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IEEE Standards

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IEEE Standard Conformance Test Procedure for Instrument Transformers

IEEE Power Engineering Society

Sponsored by the
Transformers Committee

IEEE

3 Park Avenue, New York, NY 10016-5997, USA

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IEEE Standard Conformance Test Procedure for Instrument Transformers

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Transformers Committee
of the
IEEE Power Engineering Society

Approved 9 June 2005

IEEE-SA Standards Board

Abstract: Test requirements for conducting conformance tests on instrument transformers used on 60 Hz primary systems with voltages from 600 V through 38 kV are covered. This standard also covers selection of transformers for conformance testing, basis for conformance, treatment of failures, tests required, (e.g., impulse, voltage withstand, accuracy, temperature rise, mechanical rating), insulation system acceptance, and production monitoring.
Keywords: conformance test, instrument transformer

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Introduction

This introduction is not part of IEEE Std C57.13.2-2005, IEEE Standard Conformance Test Procedure for Instrument Transformers.

This document was developed originally by the High Voltage Apparatus Coordinating Committee (HVACC) of the American National Standards Institute. When the HVACC was disbanded, the Transformers Committee of the IEEE Power Engineering Society assumed responsibility for the maintenance of this document.

This revision of IEEE Std C57.13.2-1991 has been modified to conform with the latest revision of IEEE Std C57.13™-1993 and applies to those instrument transformers used for measurements and control functions on 60 Hz primary systems with voltages from 600 V through 38 kV. The application range was broadened by reducing the number of restrictions. The original intent of this document, which was to provide a standard for the evaluation and conformance certification of instrument transformers, remains unchanged by its transfer in IEEE.

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IEEE Standard Conformance Test Procedure for Instrument Transformers

1. Overview

1.1 Scope

This standard describes the tests and documentary requirements for conducting a conformance test on instrument transformers.

1.2 Purpose

The purpose of this standard is to cover conformance test requirements for current and inductively coupled voltage transformers used for measurements and control functions on 60 Hz primary systems with voltages from 600 V through 38 kV.

This standard does not specifically cover the following:

a) Installation in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles

b) Installations underground in mines

c) Installations of railways for generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock, or installations used exclusively for signaling and communication purposes

d) Installations of communication equipment under the exclusive control of communication utilities, located outdoors or in building spaces used exclusively for such installations

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.

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IEEE Std C57.13-1993™, IEEE Standard Requirements for Instrument Transformers.[1,2]

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

ANSI/UL 1446, Standard for Systems of Insulating Materials—General.[3]

3. Definitions

For the purposes of this standard, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms* [B1],[4] as well as IEEE Std C57.12.80[5], should be referenced for terms not defined in this clause.

3.1 conformance tests: Certain performance tests used to demonstrate compliance with the applicable standards. The test specimen is normally subjected to all planned routine tests prior to initiation of the conformance test program.

NOTE—The conformance tests may, or may not, be similar to certain design tests. Demonstration of margin (capabilities beyond the standard) is not required.[6]

4. Selection of the transformer for conformance testing

Representative samples shall be chosen jointly by the concerned parties and shall represent the typical commercial product of the manufacturer.

Five current or voltage transformers shall be tested, except for the case of unusual or infrequently used types in which a smaller number that is acceptable to the certifying agency may be taken to be representative of the type. (The certifying agency may be the manufacturer.) The sample shall be selected as to be representative of the range of ratios to be certified as conforming.

5. Basis for conformance

A transformer type shall be in conformance with the standards listed when each current or voltage transformer withstands all insulation tests specified in 7.1 and 7.2, meets the requirements for both accuracy and temperature rise tests specified in 7.3 and 7.4, and meets the requirements for mechanical rating tests specified in 7.5.

The failure of a transformer to meet the requirements of the accuracy, temperature-rise, or mechanical rating tests shall be cause to reject that rating and other ratings represented by the sample. Such rejection shall not preclude the conformance of the type in other ratings that have different design characteristics and that do meet all test requirements.

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[4] The numbers in brackets correspond to those of the bibliography in Annex A.

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

[6] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

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6. Treatment of failures within test sequence

Failures occurring during conformance testing should be evaluated, and corrections should be made before any re-testing is carried out. A design change made to a transformer to correct a failure within a test sequence shall be evaluated for its effect on any preceding sequence.

7. Tests

Conformance tests shall consist of the following tests performed in the sequence shown on each transformer selected for tests.

7.1 Impulse tests

Impulse tests shall be made as specified in 8.8.5 of IEEE Std C57.13 and at the test levels indicated for the transformer BIL in Table 2 of IEEE Std C57.13-1993.

7.2 Voltage withstand tests

Voltage withstand tests of primary windings to grounded secondary windings and parts, including metallic case, frame, base, nameplate, mounting facilities, and the core (if accessible), shall be made as specified in 8.8.3 of IEEE Std C57.13-1993 and the values indicated in Table 2 of IEEE Std C57.13-1993.

