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This extended version of IEC 61558-2-12:2024 includes the content of the references made to IEC 61558-1:2017

GROUP ENERGY EFFICIENCY PUBLICATION

Safety of transformers, reactors, power supply units and combination thereof – Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This extended version (EXV) of the official IEC Standard provides the user with the comprehensive content of the Standard.

IEC 61558-2-12:2024 EXV includes the content of IEC 61558-2-12:2024, and the references made to IEC 61558-1:2017.

The specific content of IEC 61558-2-12:2024 is displayed on a blue background.

IEC 61558-2-12 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International Standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) adjustment of structure and references in accordance with IEC 61558-1:2017;
b) description of constructions moved to IEC 61558-1:2017;
c) new symbol for power supply unit with linearly regulated output voltage.

The text of this International Standard is based on the following documents:

Draft	Report on voting
96/587/FDIS	96/591/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

It has the status of a group safety publication in accordance with IEC Guide 104.

This International Standard is to be used in conjunction with IEC 61558-1:2017.

This document supplements or modifies the corresponding clauses in IEC 61558-1:2017, so as to convert that publication into the IEC standard: *Particular requirements and tests for constant voltage transformers and power supply units for constant voltage.*

A list of all parts in the IEC 61558 series published under the general title *Safety of transformers, reactors, power supply units and combinations thereof,* can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

Where this document states "*addition*", "*modification*" or "*replacement*", the relevant text of IEC 61558-1:2017 is to be adopted accordingly.

In this document, the following print types are used:

– requirements proper: in roman type;
– *test specifications: in italic type*;
– explanatory matter: in smaller roman type:

In the text of this document, the words in **bold** are defined in Clause 3.

Subclauses, notes, figures and tables additional to those in IEC 61558-1:2017 are numbered starting from 101; supplementary annexes are entitled AA, BB, etc.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document covers safety requirements for **transformers**. Where the term **transformer** is used, it covers **transformers**, **reactors** and **power supply units** where applicable.

During the development of this document, to the extent possible, the requirements of IEC 60364 (all parts) were taken into consideration, so that a **transformer** can be installed in accordance with the wiring rules contained in that document. However, national wiring rules can differ.

This document recognizes the internationally accepted levels of protection against the possible electrical, mechanical, and fire hazards caused by **transformers** operating under normal conditions in accordance with the manufacturer's instructions. It also covers abnormal conditions which can occur in practice.

A **transformer** complying with this document will not necessarily be judged to comply with the safety principles of this document if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

A **transformer** employing materials or having forms of construction differing from those detailed in this document may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the safety principles of this document.

The document dealing with non-safety aspects of electromagnetic compatibility (EMC) of **transformers** is IEC 62041. However, that document also includes tests that can subject the **transformer** to conditions involving safety aspects.

The objective of of IEC 61558-1 is to provide a set of requirements and tests considered to be generally applicable to most types of **transformers**, and which can be called up as required by the relevant part of IEC 61558-2. IEC 61558-1 is thus not to be regarded as a specification by itself for any type of **transformer**, and its provisions apply only to particular types of **transformers** to the extent determined by the appropriate part of IEC 61558-2. IEC 61558-1 also contains normative routine tests.

Each part of IEC 61558-2 in conjunction with this document contains all the necessary requirements for the **transformer** being covered and does not contain references to other parts of IEC 61558-2. For **transformers** with a protection index IP00 and associated **transformers**, it is possible to have circuits corresponding to different parts of IEC 61558-2 within the same construction (e.g. SELV output circuit according to IEC 61558-2-6 and a 230 V output circuit according to IEC 61558-2-4). However, if the **transformer** is covered by different parts IEC 61558-2, to the extent reasonable, the relevant part of IEC 61558-2 is applied to each function/application separately. If applicable, the effect of one function on the other is taken into consideration.

If an appropriate part of IEC 61558-2 does not exist for a particular **transformer** or group of **transformer**s, the nearest applicable part may be used as a guide to the requirements and tests.

However, individual countries may wish to consider its application, to the extent reasonable, to transformers not mentioned in the IEC 61558-2 series, and to transformers designed on new principles.

Where the requirements of any of the clauses of a part of IEC 61558-2 refer to IEC 61558-1 by the phrase "This clause of Part 1 is applicable", this phrase means that all the requirements of that clause of IEC 61558-1 are applicable, except those requirements that are clearly not applicable to the particular type of **transformer** covered by that part of IEC 61558-2.

