IEC 61558-2-13

Edition 3.0 2022-10
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

GROUP SAFETY PUBLICATION

Safety of transformers, reactors, power supply units and ~~similar products for supply voltages up to 1 100 V~~ combinations thereof –
Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

IEC 61558-2-13:2022-10 RLV(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

IEC 61558-2-13

Edition 3.0 2022-10
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

GROUP SAFETY PUBLICATION

Safety of transformers, reactors, power supply units and ~~similar products for supply voltages up to 1 100 V~~ combinations thereof –
Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.180

ISBN 978-2-8322-5925-2

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

iTeh Standards
(https://standards.iteh.ai)
Document Preview
IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND ~~SIMILAR PRODUCTS FOR SUPPLY VOLTAGES UP TO 1 100 V~~ COMBINATIONS THEREOF –

Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-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.
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.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) 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.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-13:2009. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IECNORM.COM : Click to view the full PDF of IEC 61558-2-13:2022
Withdrawn
Document Preview
IEC 61558-2-13:2022
https://standards.iec.ch/catalog/standards/iec/61558-2-13-2022

International standard IEC 61558-2-13 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 to IEC 61558-1:2017;
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
96/549/FDIS	96/555/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.

iTeh Standards

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.

(https://standards.iteh.ai)
Document Preview

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

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d9047fd-5970-45e0-853e-55da3e80a23d/iec-61558-2-13-2022

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 auto-transformers and power supply units incorporating auto-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 a particular subclause of IEC 61558-1:2017 is not mentioned in this part, that subclause applies as far as is reasonable. Where this part 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 "http://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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

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 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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND ~~SIMILAR PRODUCTS FOR SUPPLY VOLTAGES UP TO 1 100 V~~ COMBINATIONS THEREOF –

Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications

1 Scope

Replacement:

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

iTeh Standards
(https://standards.iteh.ai)
Document Preview

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

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 ~~may~~ can be encapsulated or non-encapsulated.

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

The **rated supply voltage** does not exceed ~~1 100~~ 1 000 V AC, and the **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **core power** does not exceed:

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

The **rated output** does not exceed:

- 40 kVA for single-phase **transformers**;
- 200 kVA for polyphase **transformers**.

This document is applicable to **transformers** without limitations of the **core power** and the **rated output** both being subject to an agreement between the purchaser and the manufacturer.

Where applicable, 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 the **rated output voltage** ~~exceeds~~ 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 2 **Transformers** covered by this document are used only in applications where no **insulation** between circuits is required by the installation rules or by the end product standard.

~~NOTE 3~~ 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.) ~~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 **transformers** ~~should also be considered~~;
- additional requirements in accordance with other appropriate standards and national rules ~~may~~ can be applicable to **transformers** intended for use in special environments.

~~NOTE 4~~ Future technological development of **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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

2 Normative references

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

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

Addition:

IEC 61558-1:~~2005~~2017, *Safety of ~~power~~ transformers, ~~power supplies,~~ reactors, power supply units and ~~similar products~~ combinations thereof – Part 1: General requirements and tests*

3 Terms and definitions

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

~~*Modification:*~~

~~Delete the third paragraph.~~

~~Note 2 of 3.7.22 is not applicable.~~

~~*Addition:*~~

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

Replacement:

3.1.~~101~~5
auto-transformer
transformer in which **input** and **output windings** have a common part

Note 1 to entry: **Auto-transformers** ~~may~~ can have supplementary windings (see Figure 101) or tappings (see Figure 102) for adjustment purposes.

Note 2 to entry: Transformers with windings separated at least by functional insulation and electrically connected, will be treated as **auto-transformers** (see Figure 103).

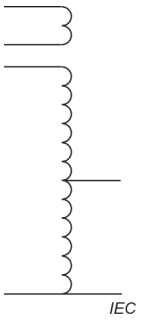


Figure 101 – Windings

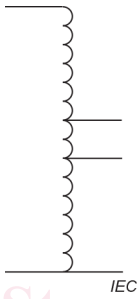


Figure 102 – Tappings

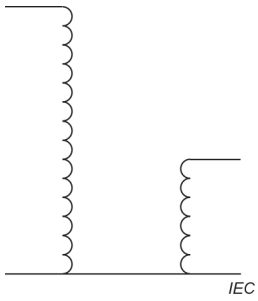


Figure 103 – Windings separated by functional isolation

iTeh Standards
(https://standards.iteh.ai)
Document Preview

Addition:

3.5.101
core power
power transformed by the core, if this core was used in a **transformer** with separate windings at the same **supply voltage**, **output voltage**, **frequency**, **power factor** and thermal characteristics

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

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. For **independent transformers** the **rated output voltage** shall exceed 50 V AC or 120 V ripple-free DC.

