# IEC 61558-2-2

Edition 3.0 2022-10
REDLINE VERSION

# INTERNATIONAL STANDARD

colour inside

GROUP SAFETY PUBLICATION

**Safety of ~~power~~ transformers, ~~power supplies,~~ reactors, power supply units and ~~similar products~~ combinations thereof –**
**Part 2-2: Particular requirements and tests for control transformers and power ~~supplies~~ supply units incorporating control transformers**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# SAFETY OF ~~POWER~~ TRANSFORMERS, ~~POWER SUPPLIES,~~ REACTORS, POWER SUPPLY UNITS AND ~~SIMILAR PRODUCTS~~ COMBINATIONS THEREOF –

## Part 2-2: Particular requirements and tests for control transformers and power ~~supplies~~ supply units incorporating control transformers

## FOREWORD

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**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-2:2007. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

International standard IEC 61558-2-2 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof.

This third edition cancels and replaces the second edition published in 2007. 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) new general symbol for control transformers;
c) new symbol for power supply unit with linearly regulated output voltage.

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

| Draft | Report on voting |
|---|---|
| 96/548/FDIS | 96/554/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 document 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 document 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 control transformers and power supply units incorporating control transformers.*

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 www.webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**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

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, 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 example 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 the IEC 61558-2 series 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 ~~POWER~~ TRANSFORMERS, ~~POWER SUPPLIES,~~ REACTORS, POWER SUPPLY UNITS AND ~~SIMILAR PRODUCTS~~ COMBINATIONS THEREOF –

## Part 2-2: Particular requirements and tests for control transformers and power ~~supplies~~ supply units incorporating control transformers

## 1 Scope

*Replacement:*

This part of IEC 61558 deals with the safety ~~aspects~~ of **control transformers** and **power ~~supplies~~ supply units** incorporating **control transformers**. **Transformers** incorporating **electronic circuits** are also covered by this document.

NOTE 1 Safety includes electrical, thermal and mechanical ~~safety~~ aspects.

~~This Part 2-2 is applicable to **control transformers** and **power supplies** incorporating both **control transformers** and **electronic circuits**. This Part 2-2 is not applicable to external circuits and their components intended to be connected to the input terminals, output terminals or socket-outlets of the **transformer** and **power supplies**.~~

Unless otherwise specified, from here onward, the term **transformer** covers **control transformers** and **power supply units** incorporating **control transformers**.

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.

This document does not apply to **transformers** covered by IEC 60076-11.

~~This Part 2-2 applies to **stationary** or **portable**, single-phase or poly-phase, air-cooled (natural or forced), **independent** or **associated control transformers** and **power supplies** incorporating a **control transformer**, having a **rated supply voltage** not exceeding 1 000 V a.c. and **rated supply** and **internal operating frequency** not exceeding 500 Hz.~~

This document is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry-type transformers.** The windings can be encapsulated or non-encapsulated.

The **rated supply voltage** does not exceed 1 000 V AC and the **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **rated thermal output** does not exceed:

- 25 kVA for single-phase ~~**control**~~ **transformers** ~~and **power supplies** incorporating **control transformers**~~,
- 40 kVA for polyphase ~~**control**~~ **transformers** ~~and **power supplies** incorporating **control transformers**~~.

This document is applicable to ~~**control**~~ **transformers** ~~and **power supplies** incorporating **control transformers**~~ without limitation of the **rated thermal output**, subject to an agreement between the purchaser and the manufacturer.

~~This Part 2-2 is applicable to **dry-type transformers**. The windings may be encapsulated or non-encapsulated.~~

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

The **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC. For **independent** ~~**control**~~ **transformers** ~~and independent **power supplies** incorporating **control transformers**,~~ the **no-load output voltage** and / or the **rated output voltage** is not less than 50 V AC or 120 V ripple-free DC.

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**.

NOTE 3 ~~**Control**~~ **Transformers** covered by this document are only used in applications where double or reinforced insulation between circuits is not required by the installation rules or by the end product standard.

NOTE 4 Normally the **control transformers** ~~and **power supplies** incorporating **control transformers**~~ are intended to be used with equipment to provide voltages different from the supply voltage for the functional requirements of the equipment. The protection against electric shock ~~may~~ can be provided ~~(~~or completed~~)~~ by other features of the equipment, such as the **body**. Parts of **output circuits** ~~may~~ can be connected to the **input circuits** or to protective earthing.

~~This Part 2-2 is applicable to **control transformers** and **power supplies** incorporating **control transformers** associated with specific equipment, to the extent decided upon by the relevant IEC technical committees.~~

~~NOTE 2~~ Attention is drawn to the following, if necessary:

- for ~~**control**~~ **transformers** ~~and **power supplies** incorporating **control transformers**~~ intended to be used in vehicles, on board ships, and ~~on board~~ aircraft, additional requirements (from other applicable standards, national rules, etc.) ~~may be necessary~~;
- measures to protect the **enclosure** and the components inside the enclosure against external influences such as fungus, vermin, termites, solar-radiation, and icing ~~should also be considered~~;
- the different conditions for transportation, storage, and operation of the ~~**control transformers** and **power supplies** incorporating **control transformers** should also be considered~~;
- additional requirements in accordance with other appropriate standards and national rules ~~may~~ can be applicable to ~~**control transformers** and **power supplies** incorporating **control**~~ **transformers** intended for use in special environments~~, such as tropical environments~~.

