

ANSI C57.12.13

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American National Standard

conformance requirements for
liquid-filled transformers used in unit
installations, including unit substations



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ANSI C57.12.13-1982

**American National Standard
Conformance Requirements for
Liquid-Filled Transformers Used in Unit Installations,
Including Unit Substations**

Secretariat

**Institute of Electrical and Electronics Engineers
National Electrical Manufacturers Association**

Approved September 2, 1981

American National Standards Institute, Inc

American National Standard

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Foreword

(This Foreword is not a part of American National Standard Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations, ANSI C57.12.13-1982.)

The High Voltage Apparatus Coordinating Committee (HVACC) was established July 24, 1973, by the Electrical and Electronic Technical Advisory Board (later superseded by the Electrical and Electronics Standards Management Board) of the American National Standards Institute. The responsibility assigned to HVACC was to review and evaluate existing ANSI and other related standards for the purpose of developing a draft standard for unit substations and to develop recommendations for (1) correlating requirements of these standards and (2) adding requirements appropriate for product evaluation.

This standard results from the evaluation of existing American National Standards and the need to add requirements for the evaluation and conformance certification of liquid-filled transformers. It is not intended to cover application, installation, or operation of liquid-filled transformers. This document includes an Appendix outlining procedures recommended for qualifying the internal insulation system.

The intent of this standard is to allow qualification of liquid-filled transformers for use in accordance with the American National Standard National Electrical Code, ANSI/NFPA 70-1981. However, this standard does not cover transformers specifically excluded by the provisions of Section 90-2(b) of that document.

Transformers certified under this standard may contain accessories necessary for the installation. For the conformance requirements for such accessories, reference should be made to the American National Standard for each specific accessory involved. Typical accessories include fuses, lightning arresters, circuit breakers, motor starter controls, etc.

Suggestions for improvement of this standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Transformers, Regulators, and Reactors, C57. Committee approval does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the C57 Committee had the following members:

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American National Standard Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations

1. General

1.1 Scope. This standard covers conformance tests and requirements for liquid-filled transformers. Such transformers may be remotely or integrally associated with either primary and secondary switchgear or substations, or both, and rated not greater than 2500 kVA, with voltages not exceeding 38 kV (35-kV voltage class). Insulating liquids are limited to those specified in ANSI/IEEE C57.12.00-1980 unless otherwise noted herein.

This standard does not cover the following types of liquid-filled transformers:

- (1) Overhead-type distribution transformers, including those mounted in surface enclosures
- (2) Pad-mounted compartmental-type transformers as described and defined in the following standards:

American National Standard Requirements for Pad-Mounted Compartmental-Type Self-Cooled Single-Phase Distribution Transformers with High-Voltage Bushings (High-Voltage, 34 500 GrdY/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller), ANSI C57.12.21-1980

American National Standard Requirements for Pad-Mounted Compartmental-Type Self-Cooled Three-Phase Distribution Transformers with High-Voltage Bushings (34 500 GrdY/19 920 Volts and Below; 2500 kVA and Smaller), ANSI C57.12.22-1980

American National Standard Requirements for Pad-Mounted Compartmental-Type Self-Cooled Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 GrdY/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller, ANSI C57.12.25-1981

American National Standard Requirements for Pad-Mounted Compartmental-Type Self-Cooled Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 24 940 GrdY/14 400 Volts and Below; 2500 kVA and Smaller, ANSI C57.12.26-1975

- (3) Subsurface or submersible-type transformers as described and defined in the following standards:

American National Standard Requirements for Underground-Type Single-Phase Distribution Transformers, with Separable Insulated High-Voltage Connectors, High Voltage 24 940 GrdY/14 400 Volts and Below, Low Voltage 240/120, 100 kVA and Smaller, ANSI C57.12.23-1978

American National Standard Requirements for Underground-Type Three-Phase Distribution Transformers, 2500 kVA and Smaller; High Voltage 24 940 GrdY/14 400 Volts and Below; Low Voltage 480 Volts and Below, ANSI C57.12.24-1982

American National Standard Requirements for Secondary Network Transformers, Subway and Vault Types (Liquid Immersed), ANSI C57.12.40-1982