The principle for the preparation of the different parts of IEC 61558-2 is as shown in Figure 1.

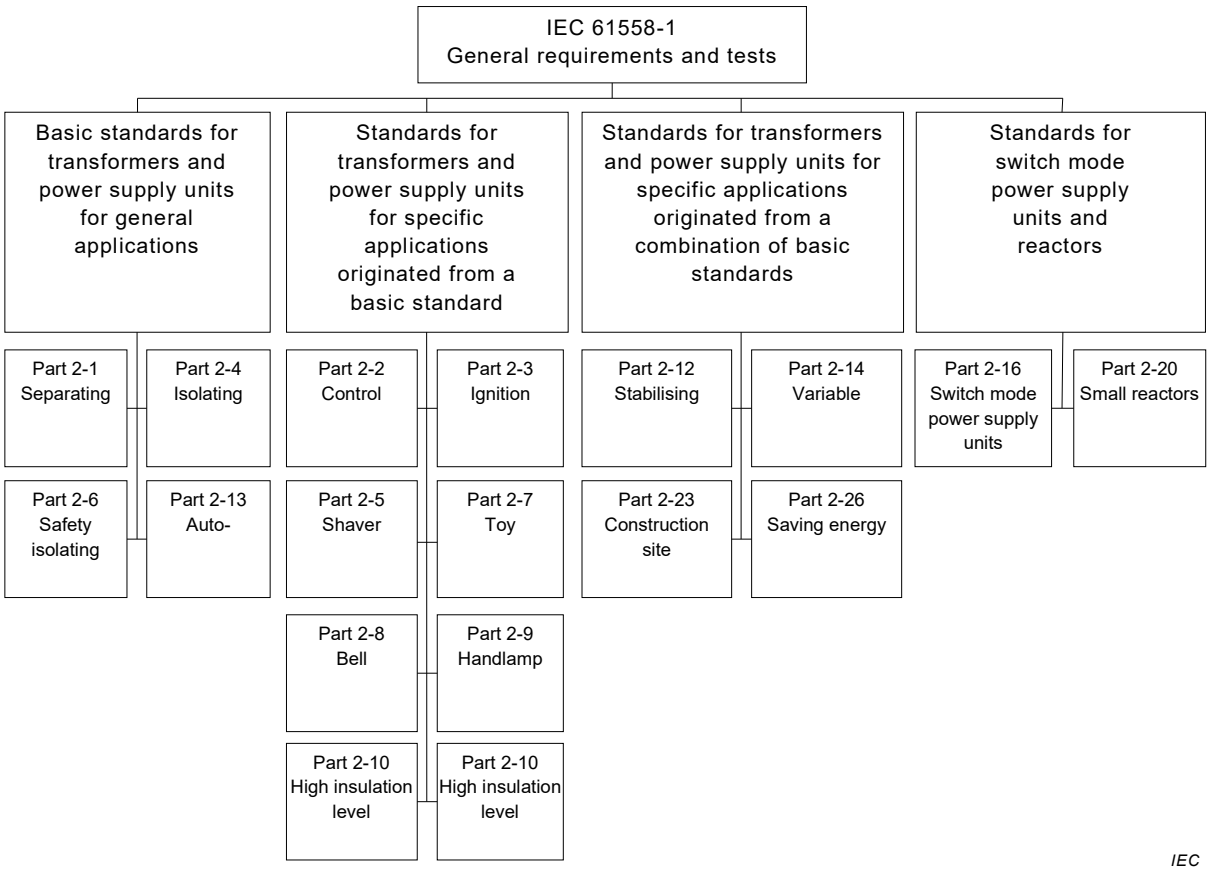


Figure 1 – IEC 61558 principle

Relevant clauses of this document (e.g. clauses dealing with thermal endurance test for windings) apply also to **transformers** forming an integral part of an appliance and which cannot be tested separately.

The IEC 61558 series consists of the following parts, under the general title *Safety of transformers, reactors, power supply units and combination thereof:*[1]

Part 1: General requirements and tests

Part 2-1: Particular requirements and tests for separating transformers for general applications

Part 2-2: Particular requirements and tests for control transformers

Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners

Part 2-4: Particular requirements and tests for isolating transformers

Part 2-5: Particular requirements and tests for shaver transformers and shaver supply units

Part 2-6: Particular requirements and tests for safety isolating transformers

Part 2-7: Particular requirements and tests for transformers for toys

Part 2-8: Particular requirements and tests for transformers for bells and chimes

Part 2-9: Particular requirements and tests for transformers for class III handlamps for tungsten filament lamps

[1] Some of the parts of this series published earlier appeared under the general title *Safety of power transformers, power supplies, reactors and similar products or Safety of power transformers, power supply units and similar or Safety of power transformers, power supply units and similar devices*. Future editions of these parts will be issued under the new general title indicated above.

Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

Part 2-12: Particular requirements and tests for constant voltage transformers

Part 2-13: Particular requirements and tests for auto transformers

Part 2-14: Particular requirements and tests for variable transformers

Part 2-15: Particular requirements and tests for isolating transformers for the supply of medical locations

Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units

Part 2-20: Particular requirements and tests for small reactors

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

Part 2-26: Particular requirements and tests for transformers and power supply units all for saving energy and other purposes

Other parts are under consideration.

INTRODUCTION to IEC 61558-2-12

IEC TC 96 has a group safety function in accordance with IEC Guide 104 for transformers other than those intended to supply distribution networks, in particular transformers and power supply units intended to allow the application of protective measures against electric shock as defined by TC 64, which is about electrical installations and protection against electric shock, but in certain cases including the limitation of voltage and horizontal safety function for SELV, in accordance with IEC 60364-4-41.

The group safety function (GSF) is used because of responsibility for safety extra-low voltage (SELV) in accordance with IEC 61140:2016, 5.2.6 and IEC 60364-4-41:2005, 414.3.1 or control circuits in accordance with IEC 60204-1:2016, 7.2.4.

The group safety function is used for each part of IEC 61558-2 because different standards of the IEC 61558 series can be combined in one construction but in certain cases with no limitation of rated output power.

For example an auto-transformer in accordance with IEC 61558-2-13 can be designed with a separate SELV-circuit in accordance with the particular requirements for IEC 61558-2-6 relating to the general requirements of IEC 61558-1.

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

1 Scope

This part of IEC 61558 deals with the safety of **constant voltage transformers** for general applications and **power supply units for constant voltage** for general applications. **Constant voltage transformers** incorporating **electronic circuits** are also covered by this document.

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** covers **constant voltage transformers** for general applications and **power supply units for constant voltage** for general applications.

This document is applicable to **stationary** or **portable** single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry-type**:

– **constant voltage auto-transformers**;
– **constant voltage separating transformers**;
– **constant voltage isolating transformers**;
– **constant voltage safety isolating transformers**.

The windings can be encapsulated or non-encapsulated.

For **power supply units** (linear) this document is applicable. For **switch mode power supply units** IEC 61558-2-16 is applicable together with this document. Where two requirements are in conflict, the most severe take precedence.

The **rated supply voltage** does not exceed 1 000 V AC. The **rated supply frequency** does not exceed 500 Hz, the **internal operating resonant frequency** does not exceed 30 kHz and the **internal operating frequency** does not exceed 100 MHz.

The **rated output** does not exceed:

– 40 kVA for single-phase **constant voltage auto-transformers**;
– 200 kVA for polyphase **constant voltage auto-transformers**;
– 25 kVA for single-phase **constant voltage separating transformers** and **constant voltage isolating transformers**;
– 40 kVA for polyphase **constant voltage separating transformers** and **constant voltage isolating transformers**;
– 10 kVA for single-phase **constant voltage safety isolating transformers**;
– 16 kVA for polyphase **constant voltage safety isolating transformers.**

This document is applicable to **transformers** without limitation of the **rated output**, subject to an agreement between the purchaser and the manufacturer.

NOTE 2 **Transformers** intended to supply distribution networks are not included in the scope.

Where applicable to **constant voltage auto-transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC, and for **independent constant voltage auto-transformers** the **no-load output voltage** and the **rated output voltage** exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage auto-transformers** covered by this document are used only in applications where no **insulation** between circuits is required by the installation rules or by the end product standard.

Where applicable to **constant voltage separating transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC, and for **independent constant voltage separating transformers** the **no-load output voltage** and the **rated output voltage** exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage separating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is not required by the installation rules or by the end product standard.

Where applicable to **constant voltage isolating transformers**

– the **no-load output voltage** or the **rated output voltage** does exceed 50 V AC or 120 V ripple-free DC and where applicable, does not exceed 500 V AC or 708 V ripple-free DC. The **no-load output voltage** and the **rated output voltage** can be up to 1 000 V AC or 1 415 V ripple-free DC for special applications;

– **constant voltage isolating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

Where applicable to **constant voltage safety isolating transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage safety isolating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

This document is not applicable to external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

Attention is drawn to the following if necessary:

– for **transformers** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) ;

– measures to protect the **enclosure** and the components inside the enclosure against external influences such as fungus, vermin, termites, solar-radiation, and icing;

– the different conditions for transportation, storage, and operation of the **transformers**;

– additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers** intended for use in special environments.