~~NOTE 3~~ Future technological development of ~~**control transformers** and **power supplies** incorporating **control**~~ **transformers** ~~may~~ can necessitate a need to increase the upper limit of the frequencies. Until then this document ~~may~~ can 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 60076-11, *Power transformers – Part 11: Dry-type transformers*~~

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 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

## 3 Terms and definitions

~~This clause of Part 1 is applicable except as follows:~~

~~*Replacement of the third paragraph:*~~

~~When the term **transformer** is used from here forward, it covers **control transformers** and **power supplies** incorporating **control transformer(s)** where applicable.~~

For the purposes of this document, the terms and definitions given in IEC 61558-1:2017 apply, except as follows:

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

*Addition:*

**3.1.101**
**control transformer**
**transformer** intended to supply power to control circuits (e.g. controlling, signalling, interlocking, etc.)

**3.5.101**
**rated thermal output**
product of the **rated output voltage** and the **rated output current**, or for polyphase **transformers**, the appropriate factor (e. g. for three-phase transformers $\sqrt{3}$ ) times the product of the **rated output voltage** and the **rated output current** delivered in continuous operation loaded at **power factor** 1

Note 1 to entry: If the **transformer** has more than one **output winding** or~~/and~~ tapped **output winding** (or both), the **rated output** denotes the sum of the products of **rated output voltage** and **rated output current** for **output circuits** intended to be loaded simultaneously.

**3.5.102**
**admissible instantaneous output**
product of the **rated output voltage** and the **rated instantaneous output current**, or for polyphase **transformers**, the appropriate factor (e. g. for three-phase transformers $\sqrt{3}$ ) times the product of the **rated output voltage** and the **rated instantaneous output current** delivered at **power factor** 0,5

Note 1 to entry: If the **transformer** has more than one **output winding** or~~/and~~ tapped **output winding** (or both), the **rated output** denotes the sum of the products of **rated output voltage** and **rated instantaneous output current** for **output circuits** intended to be loaded simultaneously.

**3.5.103**
**rated instantaneous output current**
output current for the specific operating conditions at the **rated output voltage** and the **rated supply frequency** at **power factor** 0,5 assigned to the **transformer** by the manufacturer

## 4 General requirements

This clause of IEC 61558-1:2017 is applicable.

## 5 General notes on tests

This clause of IEC 61558-1:2017 is applicable.

## 6 Ratings

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

~~*Replacement*~~ *Addition:*

**6.101** The **rated output voltage** shall not exceed 1 000 V AC or 1 415 V ripple-free DC and for **independent transformers** shall exceed 50 V AC or 120 V ripple-free DC.

For **independent transformers**, this output voltage limitation applies even when **output windings**, not intended for interconnection, are connected in series.

**6.102** The **rated thermal output** shall not exceed:

- 25 kVA for single-phase **transformers** ~~except~~,
- 40 kVA for polyphase **transformers** ~~except for **transformers** subject to an agreement between the purchaser and the manufacturer~~.

**Transformers** without limitation of the **rated thermal output** shall be subject to agreement between the purchaser and the manufacturer.

**6.103** The **rated supply frequency** and the **internal operating frequencies** shall not exceed 500 Hz.

**6.104** The **rated supply voltage** shall not exceed 1 000 V AC.

*Compliance with the requirements of 6.101 to 6.104 is checked by inspection of the marking.*

## 7 Classification

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

**7.8**

*Replacement*

**Control transformers** shall be classified for **overvoltage category III**.

## 8 Marking and other information

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

**8.1** c)

*Replacement:*

the **transformers** shall be marked with the **rated thermal output** and the **admissible instantaneous output** in volt-ampere, separated by an oblique stroke (e.g. 100/300 VA);

d)

*Replacement:*

Item d) is not applicable.

h)

~~*Replacement:*~~

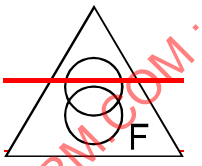
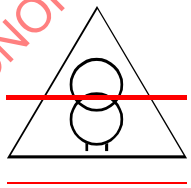
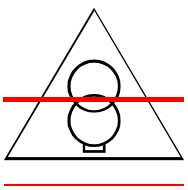
~~**the** transformers **shall be marked with one of the graphical symbols shown in 8.11.**~~

*Replacement of the content up to the first semi-colon by the following:*

relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

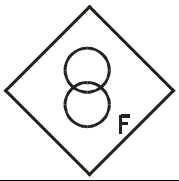
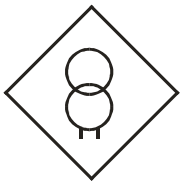
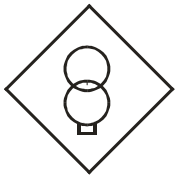
**8.11**

*Addition:*

| ~~Symbol or graphical symbol~~ | ~~Explanation or title~~ | ~~Identification~~ |
|---|---|---|
|   | ~~Fail-safe **control transformer**~~ | |
|  | ~~Non-short-circuit proof **control transformer**~~ | |
|  | ~~Short-circuit proof **control transformer** (inherently or non-inherently)~~ | |

The symbol for linear **power supply units** shall be used in conjunction with the symbol indicating the kind of **transformer**.