- (4) Rectifier transformers
- (5) Mobile transformers
- (6) All transformers for use in ships and other watercraft, railway rolling stock, aircraft, and automotive vehicles other than mobile home and recreational vehicles
- (7) Transformers used in mines
- (8) Transformers installed in railways for the generation, transformation, transmission, or distribution of power and used exclusively for operation of rolling stock, or transformers installed in railways and used exclusively for signaling, or communication purposes
- (9) Instrument transformers
- (10) Step-voltage regulators and induction voltage regulators
- (11) Arc furnace transformers
- (12) Transformers installed with communication equipment under the exclusive control of communication utilities, located outdoors or in building spaces used exclusively for such installations
- (13) Transformers that are used under the exclusive control of electric utilities for the purpose of communication or metering, or for the generation, control, transformation, transmission, and distribution of elec-

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tric energy and that are located in buildings used exclusively for such purposes or located outdoors on property owned or leased by the utility, or on public highways, streets, roads, etc., or by established rights on private property

1.2 Reference Standards. Transformers covered by this standard shall conform to relevant sections of the latest revision of applicable industry standards, except as otherwise indicated in this standard. Included among these standards are the following:

American National Standard Requirements for Transformers 230 000 Volts and Below, 833/958 through 8333/10 417 kVA, Single Phase and 750/862 through 60 000/80 000/100 000 kVA Three Phase (includes supplement ANSI C57.12.10a-1978), ANSI C57.12.10-1977

American National Standard Terminal Markings and Connections for Distribution and Power Transformers, ANSI C57.12.70-1978

American National Standard Transformer Terminology, ANSI C57.12.80-1978

American National Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers, ANSI/IEEE C57.12.00-1980

American National Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers, ANSI/IEEE C57.12.90-1980

American National Standard National Electrical Code, ANSI/NFPA 70-1981

American National Standard Safety Standard for High Voltage Industrial Control Equipment, ANSI/UL 347-1978

NEMA Standards Publication for Transformers, Regulators, and Reactors, NEMA TR 1-1980¹

1.3 Definitions

1.3.1 Routine Tests. Tests made for quality control by the manufacturer on every device or representative samples, or on parts or materials as required to verify during production that the product meets the design specifications and applicable standards.

NOTES:

(1) Certain quality assurance tests on identified critical parts of repetitive high-production devices may be tested on a planned statistical sampling basis.

(2) "Routine tests" are sometimes called "production tests."

¹ Available from the National Electrical Manufacturers Association, 2101 L Street NW, Washington, D.C. 20037.

1.3.2 Design Tests. Tests made by the manufacturer to determine the adequacy of the design of a particular type, style, or model of equipment or its component parts to meet its assigned ratings and to operate satisfactorily under normal service conditions or under special conditions if specified. These tests may be used to demonstrate compliance with applicable standards of the industry.

NOTES:

(1) Design tests are made on representative apparatus or prototypes to verify the validity of design analysis and calculation methods and to substantiate the ratings assigned to all other apparatus of basically the same design. These tests may also be used to evaluate modifications of a previous design and to ensure that performance has not been adversely affected. Test data from previous similar designs may be used for current designs, where appropriate. Once made, the tests need not be repeated unless the design is changed so as to modify performance.

(2) "Design tests" are sometimes called "type tests."

1.3.3 Other Tests. Tests so identified in individual product standards that may be specified by the user in addition to routine tests. (Examples include impulse, insulation power factor, and audible sound tests.)

1.3.4 Conformance Tests. Certain performance tests conducted 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 requirements is unnecessary.

2. Insulation System Requirements

2.1 Internal Insulation System. The transformer shall utilize a qualified internal insulation system, as described in the Appendix to this standard.

2.2 External Electrical Clearances. External electrical clearances for high-voltage bushings and low-voltage terminals with exposed conducting parts shall be as shown in Table 1. The clearances shown apply to a completely assembled unit including enclosure, if any, and are minimum values for the rating given.

3. Optional Accessory Devices

3.1 General. Accessory devices are those devices that are not basically required for proper operation of a transformer but perform a secondary or minor function as an adjunct or refinement to the primary func-