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IEEE Guide for Transformer Loss Measurement

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IEEE Power and Energy Society

Developed by the
Transformer Committee

IEEE Std C57.123™-2019
(Revision of IEEE Std C57.123-2010)

IEEE

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Developed by the

Transformer Committee
of the
IEEE Power and Energy Society

Approved 7 November 2019

IEEE SA Standards Board

Abstract: Information and general recommendations of instrumentation, circuitry, calibration, and measurement techniques of no-load losses (excluding auxiliary losses), excitation current, and load losses of power and distribution transformers are provided. The guide is intended as a complement to the test code procedures given in Clause 8 and Clause 9 of IEEE Std C57.12.90™.

Keywords: calibration, IEEE C57.123™, load loss, no-load loss, testing, transformers

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-1-5044-6327-0 STD23989
Print: ISBN 978-1-5044-6328-7 STDPD23989

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Introduction

This introduction is not part of IEEE Std C57.123, IEEE Guide for Transformer Loss Measurement.

This guide was originally initiated to explain in more detail the accuracy requirements, test code procedures, various available test methods, methods to diagnose test anomalies, and the procedures for calibration and safety.

In this latest revision, the following updates were made:

— Better explanation of parameters affecting core loss measurement in 3.2

— Added explanation in 3.5.3 for the usage of capacitors in parallel with the voltage source to reduce voltage distortion during no load loss measurement

— Added 3.8 about no-load loss measurements using three phase power analyzer to recognize that most measurements are now made with digital instruments

— Added an alternate load loss wattmeter-voltmeter-ammeter test method in 4.6

— Updated modern power loss measurements systems in Clause 5

— Added explanation of system calibration versus component calibration in Clause 7

— Added new references to the bibliography

— Removed 8.3 on safety

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IEEE Guide for Transformer Loss Measurement

1. Overview

1.1 Scope

This guide provides background information and general recommendations of instrumentation, circuitry, calibration, and measurement techniques of no-load losses (excluding auxiliary losses), excitation current, load losses of power, and distribution transformers. The test codes, namely, IEEE Std C57.12.90™, IEEE Std C57.12.91™, and the test code section of IEEE Std C57.15™ provide specifications and requirements for conducting these tests. This guide has been written to provide supplemental information for each test. More technical details of the measuring instruments and techniques presented in this guide can be found in the document developed by So [B23]. This guide applies to liquid-immersed power and distribution transformers, dry-type transformers, and step-voltage regulators. Additionally, it applies to both single- and three-phase transformers.

1.2 Purpose

The purpose of the guide is:

- To describe the basis and methodology by which the accuracy requirements of Clause 8 and Clause 9 of IEEE Std C57.12.90 for liquid-immersed transformers and IEEE Std C57.12.91 for dry-type transformers can be achieved.
- To explain why the test code specifies certain procedures and limits.
- To explain advantages and disadvantages of different test methods where alternative methods are available.
- To explain practical limitations and valid means of overcoming them.
- To give theoretical basis for interpolation/extrapolation of tested data and valid limits.
- To explain test anomalies—how they result, what they mean, and how to handle them.
- To give procedures for calibration, certification, and traceability of measurement processes to reference standards.
- To discuss procedures for grounding and shielding.
- To provide schematics and examples to clarify concepts and demonstrate methodologies.