**Table 101 – Symbols indicating the kind of transformer**

| Symbol or graphical symbol | Explanation or title | Identification |
|---|---|---|
|  | **Fail-safe control transformer** | IEC 60417-6036:2010-08 |
|  | **Non-short-circuit-proof control transformer** | IEC 60417-6037:2010-08 |
|  | **Short-circuit-proof control transformer**<br>(inherently or non-inherently) | IEC 60417-6038:2010-08 |
|  | **Power supply unit, linear** | IEC 60417-6210:2013-10 |

*Addition:*

**8.101** If **transformers** are provided with input tappings to allow adjustments to the supply voltage, these tappings shall be marked with the value or the variation (e.g. +5 V or –5 V) of the input voltage corresponding to the tapping.

NOTE If **control transformers** are provided with input tappings to allow adjustments to the supply voltage, tappings in steps of 5 % are preferred.

## 9 Protection against electric shock

This clause of IEC 61558-1:2017 is applicable.

## 10 Change of input voltage setting

This clause of IEC 61558-1:2017 is applicable.

## 11 Output voltage and output current under load

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

**11.1**

*Replacement:*

When the **transformer** is connected to the **rated supply voltage**, at **rated supply frequency**, and loaded with an impedance at **power factor** 1 resulting in the **rated thermal output** at the **rated output voltage**, the output voltage shall not differ from the rated value by more than ±5 %.

*Compliance is checked by measuring the output voltage when steady-state conditions are established.*

Immediately after the **transformer** is loaded with an impedance resulting in the **admissible instantaneous output** at the **rated output voltage** at **power factor** 0,5 (inductive), the output voltage measured shall not be less than 95 % of the measured voltage at the **rated thermal output**.

~~NOTE~~ The output voltage measurement for the **admissible instantaneous output** should be carried out within 50 ms after applying this overload to minimise the effects of supplementary heating of the **transformer**.

For **transformers** with more than one **rated supply voltage**, the requirement is applicable for each of the **rated supply voltages**.

## 12 No-load output voltage

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

*Addition:*

**12.101** The **no-load output voltage** shall not exceed 1 000 V AC or 1 415 V ripple-free DC and for **independent transformers** shall exceed 50 V AC or 120 V ripple-free DC.

For **independent transformers**, this **output voltage** limitation applies even when **output windings**, not intended for interconnection, are connected in series.

NOTE The requirement for series connection does not apply to associated or IP 00 **transformers**.

**12.102** The difference between the **no-load output voltage** and the **output voltage** under load shall not be excessive.

The ~~difference~~ ratio between the **no-load output voltage** measured in Clause 12 and the **output voltage** under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed 10 %.

~~NOTE~~ The ratio is ~~defined~~ determined by Formula (1):

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100(\%) \quad (1)$$

where

$U_{\text{no-load}}$ is the no-load output voltage, expressed in V;

$U_{\text{load}}$ is the output voltage under load, expressed in V.

*Compliance with the requirements of 12.101 and 12.102 is checked by measuring the* ***no-load output voltage*** ~~*when*~~ *at the* ***ambient temperature***~~,~~ *when the* ***transformer*** ~~*being*~~ *is connected to* ***the rated supply voltage*** *at the* ***rated supply frequency*** *and at the* ***rated thermal output****.*

## 13 Short-circuit voltage

This clause of IEC 61558-1:2017 is applicable.

## 14 Heating

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

**14.1.1**

*Replacement of the* ~~*tenth*~~ *eleventh paragraph:*

***Transformers*** *are supplied at the* ***rated supply voltage*** *and loaded with an impedance producing the* ***rated thermal output*** *at the* ***rated output voltage*** *and, for AC current, at the* ***rated power factor****. The value of the output current is measured when steady state is established. Then the supply voltage is increased by 10 % and the output current is adjusted to the same value measured* ~~*before*~~ *previously. The output current is not adjusted for* ***independent transformers****. After this increase of the supply voltage, no change is made in the circuit. The test is repeated under no-load condition, if this is a more unfavourable situation.*

## 15 Short-circuit and overload protection

This clause of IEC 61558-1:2017 is applicable.

## 16 Mechanical strength

This clause of IEC 61558-1:2017 is applicable.

## 17 Protection against harmful ingress of dust, solid objects and moisture

This clause of IEC 61558-1:2017 is applicable.

