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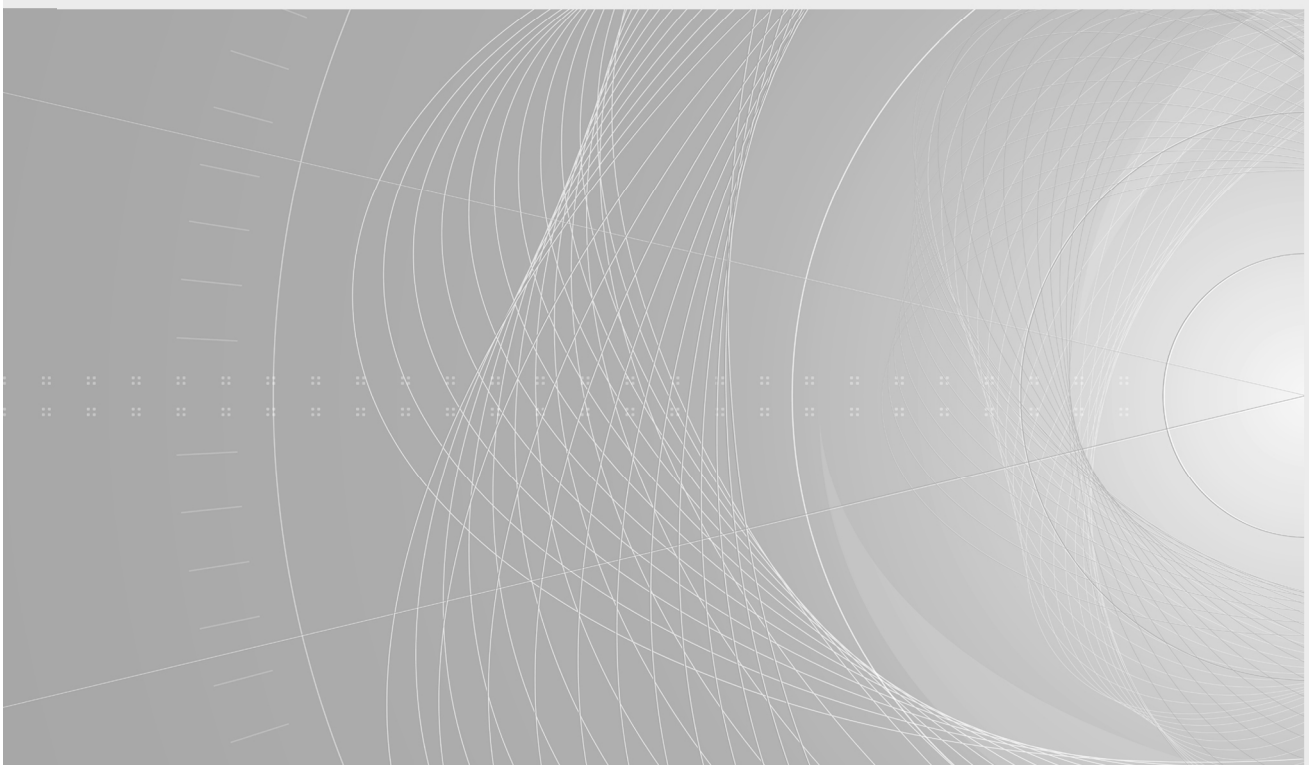
GROUP SAFETY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof –
Part 2-14: Particular requirements and tests for variable transformers and power
supply units incorporating variable transformers for general applications**

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[IEC 61558-2-14:2022](#)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2-14: Particular requirements and tests for variable transformers and power supply units incorporating variable transformers for general applications

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 redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-14:2012. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61558-2-14 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International standard.

This second edition cancels and replaces the first edition published in 2012. 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 symbols for **power supply units** with linearly regulated output voltages and required **current collector** position changes.

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

Draft	Report on voting
96/507/CDV	96/528/RVC

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/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 variable transformers and power supply units incorporating variable 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.

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.

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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 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 60364-4-41:2005, 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.

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

Part 2-14: Particular requirements and tests for variable transformers and power supply units incorporating variable transformers for general applications

1 Scope

Replacement

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

NOTE 1 Safety includes electrical, thermal, mechanical and chemical aspects.

