE are not well understood. As a result, there is considerable confusion among engineers and field personnel on how to properly measure moisture (particularly under high-pressure conditions), interpret the results, and control the moisture levels.

Compounding the problem of moisture measurement in GIE is the fact that moisture inside the GIE system can exist in either the vapor or adsorbed phase on the surface of the enclosure, or in the absorbed phase inside the polymeric solid insulator. The distribution of moisture in the various phases can significantly affect the dielectric strength and the measurement results. For example, moisture measurements taken in the winter would tend to be lower than moisture measurements taken in the summer, since more surface-adsorbed water exists during periods of low temperature. Elucidation of the moisture sources and migration phenomena is the key to designing an effective moisture measurement and control program.

The objective of this guide is to provide adequate information about the techniques and know-how needed to conduct a successful moisture measurement and control program for GIE.

2. Scope

This document establishes guidelines for moisture level measurement, moisture data interpretation, and moisture control in gas-insulated transmission class equipment.

¹The numbers in brackets correspond to those of the bibliography in clause 11.