## 18 Insulation resistance, dielectric strength and leakage current

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

### 18.3 Dielectric strength test

~~*Add the following paragraph and note before Table 8a:*~~

~~For **transformers,** the values of test voltages for **basic insulation** (boxes 1) and 3) in Table 8a) are multiplied by a factor of 1,4.~~

*Addition:*

The required values of the dielectric strength test voltages for **basic insulation** of Table 14 shall be multiplied by a factor of 1,4.

NOTE **Basic insulation** has been increased because **transformers** are subjected to surge voltages due to the inductive nature of their loads.

## 19 Construction

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

### 19.1 General construction

*Replacement:*

The **input** and **output circuits** shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, ~~through~~ via other **conductive parts**, except by deliberate action.

*Compliance is checked by inspection and measurements, taking Clause 18 and Clause 26 into consideration.*

**19.1.1** The insulation between the **input** and **output winding(s)** shall consist of at least **basic insulation** (rated for the **working voltage**).

In addition, the following requirements apply:

- for **class I transformers**, the insulation between the **input windings** and the **body,** and between the **output windings** and the **body**, shall consist of **basic insulation** (both **basic insulations** rated for the **working voltage**);
- for **class II transformers**, the insulation between the **input windings** and the **body**, and between the **output windings** and the **body** shall consist of **double** or **reinforced insulation** (both **double or reinforced insulations** rated for the **working voltage**).

**19.1.2** For **transformers** with **intermediate conductive parts** (e.g. the iron core) not connected to the **body** and located between the **input** and **output windings**, the insulation between the **intermediate conductive parts** and the **input windings** or between the **intermediate conductive parts** and the **output windings** shall consist of at least **basic insulation** (rated for the **working voltage**).

NOTE An **intermediate conductive part** not separated from the **input** or **output windings** or the **body** by at least a **basic insulation** is considered to be connected to the relevant part(s).

In addition, the following requirements apply:

– for **class I transformers**, the insulation between the **input** and **output windings** via the intermediate **conductive parts** shall consist of at least **basic insulation** (rated for the **working voltage**);

– for **class II transformers**, the insulation between the **input windings** and the **body**, and between the **output windings** and the **body** via the intermediate **conductive parts** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

*Addition:*

**19.101** There shall be no connections between the **output circuits** and the protective earth unless allowed by the relevant equipment standard for **associated transformers**.

**19.102** There shall be no connections between the **output circuits** and the **body** unless allowed by the relevant equipment standard for **associated transformers**.

*Compliance is checked by inspection.*

## 20 Components

This clause of IEC 61558-1:2017 is applicable.

## 21 Internal wiring

This clause of IEC 61558-1:2017 is applicable.

## 22 Supply connection and other external flexible cables or cords

This clause of IEC 61558-1:2017 is applicable.

## 23 Terminals for external conductors

This clause of IEC 61558-1:2017 is applicable.

## 24 Provisions for protective earthing

This clause of IEC 61558-1:2017 is applicable.

## 25 Screws and connections

This clause of IEC 61558-1:2017 is applicable.

## 26 Creepage distances, clearances and distances through insulation

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

### 26.1 General

*Replacement of the first paragraph:*

~~**Creepage distances**, **clearances** and **distances through insulation** shall not be less than the values shown in Table 13, the values for **basic insulation** (boxes 1, 3 and 5) being multiplied by a factor of 1,4.~~

The required values of **creepage distances and clearances** for **basic insulation** in accordance with Table 20 and Table 21 shall be multiplied by a factor of 1,4.

NOTE ~~101~~ **Basic insulation** has been increased because **transformers** are subjected to surge voltages due to the inductive nature of their loads.

## 27 Resistance to heat, fire and tracking

This clause of IEC 61558-1:2017 is applicable.

## 28 Resistance to rusting

This clause of IEC 61558-1:2017 is applicable.

## Annexes

The annexes of IEC 61558-1:2017 are applicable.

# Bibliography

The bibliography of IEC 61558-1:2017 is applicable, except as follows:

*Addition:*

IEC 60076-11:2018, *Power transformers – Part 11: Dry-type transformers*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61558 (all parts), *Safety of transformers, reactors, power supply units and combinations thereof*

IEC 61558-2-13:2022, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-13: Particular requirements and tests for auto transformers and power supply units incorporating auto transformers for general applications*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

IEC Guide 104:2019, *The preparation of safety publications and the use of basic safety publications and group safety publications*

