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IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment

Sponsor

IEEE Transformers Committee
of the
IEEE Power Engineering Society

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Abstract: Recommendations regarding oil tests and evaluation procedures are made in this guide; references are made to methods of reconditioning and reclaiming conventional petroleum (mineral) dielectric insulating oils; the levels at which these methods become necessary; and the routines for restoring oxidation resistance, where required, by the addition of oxidation inhibitors. The intent is to assist the power equipment operator in evaluating the serviceability of oil received in equipment, oil as received from the supplier for filling new equipment at the installation site, and oil as processed into such equipment; and to assist the operator in maintaining oil in serviceable condition. The mineral oil covered is used in transformers, reactors, circuit breakers, load tap changers, and voltage regulators.

Keywords: insulation testing, load tap changers, oil circuit breakers, oil insulation, power distribution maintenance, power transformer insulation, reactors, transformers, voltage regulators

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Introduction

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Contents

IEEE Guide for Maintenance and Acceptance of Insulating Oil in Equipment

1. Overview

The reliable performance of oil in insulation systems depends on the basic characteristics of the oil that can affect overall apparatus characteristics. These oil characteristics are integral parts of the equipment design of the manufacturer. Certain properties of mineral insulating oil have been determined as important for proper electrical equipment performance. A description of these properties and their recommended value ranges for new oil and for continued use of service-aged oils are included in this guide.

Mineral insulating oil that is received in electrical equipment will exhibit different characteristics from new oil received in bulk, which has not been in contact with apparatus construction materials.

Oil in service may contain dissolved gases that are useful in assessing the continued serviceability of certain types of transformers. It is not the intention of this guide to cover this subject, as that information is available in IEEE Std C57.104™.[1]

This guide reflects the current state of the art and may differ from information contained in IEEE Std 62™, which was authored by the Power System Instrumentation and Measurements (PSIM) Committee.

Should instructions or product standards given by the manufacturer differ from recommendations made in this guide, the instructions of the manufacturer are to be given preference.

1.1 Scope

This guide applies to mineral oil used in transformers, load tap changers, voltage regulators, reactors, and circuit breakers. The guide discusses the following:

a) Analytical tests and their significance for the evaluation of mineral insulating oil.

b) The evaluation of new, unused mineral insulating oil before and after filling into equipment.

c) Methods of handling and storage of mineral insulating oil.

d) The evaluation of service-aged mineral insulating oil.

e) Health and environmental care procedures for mineral insulating oil.

[1] Information on references can be found in Clause 2.

The characteristics of the oils discussed in this guide do not include oil that is in factory fill lines, nor does this guide cover reclaimed oil installed in new equipment. The qualities of such oil, if used, should be agreed upon by the manufacturer and the user of the equipment.

1.2 Purpose

The purpose of this guide is to assist the user of the equipment in evaluating the serviceability of new, unused oil being received in equipment; oil as received for filling new equipment at the installation site; and oil as processed into equipment. It also assists the operator in maintaining the oil in serviceable condition.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM D88, Standard Test Method for Saybolt Viscosity.[2]

ASTM D92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester.

ASTM D97, Standard Test Method for Pour Point of Petroleum Products.

ASTM D445, Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity).

ASTM D611, Standard Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents.

ASTM D664, Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration.

ASTM D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

ASTM D923, Standard Practice for Sampling Electrical Insulating Liquids.

ASTM D924, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.

ASTM D971, Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.

ASTM D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.

ASTM D1275, Standard Test Method for Corrosive Sulfur in Electrical Insulating Oils.

ASTM D1298, Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.

ASTM D1500, Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).

[2] ASTM publications are available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA (http://www.astm.org/).