

INTERNATIONAL STANDARD



GROUP ENERGY EFFICIENCY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof –
Part 2-10: Particular requirements and tests for separating transformers with
high insulation level and separating transformers with output voltages
exceeding 1 000 V**

Document Preview

IEC 61558-2-10:2024

<https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 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 Varembe
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 It also gives information on projects, replaced and withdrawn publications.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 Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

International
Standards
Document Preview
standards.iteh.ai

[IEC 61558-2-10:2024](https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024)

<https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024>



IEC 61558-2-10

Edition 2.0 2024-06
REDLINE VERSION

INTERNATIONAL STANDARD



GROUP ENERGY EFFICIENCY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof –
Part 2-10: Particular requirements and tests for separating transformers with
high insulation level and separating transformers with output voltages
exceeding 1 000 V**

Document Preview

[IEC 61558-2-10:2024](https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024)

<https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.180

ISBN 978-2-8322-9131-3

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

CONTENTS

| | |
|--|----|
| FOREWORD..... | 3 |
| INTRODUCTION..... | 2 |
| 1 Scope..... | 7 |
| 2 Normative references | 8 |
| 3 Terms and definitions | 8 |
| 4 General requirements | 9 |
| 5 General notes on tests | 9 |
| 6 Ratings..... | 9 |
| 7 Classification..... | 10 |
| 8 Marking and other information | 10 |
| 9 Protection against electric shock | 13 |
| 10 Change of input voltage setting | 14 |
| 11 Output voltage and output current under load | 14 |
| 12 No-load output voltage | 14 |
| 13 Short-circuit voltage..... | 15 |
| 14 Heating..... | 15 |
| 15 Short-circuit and overload protection | 15 |
| 16 Mechanical strength | 15 |
| 17 Protection against harmful ingress of dust, solid objects and moisture | 15 |
| 18 Insulation resistance, dielectric strength and leakage current | 15 |
| 19 Construction | 16 |
| 20 Components | 17 |
| 21 Internal wiring..... | 17 |
| 22 Supply connection and other external flexible cables or cords | 17 |
| 23 Terminals for external conductors..... | 17 |
| 24 Provisions for protective earthing..... | 17 |
| 25 Screws and connections | 18 |
| 26 Creepage distances, clearances and distances through insulation..... | 18 |
| 27 Resistance to heat, fire and tracking..... | 19 |
| 28 Resistance to rusting..... | 20 |
| Annexes | 21 |
| Bibliography..... | 22 |
| | |
| Table 101 – Symbols indicating the kind of transformer | 13 |
| Table 102 – Output voltage difference..... | 15 |
| Table 103 – Table of dielectric strength test voltages for working voltages above 1 000 V | 16 |
| Table 104 – Minimum clearances in air up to 2 000 m above sea level..... | 19 |
| Table 105 – Creepage distances for material group III a, II and I (CTI > 175) for basic or supplementary insulation Minimum creepage distances for basic or supplementary insulation | 20 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF TRANSFORMERS, REACTORS,
POWER SUPPLY UNITS AND COMBINATIONS THEREOF –****Part 2-10: Particular requirements and tests for separating
transformers with high insulation level and separating
transformers with output voltages exceeding 1 000 V**

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-10:2014. 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 61558-2-10 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 2014. 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) overvoltage categories I, II, III and IV for clearances and dielectric strength tests are included;
- c) clearances for homogenous field conditions deleted.

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

| Draft | Report on voting |
|-------------|------------------|
| 96/589/FDIS | 96/595/RVD |

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

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

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

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

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

This document supplements or modifies the corresponding clauses in IEC 61558-1:2017, so as to convert that publication into the IEC standard: *Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V*.

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, or
- revised.

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

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 61558-2-10:2024](https://standards.itih.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024)

<https://standards.itih.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024>

INTRODUCTION

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

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

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

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

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

[IEC 61558-2-10:2024](https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024)

<https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4cd-333b35249b17/iec-61558-2-10-2024>

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

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

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **separating transformers with high insulation level** and **separating transformers with output voltages exceeding 1 000 V**. 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 **separating transformers with high insulation level** and **separating transformers with output voltages exceeding 1 000 V AC or 1 500 V DC**.

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.

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

<https://standards.iteh.ai/catalog/standards/iec/4d511291-770a-429c-b4ed-333b35249b17/iec-61558-2-10-2024>

~~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 takes precedence.

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:

- 25 kVA for single-phase **transformers**;
- 40 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.

