

ANSI®
C57.12.10-1988
Revision and Consolidation of
ANSI C57.12.10-1977, C57.12.10a-1978,
and C57.12.30-1977

**American National Standard
for Transformers –**

230 kV and Below
833/958 through 8333/10 417 kVA, Single-Phase,
and 750/862 through 60 000/80 000/100 000 kVA, Three-Phase
without Load Tap Changing;
and 3750/4687 through 60 000/80 000/100 000 kVA
with Load Tap Changing – Safety Requirements

Secretariat

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

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American National Standard

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Foreword (This Foreword is not part of American National Standard C57.12.10-1988.)

American National Standard C57.12.10 was first approved in 1958 and represented the first product standard for power transformers. It originally encompassed transformers 501 through 10 000 kVA with a maximum voltage of 67 000 volts. Successive revisions gradually expanded the scope, and subsequently a companion standard, ANSI C57.12.30, was added for power transformers with load-tap-changing equipment.

This standard is a revision and consolidation of ANSI C57.12.30-1977, Requirements for Load-Tap-Changing Transformers 230 000 Volts and Below, 3750/4687 through 60 000/80 000/100 000 kVA, Three-Phase; ANSI C57.12.10-1977 and C57.12.10a-1978, 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.

Some of the changes in this revision are the:

- (1) Combining of ANSI C57.12.10-1977 and C57.12.30-1977 into a single document.
- (2) Reorganizing of the data included in the two previous documents to eliminate repetition of much almost-identical data. Construction features are now described only once.
- (3) Reorganizing to better recognize small three-phase power transformers (750–2500 kVA) with distribution insulation levels (see Tables 8 and 9), and reduced construction features (see Table 11, “Basic Standard” Construction Features, 750–2500 Distribution BILs.)

It is anticipated that this simpler, briefer section on construction will eventually make the conversion to primary use of metric system international dimensions simpler and easier.

Other changes in the 1988 revision include numerous editorial changes to update information and references. A few nominal system voltages have been revised slightly to conform to the voltages of ANSI C84.1-1982, and are coded to indicate those which are recognized in ANSI C84.1-1982, Voltage Ratings for Electric Power Equipment (60 Hz). Manual taps have been changed to the very commonly used two 2.5-percent taps above and two 2.5-percent taps below rated high voltage. Paralleling systems for load-tap-changing transformers have been added as an “other” item. Recommended accuracy classifications of bushing current transformers for relaying service have been added. The percent impedance values of 60–150 BIL have been added. The percent impedance values of 60–150 BIL transformers have been reduced. The standard connection for shipment of series/multiple windings (when provided) was determined to be the “multiple” connection. In addition to these changes, many minor updating items and changes intended to improve format, organization, clarity, and brevity have been introduced.

This standard is a voluntary consensus standard. Its use is mandatory only when required by a duly constituted legal authority or when specified in a contractual relationship. To meet specialized needs and to allow innovation, specific changes are permissible when mutually determined by the user and the producer, provided such changes do not violate existing laws and are considered technically adequate for the function intended.

When this document is used on a mandatory basis, the words “shall” and “must” indicate mandatory requirements, and the words “should” and “may” refer to matters that are recommended and permitted, respectively, but are not mandatory.

Suggestions for improvement of this standard will be welcomed. They should be sent to the National Electrical Manufacturers Association, 2101 L Street, NW, Washington, DC 20037.

The standard was processed and approved for submittal to ANSI by the Accredited Standards Committee on Transformers, Regulators, and Reactors, C57. Committee approval of the standard 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
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230 kV and Below

**833/958 through 8333/10 417 kVA, Single-Phase,
and 750/862 through 60 000/80 000/100 000 kVA, Three-Phase
without Load Tap Changing;
and 3750/4687 through 60 000/80 000/100 000 kVA
with Load Tap Changing – Safety Requirements**

1. Introduction, Scope, and Organization

1.1 Introduction. This voluntary consensus standard is intended for use as a basis for performance, interchangeability, and safety of equipment covered, and to assist in the proper selection of such equipment.

1.2 Scope. This standard covers certain electrical, dimensional, and mechanical characteristics and takes into consideration certain safety features of 60-Hz, two-winding, liquid-immersed transformers rated as follows, and used for step-down purposes:

(1) 833/958 through 8333/10 417 kVA, single-phase; 750/862 through 10 000/12 500 kVA, three-phase; high voltage, 2400 through 138 000 volts; low-voltage, 480 through 36 230 volts; without load tap changing

Note: A subgroup of the above group is also identified as three-phase transformers 750–2500 kVA, with distribution BIL characteristics.