Future technological development of **transformers** may necessitate a need to increase the upper limit of the frequencies. Until then this document may be used as a guidance document.

This group safety publication focusing on safety guidance is primarily intended to be used as a product safety standard for the products mentioned in the scope, but is also intended to be used by technical committees in the preparation of publications for products similar to those mentioned in the scope of this group safety publication, in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications and/or group safety publications in the preparation of its publications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60065:2014, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test FC: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60076-1, *Power transformers – Part 1: General*

IEC 60076-11:2004, *Power transformers – Part 11: Dry-type transformers*

IEC TR 60083, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60127 (all parts), *Miniature fuses*

IEC 60127-3, *Miniature fuses – Part 3: Sub-miniature fuse-links*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60227-5:2011, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)*

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60245-4:2011, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

IEC 60269 (all parts), *Low voltage fuses*

IEC 60269-2:2013, *Low voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to K*

IEC 60269-3:2010, *Low voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications) – Examples of standardized systems of fuses A to F*

IEC 60309 (all parts), *Plugs, socket-outlets and couplers for industrial purposes*

IEC 60317 (all parts), *Specifications for particular types of windings wires*

IEC 60317-0-7:2012, *Specifications for particular types of winding wires – Part 0-7: General requirements – Fully insulated (FIW) zero-defect enamelled round copper wire with nominal conductor diameter of 0,040 mm to 1,600 mm*

IEC 60317-56, *Specifications for particular types of winding wires – Part 56: Solderable fully insulated (FIW) zero-defect polyurethane enamelled round copper wire with nominal conductor diameter 0,040 mm to 1,600 mm, class 180*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60320-2-3, *Appliance couplers for household and similar general purposes – Part 2-3: Appliance couplers with a degree of protection higher than IPX0*

IEC 60384-14:2013, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60417*, Grapahical symbols for use on equipment*
(available at http://www.graphical-symbols.info/equipment)

IEC 60454 (all parts), *Pressure-sensitive adhesive tapes for electrical purposes*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60664-1:2007, *Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60691:2015, *Thermal-links – Requirements and application guide*

IEC 60695-2-10:2013, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2014, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60730 (all parts), *Automatic electrical controls*

IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*

IEC 60851-3:2009, *Winding wires – Test methods: Part 3: Mechanical properties*

IEC 60851-5:2008, *Winding wires – Test methods: Part 5: Electrical properties*

IEC 60851-6:2012, *Winding wires – Test methods: Part 6: Thermal properties*

IEC 60884-1:2002, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*
IEC 60884-1:2002/AMD1:2006
IEC 60884-1:2002/AMD2:2013

IEC 60884-2-4, *Plugs and socket-outlets for household and similar purposes – Part 2-4: Particular requirements for plugs and socket-outlets for SELV*

IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60906-1, *IEC system of plugs and socket-outlets for household and similar purposes – Part 1: Plugs and socket-outlets 16 A 250 V a.c.*

IEC 60906-3, *IEC system of plugs and socket-outlets for household and similar purposes – Part 3: SELV plugs and socket-outlets, 16 A 6 V, 12 V, 24 V, 48 V, a.c. and d.c.*

IEC 60947-7-1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

IEC 60998-2-1, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61058-1:2016, *Switches for appliances – Part 1: General requirements*

IEC 61058-1-1:2016, *Switches for appliances – Part 1-1: Requirements for mechanical switches*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC 61558-1:2017, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-16:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

ISO 8820 (all parts), *Road vehicles – Fuse-links*

EN 50075:1990, *Specification for flat non-wirable two-pole plugs 2.5 A 250 V, with cord, for the connection of class II-equipment for household and similar purposes*

DIN 43671:1975, *Copper bus bars; design for continuous current*

DIN 43670:1975, *Aluminium bus bars; design for continuous current*

DIN 43670-2:1985, *Aluminium bus bars copper cladding; design for continuous current*

IEC 61558-2-12

Edition 3.0 2024-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP ENERGY EFFICIENCY PUBLICATION
PUBLICATION GROUPÉE SUR L'EFFICACITÉ ÉNERGÉTIQUE

Safety of transformers, reactors, power supply units and combination thereof – Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 2-12: Exigences particulières et essais pour les transformateurs à tension constante et les blocs d'alimentation pour tension constante



IEC 61558-2-12:2024-04(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
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5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61558-2-12 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International Standard.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) adjustment of structure and references in accordance with IEC 61558-1:2017;
b) description of constructions moved to IEC 61558-1:2017;
c) new symbol for power supply unit with linearly regulated output voltage.