Where applicable the **no-load output voltage** or the **rated output voltage**:

- does not exceed 1 000 V AC or 1 500 V DC for **separating transformers with high insulation level**;
- does exceed 1 000 V AC or 1 500 V DC and does not exceed 15 000 V AC or 15 000 V DC for **separating transformers with output voltage exceeding 1 000 V**.

This document does not apply to:

- **transformers** covered by IEC 60076-11;
- neon **transformers** covered by IEC 61050; and
- **power supplies** and converters for use with or in products according to IEC 61347-2-10.

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 **double or reinforced insulation** between circuits is not required by the installation rules or by the end product standard.

NOTE 2 3 Normally, the **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**.

This document is applicable to **transformers** associated with specific equipment, to the extent decided upon by the relevant IEC technical committees.

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.) ~~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 ~~can also be considered~~;
- the different conditions for transportation, storage, and operation of the **transformers** ~~can 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~~.

NOTE 4—It is possible that future technological development of **transformers** ~~can necessitate a need to~~ will require an increase in 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

IEC 61558-1:2017, Clause 2 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 61558-2-16, Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units~~

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:~~

~~The third paragraph is not applicable.~~

For the purposes of this document, the terms and definitions given in IEC 61558-1 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>

3.1 Transformers

Addition:

3.1.101

separating transformer with high insulation level

separating transformer where the **output voltage** does not exceed 1 000 V AC or 1 500 V DC and does exceed 50 V AC or DC for **independent transformers**, the **output winding(s)** is (are) isolated from both, **input winding(s)** and **body** for a **working voltage** exceeding 1 000 V AC or 1 500 V DC but not exceeding 15 000 V AC or 15 000 V DC

~~Note 1 to entry: The output winding(s) are isolated from both, input winding(s) and body for a working voltage exceeding 1 000 V a.c or 1 500 V d.c but not exceeding 15 000 V a.c or 15 000 V d.c.~~

3.1.102

separating transformer with output voltages exceeding 1 000 V

separating transformer where the **output circuits** of which are designed to give voltages exceeding 1 000 V AC or 1 500 V DC and not exceeding 15 000 V AC or 15 000 V DC

4 General requirements

IEC 61558-1:2017, Clause 4 is applicable.

5 General notes on tests

IEC 61558-1:2017, Clause 5 is applicable.

6 Ratings

~~This clause of Part 1 is not applicable.~~

Replacement:

IEC 61558-1:2017, Clause 6 is applicable except as follows.

Addition:

6.101 The **rated output voltage** is limited as follows.

For **separating transformers with high insulation level**:

- the **no-load output voltage** or the **rated output voltage** shall not exceed 1 000 V AC or 1 500 V DC;
- for **independent transformers** the **rated output voltage** shall exceed 50 V AC or 50 V DC and this **output voltage** applies even when **output windings**, not intended for interconnection, are connected in series.

For **separating transformers with no load output voltages exceeding 1 000 V**:

- the **rated output voltage** shall exceed 1 000 V AC or 1 500 V DC and shall not exceed 15 000 V AC or 15 000 V DC;
- for **independent transformers** these **output voltage** limitations apply even when **output windings**, not intended for interconnection, are connected in series.

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

- 25 kVA for single-phase **transformers**;
- 40 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

IEC 61558-1:2017, Clause 7 is applicable.

8 Marking and other information

IEC 61558-1:2017, Clause 8 is applicable, except as follows:

8.1 h)

Replacement:

~~Replace the first sentence by the following: relevant graphical symbols shown in 8.11 indicating the kind of transformer;~~