# IEC 61558-2-2

Edition 3.0 2022-10

# INTERNATIONAL STANDARD

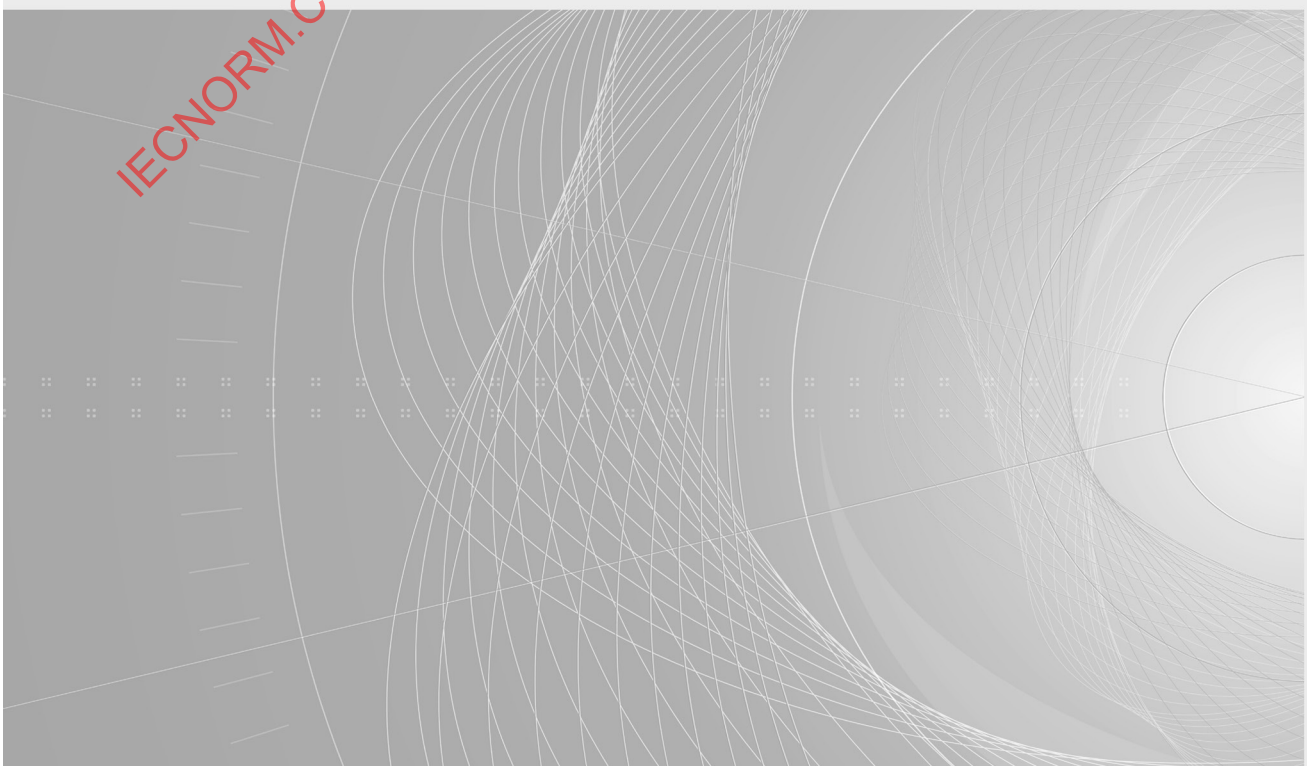
# NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

## Safety of transformers, reactors, power supply units and combinations thereof – Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers

## Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments – Partie 2-2: Exigences particulières et essais pour les transformateurs de commande et les blocs d'alimentation qui incorporent des transformateurs de commande





IEC 61558-2-2:2022-10(en-fr)

# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

## Part 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers

## 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.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
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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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.



International standard IEC 61558-2-2 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof.

This third edition cancels and replaces the second edition published in 2007. 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) new general symbol for control transformers;
c) new symbol for power supply unit with linearly regulated output voltage.

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

| Draft | Report on voting |
|---|---|
| 96/548/FDIS | 96/554/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 document 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 document 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 control transformers and power supply units incorporating control transformers.*

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 www.webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

# 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, 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 example 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 the IEC 61558-2 series 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 2-2: Particular requirements and tests for control transformers and power supply units incorporating control transformers

## 1 Scope

*Replacement:*

This part of IEC 61558 deals with the safety of **control transformers** and **power supply units** incorporating **control transformers**. **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 **control transformers** and **power supply units** incorporating **control transformers**.

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.

This document does not apply to **transformers** covered by IEC 60076-11.

This document is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry-type transformers.** The windings can be encapsulated or non-encapsulated.

The **rated supply voltage** does not exceed 1 000 V AC and the **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **rated thermal output** does not exceed:

- 25 kVA for single-phase **transformers,**
- 40 kVA for polyphase **transformers**.

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

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

The **no-load output voltage** or the **rated output voltage** does not exceed 1 000 V AC or 1 415 V ripple-free DC. For **independent transformers** the **no-load output voltage** and / or the **rated output voltage** is not less than 50 V AC or 120 V ripple-free DC.

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**.

NOTE 3 **Transformers** covered by this document are only used in applications where double or reinforced insulation between circuits is not required by the installation rules or by the end product standard.

NOTE 4 Normally the **control transformers** are intended to be used with equipment to provide voltages different from the supply voltage for the functional requirements of the equipment. The protection against electric shock can be provided or completed by other features of the equipment, such as the **body**. Parts of **output circuits** can be connected to the **input circuits** or to protective earthing.

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 can be applicable to **transformers** intended for use in special environments.