(2) 12 000/16 000/20 000 through 60 000/80 000/100 000 kVA, three-phase; high voltage, 23 000 through 230 000 volts; low voltage, 4800 through 36 230 volts; without load tap changing

(3) 3750/4687 through 10 000/12 500 kVA, three-phase; high voltage, 6900 through 138 000 volts; low voltage, 2400 through 36 230 volts; with load tap changing

(4) 12 000/16 000/20 000 through 60 000/80 000/100 000 kVA, three-phase; high voltage, 23 000 through 230 000 volts; low voltage, 4800 through 36 230 volts; with load tap changing

It is not intended that this standard shall apply to dry-type, regulating, pad-mounted, secondary-network, furnace, rectifier, or mine transformers.

1.3 Organization. This standard is divided into two parts:

(1) Part A. “Basic Standard” ratings, characteristics, construction, and routine tests

(2) Part B: “Other” ratings, construction, and tests

1.4 Mandatory Requirements. When this standard is used on a mandatory basis, the words “shall” and “must” indicate mandatory requirements, and the words “should” and “may” refer to matters that are recommended and permitted, respectively, but not mandatory.

Note: The Foreword of this standard describes the circumstances under which the document may be used on a mandatory basis.

Part A: “Basic Standard” Ratings, Characteristics, Construction, and Routine Tests

2. Referenced and Related Standards

2.1 Referenced American National Standards. This standard is intended for use in conjunction with the following American National Standards. When the referenced standards are superseded by a revision approved by the American National Standards Institute, Inc, the latest revision shall apply:

ANSI B1.1-1982, Unified Inch Screw Threads (UN and UNR Thread Form)

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

ANSI C84.1-1982, Electric Power Systems and Equipment (60 Hz) – Voltage Ratings

ANSI/ASME B1.20.1-1983, Pipe Threads, General Purpose (Inch)

ANSI/IEEE 21-1976, General Requirements and Test Procedure for Outdoor Apparatus Bushings

ANSI/IEEE 24-1984, Performance Characteristics and Dimensions for Outdoor Apparatus Bushings

ANSI/IEEE 100-1984, Dictionary of Electrical and Electronics Terms

ANSI/IEEE C37.90.1-1974, Guide for Surge Withstand Capability (SWC) Tests

ANSI/IEEE C57.12.00-1987, General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers

ANSI/IEEE C57.12.80-1978, Terminology for Power and Distribution Transformers

ANSI/IEEE C57.13-1978, Requirements for Instrument Transformers

ANSI/IEEE C57.92-1981, Guide for Loading Mineral-Oil-Immersed Power Transformers

2.2 Related Standard. The following standard is listed for information only and is not essential for the completion of the requirements of this standard:

ANSI/IEEE C57.12.90-1987, Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers, and Guide for Short-Circuit Testing of Distribution and Power Transformers

3. Terminology

Standard transformer terminology in ANSI/IEEE C57.12.80-1978 shall apply. Other electrical terms are defined in ANSI/IEEE 100-1984.

4. Rating Data

4.1 Usual Service Conditions. Service conditions shall be in accordance with ANSI/IEEE C57.12.00-1987.

4.2 Kilovolt-Ampere Ratings

4.2.1 Kilovolt-ampere ratings are continuous and based on not exceeding either a 65°C average winding temperature rise by resistance or an 80°C hottest spot temperature rise, as covered in ANSI/IEEE C57.12.00-1987.

4.2.2 Kilovolt-ampere ratings shall be as listed in Tables 1 and 2.

4.3 Kilovolt-Ampere and Voltage Ratings. Kilovolt-ampere and voltage ratings for self-cooled transformers shall be as listed in Tables 3 through 6.

4.4 Insulation Levels. Basic impulse insulation levels (BILs) for transformers shall be as listed in Tables 7 through 9.

4.5 Taps

4.5.1 High Voltage Winding Taps for Deenergized Operation. The following four high-voltage rated kVA taps shall be provided: two (2) 2.5 percent above rated voltage, and two (2) 2.5 percent below rated voltage. Voltages and currents should be listed in accordance with 7.1.

