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This second edition cancels and replaces the first edition, published in 2005, and constitutes a technical revision.

The text of this standard is based on the following documents:

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IEEE Std C57.135-2011	14/710/FDIS	14/714/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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IEEE Std C57.135™-2011
(Revision of
IEEE Std C57.135-2001)

IEEE Guide for the Application, Specification, and Testing of Phase-Shifting Transformers

Sponsor

Transformers Committee
of the
IEEE Power & Energy Society

Approved 16 June 2011

IEEE-SA Standards Board

Abstract: Theory, application of phase-shifting transformers, and the difference of specification and testing to standard system transformers are described in this guide. Various types of phase-shifting transformers and how to select the optimal design to achieve required control of power flow are covered. An understanding of the terminology, types, construction, and testing specific to phase-shifting transformers is provided.

Keywords: advance phase angle, dual-core design, IEEE C57.135, main transformer, phase-shifting transformer, power transfer, retard phase angle, series transformer, single-core design, special tests

IEEE Introduction

This introduction is not part of IEEE Std C57.135-2011, IEEE Guide for the Application, Specification, and Testing of Phase-Shifting Transformers.

This guide describes the application, specification, and testing of phase-shifting transformers. It is intended for the following:

— Organizations responsible for the application and specification of phase-shifting transformers for electric transmission systems to control power flow.

— Organizations responsible for testing phase-shifting transformers.

This guide is designed to help organizations:

— Understand the various types of phase-shifting transformers and how to apply them to obtain required control of power flow.

— Prepare specifications for the purchase of phase-shifting transformers.

— Standardize tests and test methods for phase-shifting transformers.

This guide is intended to satisfy the following objectives:

— Promote consistency within organizations for the application and specification of phase-shifting transformers.

— Provide an understanding of the terminology, types, construction, and testing relating specifically to phase-shifting transformers.

— Promote the standardization of testing procedures for phase-shifting transformers.

Since this guide was first published in 2001, several recommendations from users and manufacturers were made to revise it to improve accuracy and applicability. Some of the revisions are as follows:

— Figure 1, Figure 3, Figure 4, Figure 7, and Figure 11 were improved.

— Equation (1) was divided into two parts to show the difference between advance and retard operations.

— A new section on minimum information requirements for specifying a PST was inserted.

— Various editorial changes were made to clarify the contents of the guide.

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1. Overview

1.1 Scope

This guide covers the application, specification, theory of operation, and factory and field testing of single-phase and three-phase oil-immersed, phase-shifting transformers (PSTs).

This guide is limited to matters particular to PSTs and does not include matters relating to general requirements for power transformers covered in existing standards, recommended practices, or guides.

1.2 Purpose

The terminology, function, application, theory of operation and protection, and design of PSTs are not covered by existing transformer standards and guides. The purpose of this document is to provide guidance to those specifying, designing, and using PSTs.

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.

IEC 60076-1, Power Transformers—Part 1: General.[1]

IEC 60076-3, Power Transformers—Part 3: Insulation Levels, Dielectric Tests and External Clearances in Air.

IEC 60076-5, Power Transformers—Part 5: Ability to Withstand Short Circuit.

IEC 60076-7, Power Transformers—Part 7: Loading Guide for Oil-Immersed Power Transformers.

IEEE Std 693™, IEEE Recommended Practice for Seismic Design for Substations.[2,3]

IEEE Std C37.90.1™-1989, IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

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

IEEE Std C57.12.80™, IEEE Standard Terminology for Power and Distribution Transformers.

IEEE Std C57.12.90™, IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers, and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.

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