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IEEE Guide for Installation and Maintenance of Liquid-Immersed Power Transformers

IEEE Power and Energy Society

Sponsored by the
Transformers Committee

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(Revision of IEEE Std C57.93-2007)

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Abstract: Guidance on and recommended practices for the installation and maintenance of liquid-immersed power transformers rated 501 kVA and above with secondary voltages of 1000 V and above are provided in this guide. The entire range of power transformers, including extra high-voltage (EHV) transformers are covered in this guide. Special transformers, such as furnace transformers, rectifier transformers, etc., are not covered in this guide. Distinctions are made, as required, for various MVA ratings, voltage ratings, and types of liquid insulation.

Keywords: IEEE C57.93™, installation, liquid processing, liquid-immersed transformer, maintenance, testing, transformer

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Introduction

This introduction is not part of IEEE Std C57.93-2019, IEEE Guide for Installation and Maintenance of Liquid-Immersed Power Transformers.

The significant changes in this new revision are the removal of the clauses pertaining to the transportation of transformers and the inclusion of other insulating liquids such as natural ester based liquids. Power transformers usually represent one of the most important and most costly single items in substations. Furthermore, particularly for large transformers, their failure usually results in lengthy outages or downgrading of service. For these reasons, a high degree of care is required to properly install and maintain them.

Because of these considerations, IEEE and other standards-developing organizations have published, since at least the early 1920s, various recommendations for testing, installing, and maintaining transformers. This guide consolidates and replaces IEEE Std C57.12.11™-1980 and IEEE Std C57.12.12™-1980, which covered large transformers, and ASA C57.93-1958, which covered smaller units.

The intention of this guide is to assist users and suppliers in the inspection, installation, commissioning, and routine maintenance of liquid-immersed power transformers to help ensure that the units are placed in service in acceptable condition to provide years of reliable service. This guide also provides information on developing a maintenance and monitoring program.

This guide discusses the following two sizes of transformers:

— 501 kVA and less than 10 MVA, or with high voltage windings less than 69 kV

— 10 MVA and above, or with high voltage windings of 69 kV and above

The working group of this guide recognizes that substantial variations exist among transformer suppliers on certain aspects of transformer installation requirements and that these vary with size and voltage. This guide attempts to accommodate these variations and facilitate a full understanding between supplier and user. The manufacturer may specify more stringent requirements than this guide. Generally, the user shall conform to the manufacturer's minimum recommendations in order to obtain a proper warranty.

NOTE—This guide covers installation and testing of liquid-immersed power transformers after the units are received and positioned on the foundation. For information on receiving, inspection, and acceptance testing of liquid-immersed power transformers before they are unloaded, see IEEE Std C57.150™, IEEE Guide for the Transportation of Transformers and Reactors Rated 10 000 kVA or High[er].

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IEEE Guide for Installation and Maintenance of Liquid-Immersed Power Transformers

1. Scope

The recommendations presented in this guide apply to the inspection, installation, and maintenance of liquid-immersed power transformers rated 501 kVA and above with secondary voltages of 1000 V and above. This guide covers the entire range of power transformers, including extra high-voltage (EHV) transformers. This guide does not cover special transformers such as furnace transformers, rectifier transformers, etc. Distinctions are made as required for various MVA ratings, voltage ratings, and types of liquid insulation. The manufacturer's instruction manual should be the primary reference for transformer inspection, installation, and maintenance, especially while the equipment is under warranty. This guide should be used in conjunction to supplement the manufacturer's instruction manual, or as a substitute when it is not available.

Clause 4 contains information for use with transformers rated below 10 MVA with high voltages less than 69 kV. Clause 5 applies to transformers rated 10 MVA and above with high voltages of 69 kV and above, including EHV transformers. For transformers with high voltages that are less than 69 kV and larger than or equal to 10 MVA, users should follow Clause 5.

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). 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 D923, Standard Practices for Sampling Electrical Insulating Liquids.[1]

ASTM D1816, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes.

ASTM D3487, Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.

IEEE Std C57.12.00™, IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.[2,3]

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