The text of this International Standard is based on the following documents:

Draft	Report on voting
96/587/FDIS	96/591/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

It has the status of a group safety publication in accordance with IEC Guide 104.

This International Standard is to be used in conjunction with IEC 61558-1:2017.

This document supplements or modifies the corresponding clauses in IEC 61558-1:2017, so as to convert that publication into the IEC standard: *Particular requirements and tests for constant voltage transformers and power supply units for constant voltage.*

A list of all parts in the IEC 61558 series published under the general title *Safety of transformers, reactors, power supply units and combinations thereof,* can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

Where this document states "*addition*", "*modification*" or "*replacement*", the relevant text of IEC 61558-1:2017 is to be adopted accordingly.

In this document, the following print types are used:

– requirements proper: in roman type;

– *test specifications: in italic type*;

– explanatory matter: in smaller roman type:

In the text of this document, the words in **bold** are defined in Clause 3.

Subclauses, notes, figures and tables additional to those in IEC 61558-1:2017 are numbered starting from 101; supplementary annexes are entitled AA, BB, etc.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

IEC TC 96 has a group safety function in accordance with IEC Guide 104 for transformers other than those intended to supply distribution networks, in particular transformers and power supply units intended to allow the application of protective measures against electric shock as defined by TC 64, which is about electrical installations and protection against electric shock, but in certain cases including the limitation of voltage and horizontal safety function for SELV, in accordance with IEC 60364-4-41.

The group safety function (GSF) is used because of responsibility for safety extra-low voltage (SELV) in accordance with IEC 61140:2016, 5.2.6 and IEC 60364-4-41:2005, 414.3.1 or control circuits in accordance with IEC 60204-1:2016, 7.2.4.

The group safety function is used for each part of IEC 61558-2 because different standards of the IEC 61558 series can be combined in one construction but in certain cases with no limitation of rated output power.

For example an auto-transformer in accordance with IEC 61558-2-13 can be designed with a separate SELV-circuit in accordance with the particular requirements for IEC 61558-2-6 relating to the general requirements of IEC 61558-1.

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-12: Particular requirements and tests for constant voltage transformers and power supply units for constant voltage

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **constant voltage transformers** for general applications and **power supply units for constant voltage** for general applications. **Constant voltage transformers** incorporating **electronic circuits** are also covered by this document.

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** covers **constant voltage transformers** for general applications and **power supply units for constant voltage** for general applications.

This document is applicable to **stationary** or **portable** single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry-type**:

– **constant voltage auto-transformers**;
– **constant voltage separating transformers**;
– **constant voltage isolating transformers**;
– **constant voltage safety isolating transformers**.

The windings can be encapsulated or non-encapsulated.

For **power supply units** (linear) this document is applicable. For **switch mode power supply units** IEC 61558-2-16 is applicable together with this document. Where two requirements are in conflict, the most severe take precedence.

The **rated supply voltage** does not exceed 1 000 V AC. The **rated supply frequency** does not exceed 500 Hz, the **internal operating resonant frequency** does not exceed 30 kHz and the **internal operating frequency** does not exceed 100 MHz.

The **rated output** does not exceed:

– 40 kVA for single-phase **constant voltage auto-transformers**;
– 200 kVA for polyphase **constant voltage auto-transformers**;
– 25 kVA for single-phase **constant voltage separating transformers** and **constant voltage isolating transformers**;
– 40 kVA for polyphase **constant voltage separating transformers** and **constant voltage isolating transformers**;
– 10 kVA for single-phase **constant voltage safety isolating transformers**;
– 16 kVA for polyphase **constant voltage safety isolating transformers.**

This document is applicable to **transformers** without limitation of the **rated output**, subject to an agreement between the purchaser and the manufacturer.

NOTE 2 **Transformers** intended to supply distribution networks are not included in the scope.

Where applicable to **constant voltage auto-transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC, and for **independent constant voltage auto-transformers** the **no-load output voltage** and the **rated output voltage** exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage auto-transformers** covered by this document are used only in applications where no **insulation** between circuits is required by the installation rules or by the end product standard.