Future technological development of **transformers** can necessitate a need to increase the upper limit of the frequencies. Until then this document can 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 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61558-1:2017 apply, except as follows:

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

*Addition:*

**3.1.101**
**control transformer**
**transformer** intended to supply power to control circuits (e.g. controlling, signalling, interlocking, etc.)

**3.5.101**
**rated thermal output**
product of the **rated output voltage** and the **rated output current**, or for polyphase **transformers**, the appropriate factor (e. g. for three-phase transformers $\sqrt{3}$ ) times the product of the **rated output voltage** and the **rated output current** delivered in continuous operation loaded at **power factor** 1

Note 1 to entry: If the **transformer** has more than one **output winding** or tapped **output winding** (or both), the **rated output** denotes the sum of the products of **rated output voltage** and **rated output current** for **output circuits** intended to be loaded simultaneously.

**3.5.102**
**admissible instantaneous output**
product of the **rated output voltage** and the **rated instantaneous output current**, or for polyphase **transformers**, the appropriate factor (e. g. for three-phase transformers $\sqrt{3}$ ) times the product of the **rated output voltage** and the **rated instantaneous output current** delivered at **power factor** 0,5

Note 1 to entry: If the **transformer** has more than one **output winding** or tapped **output winding** (or both), the **rated output** denotes the sum of the products of **rated output voltage** and **rated instantaneous output current** for **output circuits** intended to be loaded simultaneously.

**3.5.103**
**rated instantaneous output current**
output current for the specific operating conditions at the **rated output voltage** and the **rated supply frequency** at **power factor** 0,5 assigned to the **transformer** by the manufacturer

## 4 General requirements

This clause of IEC 61558-1:2017 is applicable.

## 5 General notes on tests

This clause of IEC 61558-1:2017 is applicable.

## 6 Ratings

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

*Addition:*

**6.101** The **rated output voltage** shall not exceed 1 000 V AC or 1 415 V ripple-free DC and for **independent transformers** shall exceed 50 V AC or 120 V ripple-free DC.

For **independent transformers**, this output voltage limitation applies even when **output windings**, not intended for interconnection, are connected in series.

**6.102** The **rated thermal output** shall not exceed:

- 25 kVA for single-phase **transformers,**
- 40 kVA for polyphase **transformers.**

**Transformers** without limitation of the **rated thermal output** shall be subject to agreement between the purchaser and the manufacturer.

**6.103** The **rated supply frequency** and the **internal operating frequencies** shall not exceed 500 Hz.

**6.104** The **rated supply voltage** shall not exceed 1 000 V AC.

*Compliance with the requirements of 6.101 to 6.104 is checked by inspection of the marking.*

## 7 Classification

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

**7.8**

*Replacement*

**Control transformers** shall be classified for **overvoltage category III**.

## 8 Marking and other information

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

**8.1** c)

*Replacement:*

the **transformers** shall be marked with the **rated thermal output** and the **admissible instantaneous output** in volt-ampere, separated by an oblique stroke (e.g. 100/300 VA);

d)

*Replacement:*

Item d) is not applicable.

h)

*Replacement of the content up to the first semi-colon by the following:*

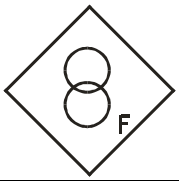
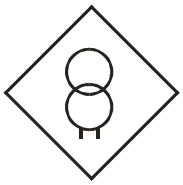
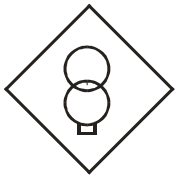
relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

**8.11**

*Addition:*

The symbol for linear **power supply units** shall be used in conjunction with the symbol indicating the kind of **transformer**.

**Table 101 – Symbols indicating the kind of transformer**

| Symbol or graphical symbol | Explanation or title | Identification |
|---|---|---|
|   | **Fail-safe control transformer** | IEC 60417-6036:2010-08 |
|  | **Non-short-circuit-proof control transformer** | IEC 60417-6037:2010-08 |
|  | **Short-circuit-proof control transformer** (inherently or non-inherently) | IEC 60417-6038:2010-08 |
|   | **Power supply unit, linear** | IEC 60417-6210:2013-10 |

*Addition:*

**8.101** If **transformers** are provided with input tappings to allow adjustments to the supply voltage, these tappings shall be marked with the value or the variation (e.g. +5 V or –5 V) of the input voltage corresponding to the tapping.

NOTE If **control transformers** are provided with input tappings to allow adjustments to the supply voltage, tappings in steps of 5 % are preferred.

## 9 Protection against electric shock

This clause of IEC 61558-1:2017 is applicable.

## 10 Change of input voltage setting

This clause of IEC 61558-1:2017 is applicable.

## 11 Output voltage and output current under load

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

**11.1**

*Replacement:*

When the **transformer** is connected to the **rated supply voltage**, at **rated supply frequency**, and loaded with an impedance at **power factor** 1 resulting in the **rated thermal output** at the **rated output voltage**, the output voltage shall not differ from the rated value by more than ±5 %.