7.3 Accuracy

7.3.1 Metering accuracy of current transformers

Metering accuracy test shall be made per 8.1 of IEEE Std C57.13-1993. The transformers shall be demagnetized and then tested at 10% and 100% of rated primary current and with a primary current equal to the rated current multiplied by the continuous thermal current rating factor. Tests shall be made with the minimum and maximum standard metering burdens for which the manufacturer assigns the same metering accuracy class.

In the case of dual ratio and multi-ratio transformers, tests shall be made to verify the accuracy at all ratios assigned accuracy ratings by the manufacturer and to verify the ratio of each tap.

7.3.2 Relaying accuracy of current transformers

Relay accuracy classes assigned by the manufacturer shall be verified in 7.3.2.1 and 7.3.2.2.

7.3.2.1 Transformers assigned “C” classification

a) Check ratio per 8.1 of IEEE Std C57.13-1993.

b) Measure resistance of the secondary winding.

c) Test excitation current per 8.3.2 of IEEE Std C57.13-1993.

d) Using data from (b) and (c), calculate relay accuracy per 8.1.10 of IEEE Std C57.13-1993 to verify that the transformers meets the requirements of 6.4 of IEEE Std C57.13-1993.

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7.3.2.2 Transformers assigned "T" classification

These transformers shall be tested per 8.1 of IEEE Std C57.13-1993 to verify that the relay accuracy requirements of 6.4 of IEEE Std C57.13-1993 are met.

7.3.3 Accuracy of voltage transformers

The transformers shall be tested at 90% and 100% of rated voltage with zero burden and at 110% of rated voltage at the maximum burden for which an accuracy class is assigned by the manufacturer. Accuracy at other burdens may be determined by test or by calculation, as specified in 8.1.12 of IEEE Std C57.13-1993.

The accuracy at 90% and 110% of the rated voltage at any burden may be determined by applying the ratio and phase angle differentials determined in the zero burden test to the accuracy for that burden at 100% of rated voltage.

7.4 Temperature rise

7.4.1 Temperature rise—current transformers

Each transformer shall be tested with a primary current equal to the rated current multiplied by the continuous thermal current rating factor. The temperature rise tests shall be made in accordance with 8.7 of IEEE Std C57.13-1993, and the temperature rise for continuous operation shall not exceed the limits in Table 4 of IEEE Std C57.13-1993.

In case of a dual ratio or multi-ratio transformer, the temperature tests should be made at the primary rating that produces the greatest temperature rise.

7.4.2 Temperature rise—voltage transformers

Each voltage transformer shall be tested with 100% of rated primary voltage at the thermal burden rating assigned by the manufacturer. The temperature rise tests shall be made in accordance with 8.7 of IEEE Std C57.13-1993 and the temperature rise for continuous operation shall not exceed the limits specified in Table 4 of IEEE Std C57.13-1993.

In the case of a dual ratio or multi-ratio transformer, the temperature tests should be made at the primary rating that produces the greatest temperature rise.

7.5 Mechanical rating test

The test to demonstrate the short-time mechanical current rating of a wound current transformer (excluding window and bar type) shall be made by subjecting the current transformer, with secondary winding short-circuited, to at least one peak of a primary current having a crest value equal to 2.7 times the mechanical short-time current rating.

The test to demonstrate the mechanical short-circuit capability of a voltage transformer shall be made with rated voltage maintained on the primary for 1 sec with the secondary terminals short-circuited.

A transformer shall be considered to have passed the test if, after being tested, it shows no damage and passes the impulse test as specified in 7.1 of this standard and routine tests in accordance with 4.7.2 of IEEE Std C57.13-1993.

Certified test reports showing that this test has been made on transformers of representative constructions and a history of satisfactory service in the field, or both, may be considered in lieu of actual tests.

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8. Insulation systems acceptance

Insulation systems that have a documented history of satisfactory service in the industry are considered acceptable for applications in which the hottest spot temperature does not exceed the hottest spot rise in Table 4 of IEEE Std C57.13-1993.

When a system is evaluated to determine its acceptability, consideration is to be given to its mechanical, chemical, dielectric, and thermal withstand properties, and the aging characteristics of these properties under the operational and environmental conditions defined in 4.1 of IEEE Std C57.13-1993. The manufacturer usually is in the best position to supply this information.

When the hottest spot temperature exceeds a temperature rise for the product being tested, it may be advisable to evaluate the insulation used in accordance with the principles outlined in ANSI/UL 1446.

9. Production monitoring

Monitoring of production units shall be done quarterly, or at other intervals at the discretion of the certifying agency, to verify that production tests are in accordance with the requirements given in 4.7.2 of IEEE Std C57.13-1993 and to observe that the product is of the design that was certified. (The certifying agency may be the manufacturer.)

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Annex A

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