Where applicable to **constant voltage separating transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC, and for **independent constant voltage separating transformers** the **no-load output voltage** and the **rated output voltage** exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage separating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is not required by the installation rules or by the end product standard.

Where applicable to **constant voltage isolating transformers**

– the **no-load output voltage** or the **rated output voltage** does exceed 50 V AC or 120 V ripple-free DC and where applicable, does not exceed 500 V AC or 708 V ripple-free DC. The **no-load output voltage** and the **rated output voltage** can be up to 1 000 V AC or 1 415 V ripple-free DC for special applications;

– **constant voltage isolating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

Where applicable to **constant voltage safety isolating transformers**

– the **no-load output voltage** or the **rated output voltage** does not exceed 50 V AC or 120 V ripple-free DC;

– **constant voltage safety isolating transformers** covered by this document are used only in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

This document is not applicable to external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

Attention is drawn to the following if necessary:

– for **transformers** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) ;

– measures to protect the **enclosure** and the components inside the enclosure against external influences such as fungus, vermin, termites, solar-radiation, and icing;

– the different conditions for transportation, storage, and operation of the **transformers**;

– additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers** intended for use in special environments.

Future technological development of **transformers** may necessitate a need to increase the upper limit of the frequencies. Until then this document may be used as a guidance document.

This group safety publication focusing on safety guidance is primarily intended to be used as a product safety standard for the products mentioned in the scope, but is also intended to be used by technical committees in the preparation of publications for products similar to those mentioned in the scope of this group safety publication, in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications and/or group safety publications in the preparation of its publications.

2 Normative references

This clause of IEC 61558-1:2017 is applicable except as follows:

Addition

IEC 61558-1:2017, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-16:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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SÉCURITÉ DES TRANSFORMATEURS, BOBINES D'INDUCTANCE, BLOCS D'ALIMENTATION ET DES COMBINAISONS DE CES ÉLÉMENTS –

Partie 2-12: Exigences particulières et essais pour les transformateurs à tension constante et les blocs d'alimentation pour tension constante

AVANT-PROPOS

1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de brevet revendiqué à cet égard. À la date de publication du présent document, l'IEC n'a pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse https://patents.iec.ch. L'IEC ne saurait être tenue pour responsable de l'identification de ces droits de propriété en tout ou partie.

L'IEC 61558-2-12 a été établie par le comité d'études 96 de l'IEC: Transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2011. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) la structure et les références ont été alignées sur l'IEC 61558-1:2017;

b) la description des constructions a été déplacée dans l'IEC 61558-1:2017;

c) un nouveau symbole a été ajouté pour les blocs d'alimentation dont la régulation de la tension secondaire est linéaire.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
96/587/FDIS	96/591/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Le présent document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Il a le statut de publication groupée de sécurité conformément au Guide 104 de l'IEC.

La présente Norme internationale doit être utilisée conjointement avec l'IEC 61558-1:2017.

Le présent document complète ou modifie les articles correspondants de l'IEC 61558-1:2017, de façon à transformer cette publication en norme IEC: *Exigences particulières et essais pour les transformateurs à tension constante et les blocs d'alimentation pour tension constante*.

Une liste de toutes les parties de la série IEC 61558, publiées sous le titre général *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments*, se trouve sur le site web de l'IEC.

Les futures normes de cette série porteront le nouveau titre général cité ci-dessus. Le titre des normes qui existent déjà dans cette série sera mis à jour lors de leur prochaine édition.

Lorsque le présent document mentionne "*addition*", "*modification*" ou "*remplacement*", le texte correspondant de l'IEC 61558-1:2017 doit être adapté en conséquence.

Dans le présent document, les caractères d'imprimerie suivants sont utilisés:

– exigences proprement dites: caractères romains;

– *modalités d'essais: caractères italiques*;

– commentaires: petits caractères romains.

Dans le texte du présent document, les termes en **gras** sont définis à l'Article 3.

Les paragraphes, notes, figures et tableaux qui s'ajoutent à ceux de l'IEC 61558-1:2017 sont numérotés à partir de 101; les annexes qui sont ajoutées sont désignées AA, BB, etc.

Le comité a décidé que le contenu du présent document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le présent document sera

- reconduit,
- supprimé, ou
- révisé.