*Compliance is checked by measuring the output voltage when steady-state conditions are established.*

Immediately after the **transformer** is loaded with an impedance resulting in the **admissible instantaneous output** at the **rated output voltage** at **power factor** 0,5 (inductive), the output voltage measured shall not be less than 95 % of the measured voltage at the **rated thermal output**.

The output voltage measurement for the **admissible instantaneous output** should be carried out within 50 ms after applying this overload to minimise the effects of supplementary heating of the **transformer**.

For **transformers** with more than one **rated supply voltage**, the requirement is applicable for each of the **rated supply voltages**.

## 12 No-load output voltage

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

*Addition:*

**12.101** The **no-load output voltage** shall not exceed 1 000 V AC or 1 415 V ripple-free DC and for **independent transformers** shall exceed 50 V AC or 120 V ripple-free DC.

For **independent transformers**, this **output voltage** limitation applies even when **output windings**, not intended for interconnection, are connected in series.

NOTE The requirement for series connection does not apply to associated or IP 00 **transformers**.

**12.102** The difference between the **no-load output voltage** and the **output voltage** under load shall not be excessive.

The ratio between the **no-load output voltage** measured in Clause 12 and the **output voltage** under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed 10 %.

The ratio is determined by Formula (1):

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100(\%) \quad (1)$$

where

$U_{\text{no-load}}$ is the no-load output voltage, expressed in V;

$U_{\text{load}}$ is the output voltage under load, expressed in V.

*Compliance with the requirements of 12.101 and 12.102 is checked by measuring the **no-load output voltage** at the **ambient temperature** when the **transformer** is connected to **the rated supply voltage** at the **rated supply frequency** and at the **rated thermal output**.*

## 13 Short-circuit voltage

This clause of IEC 61558-1:2017 is applicable.

## 14 Heating

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

**14.1.1**

*Replacement of the eleventh paragraph:*

***Transformers** are supplied at the **rated supply voltage** and loaded with an impedance producing the **rated thermal output** at the **rated output voltage** and, for AC current, at the **rated power factor**. The value of the output current is measured when steady state is established. Then the supply voltage is increased by 10 % and the output current is adjusted to the same value measured previously. The output current is not adjusted for **independent transformers**. After this increase of the supply voltage, no change is made in the circuit. The test is repeated under no-load condition, if this is a more unfavourable situation.*

## 15 Short-circuit and overload protection

This clause of IEC 61558-1:2017 is applicable.

## 16 Mechanical strength

This clause of IEC 61558-1:2017 is applicable.

## 17 Protection against harmful ingress of dust, solid objects and moisture

This clause of IEC 61558-1:2017 is applicable.

## 18 Insulation resistance, dielectric strength and leakage current

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

### 18.3 Dielectric strength test

*Addition:*

The required values of the dielectric strength test voltages for **basic insulation** of Table 14 shall be multiplied by a factor of 1,4.

NOTE **Basic insulation** has been increased because **transformers** are subjected to surge voltages due to the inductive nature of their loads.

## 19 Construction

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

### 19.1 General construction

*Replacement:*

The **input** and **output circuits** shall be electrically separated from each other, and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other **conductive parts**, except by deliberate action.

*Compliance is checked by inspection and measurements, taking Clause 18 and Clause 26 into consideration.*

**19.1.1** The insulation between the **input** and **output winding(s)** shall consist of at least **basic insulation** (rated for the **working voltage**).

In addition, the following requirements apply:

- for **class I transformers**, the insulation between the **input windings** and the **body,** and between the **output windings** and the **body**, shall consist of **basic insulation** (both **basic insulations** rated for the **working voltage**);
- for **class II transformers**, the insulation between the **input windings** and the **body**, and between the **output windings** and the **body** shall consist of **double** or **reinforced insulation** (both **double or reinforced insulations** rated for the **working voltage**).

**19.1.2** For **transformers** with **intermediate conductive parts** (e.g. the iron core) not connected to the **body** and located between the **input** and **output windings**, the insulation between the **intermediate conductive parts** and the **input windings** or between the **intermediate conductive parts** and the **output windings** shall consist of at least **basic insulation** (rated for the **working voltage**).

NOTE An **intermediate conductive part** not separated from the **input** or **output windings** or the **body** by at least a **basic insulation** is considered to be connected to the relevant part(s).

In addition, the following requirements apply:

– for **class I transformers**, the insulation between the **input** and **output windings** via the intermediate **conductive parts** shall consist of at least **basic insulation** (rated for the **working voltage**);

– for **class II transformers**, the insulation between the **input windings** and the **body**, and between the **output windings** and the **body** via the intermediate **conductive parts** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

*Addition:*

**19.101** There shall be no connections between the **output circuits** and the protective earth unless allowed by the relevant equipment standard for **associated transformers**.

**19.102** There shall be no connections between the **output circuits** and the **body** unless allowed by the relevant equipment standard for **associated transformers**.