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

- 40 kVA for single-phase **transformers**;
- 200 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 ~~1 100~~ 1 000 V AC.

6.105 The **core power** shall not exceed:

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

Transformers without limitation of the **core power** shall be subject to agreement between the purchaser and the manufacturer.

The relation between the **core power** and the **rated output** is ~~given~~ determined by Formula (1):

$$\textbf{Core power}\,[\mathrm{VA}] = \frac{V_{\max} - V_{\min}}{V_{\max}} \times \textbf{rated output}\,[\mathrm{VA}] \qquad (1)$$

iTeh Standards
(https://standards.iteh.ai)
Document Preview

where

~~$V_{\max}$ and $V_{\min}$ are the highest and lowest values (**rated supply voltage** or **rated output voltage**).~~

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/iec/7d90447d-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

$V_{\max}$ is the highest value of **rated supply voltage** or **rated output voltage**, expressed in V;

$V_{\min}$ is the lowest value of **rated supply voltage** or **rated output voltage**, expressed in V.

NOTE In this case, the limitation of the **core power** is applicable to the **rated output**.

Formula (1) is not applicable to a **transformer** with separate windings which are electrically connected (see Figure 103). In this case, the **core power** of the **transformer** is equal to the **rated output**.

Compliance with the requirements of 6.101 to 6.105 is checked by inspection of the marking.

7 Classification

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

8 Marking and other information

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

8.1 h)

~~*Replacement:*~~

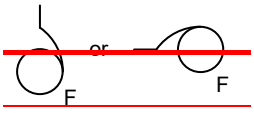
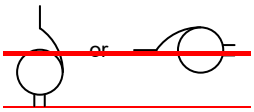
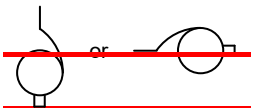
~~The transformers shall be marked with one of the graphical symbols shown in 8.11;~~

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:

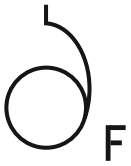
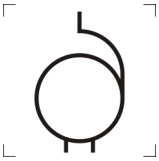
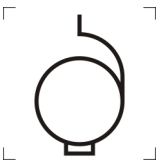
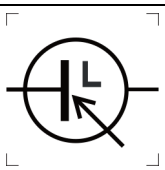
~~Symbol or graphical symbol~~	~~Explanation or title~~	~~Identification~~
	~~Fail-safe **auto-transformer**~~	~~60417-5941~~
	~~Non-short-circuit proof **auto-transformer**~~	~~60417-5942~~
	~~Short-circuit proof **auto-transformer** (inherently or non-inherently)~~	~~60417-5943~~

iTeh Standards
(https://standards.iteh.ai)
Document Preview

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

IEC 61558-2-13:2022
https://standards.iteh.ai/catalog/standards/sist/...iec-61558-2-13-2022

Table 101 – Symbols indicating the kind of transformer

Symbol or graphical symbol	Explanation or title	Identification
	Fail-safe **auto-transformer**	IEC 60417-5941:2002-10
	Non-short-circuit proof **auto-transformer**	IEC 60417-5942:2002-10
	Short-circuit proof **auto-transformer** (inherently or non-inherently)	IEC 60417-5943:2002-10
	**Power supply unit, linear**	IEC 60417-6210:2013-10

Addition:

8.101 If there is a terminal for connection to the star point, the maximum current to the star point shall be marked.

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.

12 No-load output voltage

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

Addition:

~~The **no-load output voltage** is measured when the **transformer** is connected to the **rated supply voltage** at the **rated supply frequency** at ambient temperature.~~

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 d.c. but not exceed 1 000 V a.c. or 1 415 V~~ ripple free DC.

iTeh Standards (https://standards.iteh.ai) Document Preview
https://standards.iteh.ai/catalog/standards/iec/7d9044f8-5570-45cb-853c-55da3e80a23d/iec-61558-2-13-2022

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

NOTE 1 The requirement for series connection does not apply to **associated** or IP 00 **transformers**.

NOTE 2 An **auto-transformer** ~~may~~ can have more than one **output winding** for adjustment reasons.

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 difference is expressed as a percentage of the latter voltage calculated according to the following formula:~~ The ratio is determined by Formula (2):

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100(\%) \qquad (2)$$

where

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