# IEC 61558-2-6

Edition 3.0 2021-05

# INTERNATIONAL STANDARD

GROUP SAFETY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications**



IEC 61558-2-6:2021-05(en)

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## Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications



INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 29.180

ISBN 978-2-8322-9791-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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## Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications

## FOREWORD

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International standard IEC 61558-2-6 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 2009. 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 in 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:

| FDIS | Report on voting |
|---|---|
| 96/506/FDIS | 96/512/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.

NOTE When “Part 1” is mentioned in this standard, it refers to 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 safety isolating transformers and power supply units incorporating safety isolating transformers for general applications.*

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 adapted 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,
- replaced by a revised edition, or
- amended.

# INTRODUCTION

IEC/TC 96 has 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 limitation of voltage and horizontal safety function for SELV in accordance with IEC 60364-4-41.

The group safety function (GSF) is necessary because of responsibility e.g. for safety extra-low voltage (SELV) in accordance with IEC 61140:2016, 5.2.6 and IEC 60364-4-41:2017, 414.3.1 or control circuits in accordance with IEC 60204-1:2016, 7.2.4.

The group safety function is needed 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 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications

## 1 Scope

*Replacement*

This part of IEC 61558 deals with the safety of **safety isolating transformers** for general applications and **power supply units** incorporating **safety isolating transformers** for general applications. **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 **safety isolating transformers** for general applications and **power supply units** incorporating **safety isolating transformers** for general applications.

For **power supply units** (linear) this document is applicable. For **switch mode power supply units** IEC 61558-2-16 is applicable.

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 output** does not exceed:

- 10 kVA for single-phase **transformers**;
- 16 kVA for polyphase **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.

The **no-load output voltage** or the **rated output voltage** does not exceed 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 used in applications where **double or reinforced insulation** between circuits is required by the installation rules or by the end product standard.

Attention is drawn to the following:

- additional requirements for **transformers** intended to be used in vehicles, on board ships, and aircraft (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 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 TCs 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 TC is, wherever applicable, to make use of BSPs and/or GSPs in the preparation of its publications.

## 2 Normative references

This clause of Part 1 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*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in Part 1 apply.

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

## 4 General requirements

This clause of Part 1 is applicable.

## 5 General notes on tests

This clause of Part 1 is applicable.

## 6 Ratings

This clause of Part 1 is applicable except as follows:

*Addition*

**6.101** The **rated output voltage** shall not exceed 50 V AC or 120 V ripple-free DC.

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

– 10 kVA for single-phase **transformers**;
– 16 kVA for polyphase **transformers**.

**Transformers** without limitation of the **rated 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 Part 1 is applicable.

## 8 Marking and other information

This clause of Part 1 is applicable except as follows:

**8.1** h)

*Replacement*

Replace the content up to the first semi-colon by the following:

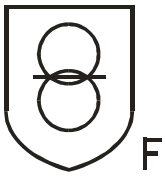
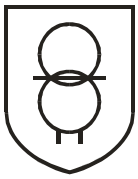
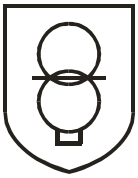
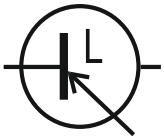
relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

**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 safety isolating transformer** | IEC 60417-5222:2002-10 |
|  | **Non-short-circuit-proof safety isolating transformer** | IEC 60417-5946:2002-10 |
|  | **Short-circuit-proof safety isolating transformer** (inherently or non-inherently) | IEC 60417-5947:2002-10 |
|  | **Power supply unit**, linear | IEC 60417-6210:2013-10 |

## 9 Protection against electric shock

This clause of Part 1 is applicable.

## 10 Change of input voltage setting

This clause of Part 1 is applicable.

## 11 Output voltage and output current under load

This clause of Part 1 is applicable.

## 12 No-load output voltage

This clause of Part 1 is applicable except as follows:

*Addition*

**12.101** The **no-load output voltage** shall not 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.

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 the values shown in Table 102.*

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.

**Table 102 – Output voltage ratio**

| **Type of transformer**<br>**Rated output**<br>VA | **Ratio between no-load output voltage and output voltage under load**<br>%<br> |
|---|---|
| **Inherently short-circuit-proof transformers:** | |
| – up to and including 63 | 100 |
| – over 63 up to and including 630 | 50 |
| – over 630 | 20 |
| **Other transformers:** | |
| – up to and including 10 | 100 |
| – over 10 up to and including 25 | 50 |
| – over 25 up to and including 63 | 20 |
| – over 63 up to and including 250 | 15 |
| – over 250 up to and including 630 | 10 |
| – over 630 | 5 |

*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**.*

*The ratio shall not exceed the values shown in Table 102.*

## 13 Short-circuit voltage

This clause of Part 1 is applicable.

## 14 Heating

This clause of Part 1 is applicable.

## 15 Short-circuit and overload protection

This clause of Part 1 is applicable.

## 16 Mechanical strength

This clause of Part 1 is applicable.

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

This clause of Part 1 is applicable.

## 18 Insulation resistance, dielectric strength and leakage current

This clause of Part 1 is applicable.

## 19 Construction

This clause of Part 1 is applicable and general requirements for **safety isolating transformers** are defined in 19.1.4 of Part 1.

## 20 Components

This clause of Part 1 is applicable.

## 21 Internal wiring

This clause of Part 1 is applicable.

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

This clause of Part 1 is applicable.

## 23 Terminals for external conductors

This clause of Part 1 is applicable.

## 24 Provisions for protective earthing

This clause of Part 1 is applicable.

## 25 Screws and connections

This clause of Part 1 is applicable.

## 26 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable.

## 27 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

## 28 Resistance to rusting

This clause of Part 1 is applicable.

## Annexes

The Annexes of Part 1 are applicable.