INTRODUCTION

Le CE 96 de l'IEC a une fonction groupée de sécurité, conformément au Guide 104 de l'IEC relatif aux transformateurs autres que ceux destinés à alimenter les réseaux de distribution, notamment les transformateurs et les blocs d'alimentation destinés à permettre l'application de mesures de protection contre les chocs électriques, comme cela est défini par le CE 64, qui traite des installations électriques et de la protection contre les chocs électriques, mais qui incluent également dans certains cas la limitation de la tension et de la fonction de sécurité horizontale pour la TBTS, conformément à l'IEC 60364-4-41.

La fonction groupée de sécurité (GSF, *Group Safety Function*) est utilisée en raison de la responsabilité de la très basse tension de sécurité (TBTS), conformément au 5.2.6 de l'IEC 61140:2016 et au 414.3.1 de l'IEC 60364-4-41:2005, ou des circuits de commande, conformément au 7.2.4 de l'IEC 60204-1:2016.

La fonction groupée de sécurité est utilisée pour chacune des parties de l'IEC 61558-2, car différentes normes de la série IEC 61558 peuvent être combinées en une seule et même construction, mais dans certains cas sans aucune limitation de la puissance secondaire assignée.

Un autotransformateur conforme à l'IEC 61558-2-13 peut par exemple être conçu avec un circuit TBTS distinct, conformément aux exigences particulières de l'IEC 61558-2-6 liées aux exigences générales de l'IEC 61558-1.

SÉCURITÉ DES TRANSFORMATEURS, BOBINES D'INDUCTANCE, BLOCS D'ALIMENTATION ET DES COMBINAISONS DE CES ÉLÉMENTS –

Partie 2-12: Exigences particulières et essais pour les transformateurs à tension constante et les blocs d'alimentation pour tension constante

1 Domaine d'application

Remplacement:

La présente partie de l'IEC 61558 traite de la sécurité des **transformateurs à tension constante** pour applications d'ordre général et des **blocs d'alimentation pour tension constante** pour applications d'ordre général. Les **transformateurs à tension constante** qui incorporent des **circuits électroniques** sont également couverts par le présent document.

NOTE 1 La sécurité comprend les aspects électriques, thermiques et mécaniques.

Sauf spécification contraire, dans la suite du document, le terme **transformateur** couvre les **transformateurs à tension constante** pour applications d'ordre général et les **blocs d'alimentation pour tension constante** pour applications d'ordre général.

Le présent document s'applique aux **transformateurs de type sec fixes** ou **mobiles**, monophasés ou polyphasés, à refroidissement par air (naturel ou forcé) **indépendants** ou **associés**:

– **autotransformateurs à tension constante**;
– **transformateurs à tension constante à enroulements séparés**;
– **transformateurs à tension constante de séparation des circuits**;
– **transformateurs à tension constante de sécurité**.

Les enroulements peuvent être enrobés ou non enrobés.

Pour les **blocs d'alimentation** (linéaires), le présent document s'applique. Pour les **blocs d'alimentation à découpage**, l'IEC 61558-2-16 et le présent document s'appliquent. Lorsque deux exigences sont contradictoires, la plus contraignante prévaut.

La **tension primaire assignée** ne dépasse pas 1 000 V en courant alternatif. La **fréquence d'alimentation assignée** ne dépasse pas 500 Hz, la **fréquence de résonance de fonctionnement interne** ne dépasse pas 30 kHz et la **fréquence de fonctionnement interne** ne dépasse pas 100 MHz.

La **puissance assignée** ne dépasse pas:

– 40 kVA pour les **autotransformateurs à tension constante** monophasés;
– 200 kVA pour les **autotransformateurs à tension constante** polyphasés;
– 25 kVA pour les **transformateurs à tension constante à enroulements séparés** et les **transformateurs à tension constante de séparation des circuits** monophasés;
– 40 kVA pour les **transformateurs à tension constante à enroulements séparés** et les **transformateurs à tension constante de séparation des circuits** polyphasés;
– 10 kVA pour les **transformateurs à tension constante de sécurité** monophasés;
– 16 kVA pour les **transformateurs à tension constante de sécurité** polyphasés.

Le présent document s'applique aux **transformateurs** sans limitation de la **puissance assignée**, qui font l'objet d'un accord entre l'acheteur et le fabricant.

NOTE 2 Le domaine d'application ne couvre pas les **transformateurs** destinés à alimenter les réseaux de distribution.