4.5.2 Taps for Load-Tap-Changing Transformers. When a load-tap-changing transformer is specified, load-tap-changing equipment shall be furnished to provide approximately ± 10 -percent automatic adjustment of the low-voltage winding voltage in approximately 5/8-percent steps, with sixteen steps above and sixteen steps below rated low voltage. The transformer shall be capable of delivering rated kilovolt-amperes at the rated low-voltage position and on all positions above rated low voltage. The transformer shall be capable of delivering low-voltage current corresponding to rated low voltage at all positions below rated low voltage.

4.6 Impedance Voltage

4.6.1 Percent Impedance Voltage. The percent impedance voltage at the self-cooled rating as measured on the rated voltage connection shall be as listed in Table 10.

4.6.2 Tolerance on Impedance Voltage. The tolerance shall be as specified in ANSI/IEEE C57.12.00-1987.

4.6.3 Percent Departure of Impedance Voltage on Taps for Deenergized Operation. The percent departure of tested impedance voltage on any tap from the tested impedance voltage at rated voltage shall not be greater than the total tap voltage range expressed as a percentage of the rated voltage.

Note: This does not apply to load-tap-changing taps.

4.7 Top-Liquid Temperature-Range Limits. The transformer shall be suitable for operation over a range of top-liquid temperatures from -20°C to +105°C, provided the liquid level has been properly adjusted to the indicated 25°C level.

Note: Operation at these temperatures may cause the mechanical pressure-vacuum bleeder device (5.7.2) to function to relieve excessive positive or negative pressures.

4.8 Routine Tests

4.8.1 "Routine Tests" shall be made in accordance with ANSI/IEEE C57.12.00-1987.

4.8.2 On load-tap-changing transformers, additional routine tests for load-tap-changing transformers listed in ANSI/IEEE C57.12.00-1987 shall be made.

Table 1 – Kilovolt-Ampere Ratings, Self-Cooled (OA)

Single-Phase (kV) Without Load Tap Changing	Three-Phase (kVA)	
	Without Load Tap Changing	With Load Tap Changing
833	750	—
1250	1 000	—
1667	1 500	—
2500	2 000	—
3333	2 500	—
5000	3 750	3 750
6667	5 000	5 000
8333	7 500	7 500
—	10 000	10 000

Table 2 – Kilovolt-Ampere Ratings,
Self-Cooled (OA), Forced-Cooled First-Stage, and
Forced-Cooled Second-Stage Three-Phase
(With, or Without, Load Tap Changing),
12 000–100 000 kVA

OA	First-Stage	Second-Stage
12 000	16 000	20 000
15 000	20 000	25 000
20 000	26 667	33 333
25 000	33 333	41 667
30 000	40 000	50 000
37 500	50 000	62 500
50 000	66 667	83 333
60 000	80 000	100 000

Table 3
Range of Voltage and Kilovolt-Ampere Ratings for Single-Phase Transformers, 833–8333 kVA

Low-Voltage Ratings (V)					
High-Voltage Ratings (V)					
	2400/4160Y, 2520/4360Y, 4800/8320Y, —	6900/11 950Y, 8355/23 085PW, 7560/13 090Y, 7620/13 200Y, —	23 555W 12 600, 13 200, 13 800 14 400	14 400/24 940Y — 34 500, 19 920/34 500Y — 20 920/36 230Y	
	480	5040/8720Y	7970/13 800Y	14 400	20 920/36 230Y
Self-Cooled (OA) Kilovolt-Ampere Ratings (kVA)					
2400/4160Y	833	—	—	—	—
4800/8320Y	833	—	—	—	—
6900/11 950Y,	833, 1250	833-2500	—	—	—
6930/12 000Y,	—	—	—	—	—
7200/12 470Y,	—	—	—	—	—
7620/13 200Y,	—	—	—	—	—
7970/13 800Y	—	—	—	—	—
12 000, 13 200, 13 800	—	—	—	—	—
23 000	833, 1250	833-2500	833-2500	—	—
34 500	833, 1250	833-2500	833-3333	833-3333	—
46 000	833, 1250	833-2500	833-8333	833-8333	—
69 000	—	833-2500	833-8333	833-8333	—
115 000	—	2500	2500-8333	2500-8333	2500-8333
138 000	—	2500	2500-8333	2500-8333	2500-8333

Notes:

- (1) All voltages are Δ unless otherwise indicated.
- (2) Kilovolt-ampere ratings separated by a dash indicate that all the intervening ratings listed in Table 1 are included.
- (3) Bold type—voltages listed in ANSI C84.1-1982.
- (4) Italics type—voltages not listed in ANSI C84.1-1982.