

IEEE Guide for Test Procedures for Thermal Evaluation of Insulation Systems for Solid-Cast and Resin-Encapsulated Power and Distribution Transformers

Sponsor

**Transformers Committee
of the
IEEE Power Engineering Society**

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Abstract: A uniform method is established for determining the temperature classification of solid-cast and resin-encapsulated power and distribution transformer insulation systems by testing rather than by chemical composition. These insulation systems are intended for use in transformers covered by IEEE Std C57.12.01-1989 and IEEE Std C57.12.91-1995 as they apply to solid-cast and resin-encapsulated transformers whose highest voltages exceed nominal 600 V.

Keywords: insulation systems, model transformer coils, resin-encapsulated transformers, solid-cast transformers, thermal evaluation

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Introduction

(This introduction is not part of IEEE Std C57.12.60-1998, IEEE Guide for Test Procedures for Thermal Evaluation of Insulation Systems for Solid-Cast and Resin-Encapsulated Power and Distribution Transformers.)

This guide was developed to provide a method for evaluating insulation systems for solid-cast and resin-encapsulated transformers with high-voltage ratings greater than 600 V. Since these procedures are considered to be new, and have not been tested exhaustively, further testing may prove the need for future revisions.

The working group that developed this guide used IEEE Std C57.12.56-1986, IEEE Standard Test Procedure for Thermal Evaluation of Insulation Systems for Ventilated Dry-Type Power and Distribution Transformers, as a starting point. New material and coil design techniques have necessitated an expansion of the procedure to recognize factors such as the effect of glass transition temperature, higher resin-to-air and resin-to-metal ratios, filler contents, and conductor identity on aging and performance characteristics. This guide describes methods that take these new materials and processes into account.

The working group was unable to define an existing insulation system that could be used as a control for comparison with an insulation system under test. Therefore, an arbitrary extrapolation criteria of 40 000 h was selected for the evaluation. The working group urges the dry-type transformer industry to report results of tests performed with this new procedure in order to provide a basis for the future improvement of this guide.

The working group considered aging under voltage stresses that might cause partial discharge at operating voltage, but ruled it out because present transformer designs are generally created to be as free as practical of partial discharges at operating voltage. If partial discharges are present, the possibility exists that such an endpoint could be an alternate approach to dielectric strength endpoints. This should be considered if data become available.

The working group also considered a vibration and shock procedure as one of the aging factors. So little information is published regarding the effects of vibration and shock in high-voltage insulation systems, however, that it was impossible to include it in the test procedure. The working group urges the industry to report procedures and results of any testing of insulation systems that uses vibration and shock so that future revisions of this guide may incorporate these factors, if they are found to be significant.

This guide relates voltage withstand endpoint criteria to the impulse voltage distribution within the coil or to the initial voltage withstand of the coil. A relationship between impulse withstand of the insulation and short-term 60 Hz withstand is identified so that 50/60 Hz testing of model coils is possible.

Since the working group was unable to define an existing insulation system to use as a control for comparison with the insulation system under test, and no data has been forthcoming to verify the techniques outlined in this document, it was recommended that this document be considered a guide.

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1. Overview

1.1 Scope

This test procedure is intended to establish a uniform method for determining the temperature classification of solid-cast and resin-encapsulated power and distribution transformer insulation systems by testing rather than by chemical composition.

These insulation systems are intended for use in transformers covered by IEEE Std C57.12.01-1989¹ and IEEE Std C57.12.91-1995 as they apply to solid-cast and resin-encapsulated transformers whose highest voltages exceed nominal 600 V.

NOTE—In this guide, the term *transformer* means solid-cast and resin-encapsulated transformer, unless qualified by other descriptive terms.

1.2 Purpose

The purpose of this test procedure is to establish a uniform method for

- a) Providing data for the selection of the temperature classification of the insulation system;
- b) Providing data that may be used as a basis for a loading guide;
- c) Comparative evaluation of different insulation systems.

¹Information on references can be found in Clause 2.