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

~~This standard is applicable to transformers and power supply units (linear) with internal operational frequencies not exceeding 500 Hz.~~

~~This standard used in combination with Part 2-16 for switch mode power supply units (SMPS) is also applicable to power supplies with internal operational frequencies higher than 500 Hz. Where the two requirements are in conflict the most severe take precedence~~

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 variable dry-type transformers**:

- ~~variable auto-transformers and power supply units incorporating variable auto-transformers;~~
- ~~variable separating transformers and power supply units incorporating variable separating transformers;~~
- ~~variable isolating transformers and power supply units incorporating variable isolating transformers;~~
- ~~variable safety isolating transformers and power supply units incorporating variable safety isolating transformers.~~

The windings ~~may~~ 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 operational frequencies** do not exceed 500 Hz.

The **rated output** does not exceed:

- 40 kVA for single-phase ~~variable auto-transformers and power supply units incorporating single-phase variable auto-transformers;~~
- 200 kVA for polyphase ~~variable auto-transformers and power supply units incorporating poly-phase variable auto-transformers;~~

- 1 kVA for single-phase **variable separating transformers** ~~and power supply units incorporating single-phase variable separating transformers~~;
- 5 kVA for polyphase **variable separating transformers** ~~and power supply units incorporating poly-phase variable separating transformers~~;
- 25 kVA for single-phase **variable isolating transformers** ~~and power supply units incorporating single-phase variable isolating transformers~~;
- 40 kVA for polyphase **variable isolating transformers** ~~and power supply units incorporating poly-phase variable isolating transformers~~;
- 10 kVA for single-phase **variable safety isolating transformers** ~~and power supply units incorporating single-phase variable safety isolating transformers~~;
- 16 kVA for polyphase **variable safety isolating transformers** ~~and power supply units incorporating poly-phase variable safety isolating transformers~~.

This document is applicable to **variable 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.

For **variable auto-transformers** ~~and power supply units incorporating variable 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;
- for **independent variable auto-transformers** the **rated output voltage** does exceed 50 V AC or 120 V ripple-free DC but does not exceed 250 V AC.

NOTE 3 Normally, **variable auto-transformers** ~~and power supply units~~ are intended to be associated with equipment to provide voltages different from the supply voltage for the functional ~~reasons~~ requirements of the equipment. The protection against electric shock can be provided or completed by other features of the equipment, such as the **body**.

NOTE 4 **Variable auto-transformers** ~~and power supply units incorporating variable auto-transformers~~ intended to be used by technically skilled or trained personnel are considered as **associated variable transformers** and **associated power supply units** ~~may~~ can have a **rated output voltage** less than 50 V AC.

For **variable separating transformers** ~~and power supply units incorporating variable 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;
- for **portable variable separating transformers** the **rated output voltage** does exceed 50 V AC or 120 V ripple-free DC;
- ~~covered by this part may~~ **are only be** used where **double** or **reinforced insulation** between circuits is not required by the installation rules or by the end product standard.

NOTE 4 5 Normally, **variable separating transformers** ~~and power supply units~~ are intended to be associated with equipment to provide voltages different from the supply voltage for the functional ~~reasons~~ 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 protective earthing.

NOTE 5 6 **Variable separating transformers** ~~and power supply units incorporating variable separating transformers~~ intended to be used by technically skilled or trained personnel are considered as **associated variable transformers** and **associated power supply units** ~~and~~ can have a **rated output voltage** less than 50 V AC or 120 V ripple-free DC.

For **variable isolating transformers** ~~and power supply units incorporating variable isolating transformers~~:

- the **no-load output voltage** or the **rated output voltage** does not exceed 500 V AC or 708 V ripple-free DC. The **no-load output voltage** and the **rated output voltage** ~~may~~ can be up to 1 000 V AC or 1 415 V ripple-free DC for special applications or in accordance with **national wiring** the installation rules;

- for **independent variable isolating transformers** the **rated output voltage** does not exceed 250 V AC;
- are used where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

For variable safety isolating transformers ~~and power supply units incorporating 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;
- are used 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**.