Quand cela s'applique aux **autotransformateurs à tension constante**

– la **tension secondaire à vide** ou la **tension secondaire assignée** ne dépasse pas 1 000 V en courant alternatif ou 1 415 V en courant continu lissé et, pour les **autotransformateurs à tension constante indépendants**, la **tension secondaire à vide** et la **tension secondaire assignée** dépassent 50 V en courant alternatif ou 120 V en courant continu lissé;
– les **autotransformateurs à tension constante** couverts par le présent document ne sont utilisés que dans le cadre d'applications pour lesquelles les règles d'installation ou la norme du produit final n'exigent aucune **isolation** entre les circuits.

Quand cela s’applique aux **transformateurs à tension constante à enroulements séparés**

– la **tension secondaire à vide** ou la **tension secondaire assignée** ne dépasse pas 1 000 V en courant alternatif ou 1 415 V en courant continu lissé et, pour les **transformateurs à tension constante à enroulements séparés indépendants**, la **tension secondaire à vide** et la **tension secondaire assignée** dépassent 50 V en courant alternatif ou 120 V en courant continu lissé;
– les **transformateurs à tension constante à enroulements séparés** couverts par le présent document ne sont utilisés que dans le cadre d'applications pour lesquelles les règles d'installation ou la norme du produit final n'exigent aucune **isolation double** ou **renforcée** entre les circuits.

Quand cela s'applique aux **transformateurs à tension constante de séparation des circuits**

– la **tension secondaire à vide** ou la **tension secondaire assignée** dépasse 50 V en courant alternatif ou 120 V en courant continu lissé et, le cas échéant, ne dépasse pas 500 V en courant alternatif ou 708 V en courant continu lissé. La **tension secondaire à vide** et la **tension secondaire assignée** peuvent atteindre 1 000 V en courant alternatif ou 1 415 V en courant continu lissé pour des applications spéciales;
– les **transformateurs à tension constante de séparation des circuits** couverts par le présent document ne sont utilisés que dans le cadre d'applications pour lesquelles les règles d'installation ou la norme du produit final exigent une **isolation double** ou **renforcée** entre les circuits.

Quand cela s’applique aux **transformateurs à tension constante de sécurité**

– la **tension secondaire à vide** ou la **tension secondaire assignée** ne dépasse pas 50 V en courant alternatif ou 120 V en courant continu lissé;
– les **transformateurs à tension constante de sécurité** couverts par le présent document ne sont utilisés que dans le cadre d'applications pour lesquelles les règles d'installation ou la norme du produit final exigent une **isolation double** ou **renforcée** entre les circuits.

Le présent document ne s'applique pas aux circuits externes et à leurs composants destinés à être connectés aux bornes primaires et bornes secondaires des **transformateurs**.

L'attention est attirée sur les points suivants, si nécessaire:

– exigences supplémentaires (issues d'autres normes applicables, règles nationales, etc.) pour les **transformateurs** destinés à être utilisés dans des véhicules, à bord de navires ou d'avions;
– des mesures visent à protéger l'**enveloppe** et les composants situés à l'intérieur de celle-ci contre les facteurs d'influence externes comme les champignons, la vermine, les termites, les rayonnements solaires et le givre;

– différentes conditions de transport, de stockage et de fonctionnement pour les **transformateurs**;
– exigences supplémentaires qui peuvent s'appliquer aux **transformateurs** destinés à être utilisés dans un environnement particulier, au regard d'autres normes et règles nationales applicables.

Les évolutions techniques futures des **transformateurs** peuvent nécessiter une augmentation de la limite supérieure des fréquences. En attendant, le présent document peut être utilisé à titre de recommandation.

La présente publication groupée de sécurité portant sur des recommandations de sécurité est avant tout destinée à être utilisée en tant que norme en matière de sécurité des produits pour les produits cités dans le domaine d'application, mais elle est également destinée à être utilisée par les comités d'études dans le cadre de l'élaboration de publications pour des produits similaires à ceux cités dans le domaine d'application de la présente publication groupée de sécurité, conformément aux principes établis dans le Guide 104 de l'IEC et le Guide 51 de l'ISO/IEC.

L'une des responsabilités d'un comité d'études consiste, le cas échéant, à utiliser les publications fondamentales de sécurité et/ou les publications groupées de sécurité dans le cadre de l'élaboration de ses publications.

2 Références normatives

L'article de l'IEC 61558-1:2017 s'applique avec les exceptions suivantes:

Addition:

IEC 61558-1:2017, *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 1: Exigences générales et essais*

IEC 61558-2-16:2021, *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments – Partie 2-16: Exigences particulières et essais pour les blocs d'alimentation à découpage et les transformateurs pour blocs d'alimentation à découpage pour applications d'ordre général*