*Compliance is checked by inspection.*

## 20 Components

This clause of IEC 61558-1:2017 is applicable.

## 21 Internal wiring

This clause of IEC 61558-1:2017 is applicable.

## 22 Supply connection and other external flexible cables or cords

This clause of IEC 61558-1:2017 is applicable.

## 23 Terminals for external conductors

This clause of IEC 61558-1:2017 is applicable.

## 24 Provisions for protective earthing

This clause of IEC 61558-1:2017 is applicable.

## 25 Screws and connections

This clause of IEC 61558-1:2017 is applicable.

## 26 Creepage distances, clearances and distances through insulation

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

### 26.1 General

*Replacement of the first paragraph:*

The required values of **creepage distances and clearances** for **basic insulation** in accordance with Table 20 and Table 21 shall be multiplied by a factor of 1,4.

NOTE **Basic insulation** has been increased because **transformers** are subjected to surge voltages due to the inductive nature of their loads.

## 27 Resistance to heat, fire and tracking

This clause of IEC 61558-1:2017 is applicable.

## 28 Resistance to rusting

This clause of IEC 61558-1:2017 is applicable.

## Annexes

The annexes of IEC 61558-1:2017 are applicable.

# Bibliography

The bibliography of IEC 61558-1:2017 is applicable, except as follows:

*Addition:*

IEC 60076-11:2018, *Power transformers – Part 11: Dry-type transformers*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 61558 (all parts), *Safety of transformers, reactors, power supply units and combinations thereof*

IEC 61558-2-13:2022, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-13: Particular requirements and tests for auto transformers and power supply units incorporating auto transformers for general applications*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

IEC Guide 104:2019, *The preparation of safety publications and the use of basic safety publications and group safety publications*

# SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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

## Partie 2-2: Exigences particulières et essais pour les transformateurs de commande et les blocs d'alimentation qui incorporent des transformateurs de commande

## AVANT-PROPOS

1) La Commission Electrotechnique 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. A 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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La Norme internationale IEC 61558-2-2 a été établie par le comité d'études 96 de l'IEC: Transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments.

Cette troisième édition annule et remplace la deuxième édition parue en 2007. 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) un nouveau symbole général a été ajouté pour les transformateurs de commande;

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

Le texte de ce document est issu des documents suivants:

| Projet | Rapport de vote |
|---|---|
| 96/548/FDIS | 96/554/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 ce document est l'anglais.

Ce 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.

Le présent document doit être utilisé 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 de commande et les blocs d'alimentation qui incorporent des transformateurs de commande.*

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 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 la 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 de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous www.webstore.iec.ch dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

# 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, 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, par exemple, 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 la série 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 séparé, 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 COMBINAISONS DE CES ÉLÉMENTS –

## Partie 2-2: Exigences particulières et essais pour les transformateurs de commande et les blocs d'alimentation qui incorporent des transformateurs de commande

## 1 Domaine d'application

*Remplacement:*

La présente partie de l'IEC 61558 traite de la sécurité des **transformateurs de commande** et des **blocs d'alimentation** qui incorporent des **transformateurs de commande**. Les **transformateurs** qui incorporent des **circuits électroniques** sont également couverts par le présent document.

NOTE 1 La sécurité comprend les aspects électrique, thermique et mécanique.

Sauf spécification contraire dans la suite du présent document, le terme **transformateur** couvre les **transformateurs de commande** et les **blocs d'alimentation** qui incorporent des **transformateurs de commande**.

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.

Le présent document ne s'applique pas aux **transformateurs** couverts par l'IEC 60076-11.

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**. Les enroulements peuvent être enrobés ou non enrobés.

La **tension primaire assignée** ne dépasse pas 1 000 V en courant alternatif, et la **fréquence d'alimentation assignée** et les **fréquences de fonctionnement interne** ne dépassent pas 500 Hz.

La **puissance thermique assignée** ne dépasse pas:

- 25 kVA pour les **transformateurs** monophasés;
- 40 kVA pour les **transformateurs** polyphasés.

Le présent document s'applique aux **transformateurs** sans limitation de la **puissance thermique 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.

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. Pour les **transformateurs indépendants**, la **tension secondaire à vide** et/ou la **tension secondaire assignée** n'est pas inférieure à 50 V en courant alternatif ou 120 V en courant continu lissé.

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**.

NOTE 3 Les **transformateurs** 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.

NOTE 4 Normalement, les **transformateurs de commande** sont destinés à être utilisés avec des équipements dans le but de délivrer des tensions différentes de la tension du réseau afin de satisfaire aux exigences fonctionnelles de l'équipement. La protection contre les chocs électriques peut être procurée ou complétée par d'autres parties de l'équipement, telles que la **masse**. Des parties de **circuits secondaires** peuvent être connectées aux **circuits primaires** ou à la terre de protection.

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;
- mesures qui visent à protéger l'**enveloppe** et les composants à l'intérieur de l'enveloppe contre les influences externes, telles que les champignons, la vermine, les termites, le rayonnement solaire 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 qui sont 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*