~~NOTE 6~~ Attention is drawn to the following, if necessary:

- **additional requirements** for **transformers** intended to be used in vehicles, on board ships, and aircraft, ~~additional requirements~~ (from other applicable standards, national rules, etc. ~~can 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 ~~are also considered~~;
- the different conditions for transportation, storage, and operation of the **transformers** ~~are also be considered~~;
- additional requirements in accordance with other appropriate standards and national rules can be applicable to **transformers** intended for use in special environments, ~~such as tropical environment~~.

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

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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 61558-1:2005, Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests Amendment 1 (2009)~~

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

3 Terms and definitions

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

For the purposes of this document, the terms and definitions given in Part 1 apply except as follows:

ISO and IEC maintain terminology 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>

3.1 Transformers

Addition

3.1.101

variable transformer

transformer having unlimited numbers of transformation ratios and adjustable by means of a movable **current collector** positioned along a continuous path of locally exposed winding turns

3.1.102

variable auto-transformer

variable transformer in which input and output voltages are derived from a common winding

3.2 General terms

Addition

3.2.101

current collector

assembly of moving contact parts which serve to transmit current from a point on the contact path to the tapping point at the bushings or terminals

3.2.102

drive

mechanical assembly used for moving the **current collector**

3.2.103

fixed winding

winding or part of the winding with no means for varying the transformation ratio

3.2.104

variable winding

winding or part of the winding with a contact path used for varying the transformation ratio

3.5 Ratings

Modification

3.5.5 is not applicable.

Addition

3.5.101

rated output voltage range

output voltage range (for polyphase **transformer** and **power supply units**, the phase-to-phase voltage) at **rated supply voltage**, **rated supply frequency**, **rated output current**, and **rated power factor** assigned to the **transformer** or **power supply unit** by the manufacturer

4 General requirements

This clause of Part 1 is applicable except as follows:

Addition

If the **current collector** ~~may not~~ cannot stay permanently in the same position it ~~has to~~ shall be marked on the **variable transformer** with the symbol IEC 60417-6263:2014-03 (see 8.11) placed adjacent to the supply information (e.g. on the rating plate).

5 General notes on tests

This clause of Part 1 is applicable except as follows:

5.3*Addition*

The test of 16.101 shall be conducted before all other tests.

6 Ratings

This clause of Part 1 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 for **variable auto-transformers** and **variable separating transformers**;
- 500 V AC or 708 V ripple-free DC for **variable isolating transformers**; the **rated output voltage** ~~may can~~ exceed these limits in order to be in accordance with the ~~national wiring installation~~ rules, however, it shall not exceed 1 000 V AC or 1 415 V ripple-free DC;
- 250 V AC for **portable variable auto-transformers**, **portable variable separating transformers** and **independent variable isolating transformers**;
- 50 V AC or 120 V ripple-free DC for **variable safety isolating transformers**.

This document is also applicable to **variable transformers** of a **rated output voltage** of more than 1 000 V AC or 1 415 V ripple-free DC. Such **transformers**, however, are classified as special **transformers** and are subject to agreement between purchaser and manufacturer. ~~Such special variable transformers have no limitation in terms of their rated output voltage.~~

The **rated output voltage** shall exceed:

- 50 V AC or 120 V ripple-free DC for ~~variable independent~~ **variable auto-transformers** and **independent variable separating transformers**.

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

- 40 kVA for single-phase **variable auto-transformers**;
- 200 kVA for polyphase **variable auto-transformers**;
- 1 kVA for single-phase **variable separating transformers**;
- 5 kVA for polyphase **variable separating transformers**;
- 25 kVA for single-phase **variable isolating transformers**;
- 40 kVA for polyphase **variable isolating transformers**;
- 10 kVA for single-phase **variable safety isolating transformers**;
- 16 kVA for polyphase **variable safety isolating 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 **internal operational 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 b)

Replacement

rated output voltage range in volts or kilovolts;

For **transformers** incorporating a rectifier, the **rated output voltage range** after the rectifier shall be marked with the arithmetic mean value. If, however, the output voltage is given as an RMS value, this shall be stated.

NOTE An RMS value is distinguished from an arithmetic mean value by the use of RMS in the marking.

8.1 h)

~~*Replacement of the first sentence by the following:*~~

~~*Relevant graphical symbols shown in 8.11 indicating the kind of **transformers**;*~~

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**.