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

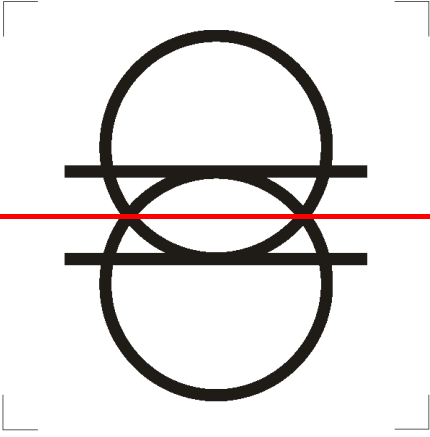
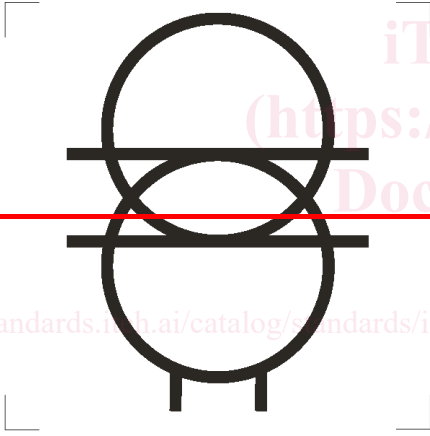
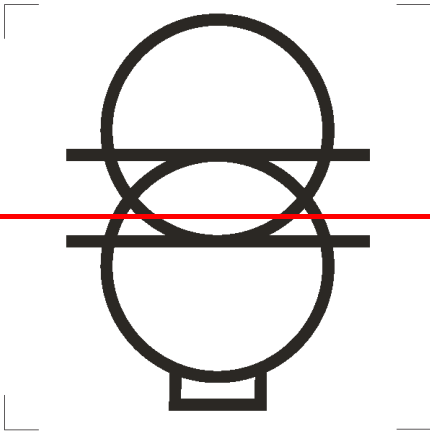
relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

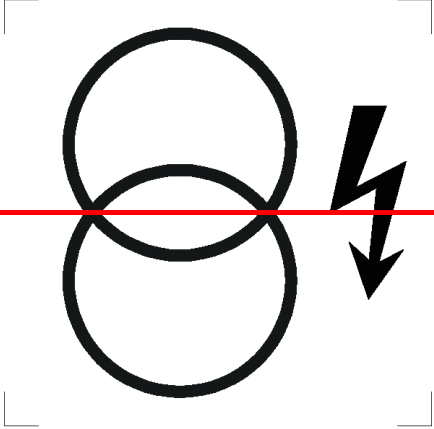
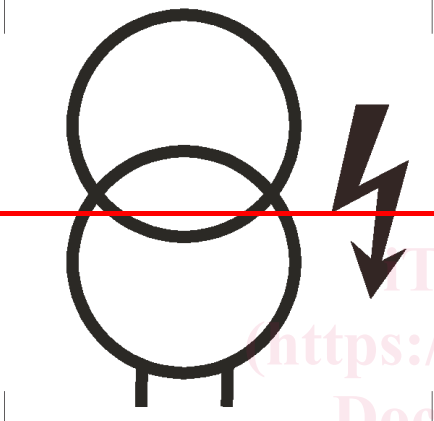
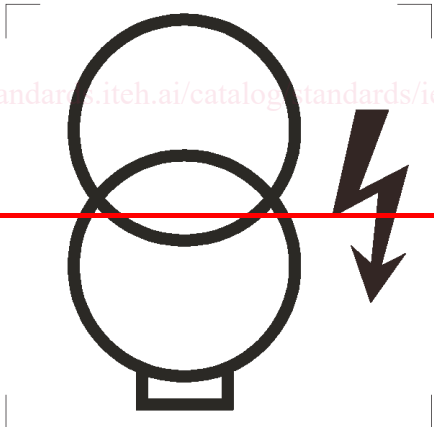
The voltage of the **insulation level**, expressed in kV is not a part of the symbol.

8.11

Addition:

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

| Symbol or graphical symbol | Explanation or title | Identification |
|---|--|----------------|
|  | <p>Separating transformer, high insulation level, general</p> <p>To identify the separating transformer with high insulation level, where the letter "F" may be used adjacent to the symbol to indicate a fail-safe function.</p> <p>The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol.</p> | IEC 60417-6063 |
|  | <p>Separating transformer, high insulation level, non-short-circuit-proof</p> <p>To identify the non-short-circuit-proof separating transformer with high insulation level.</p> <p>The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol.</p> | IEC 60417-6064 |
|  | <p>Separating transformer, high insulation level, short-circuit-proof</p> <p>To identify the short-circuit-proof (inherently or non-inherently) separating transformer with high insulation level.</p> <p>The voltage of the insulation level, expressed in kV, may be added adjacent to the symbol.</p> | IEC 60417-6065 |

| Symbol or graphical symbol | Explanation or title | Identification |
|---|--|-----------------------|
|  | <p>Separating transformer, output voltages exceeding 1 kV, general</p> <p>To identify the separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V, where the letter "F" may be used adjacent to the symbol to indicate a fail-safe function.</p> | <p>IEC 60417-6066</p> |
|  | <p>Separating transformer, output voltages exceeding 1 kV, non-short-circuit-proof</p> <p>To identify the non-short-circuit-proof separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V.</p> | <p>IEC 60417-6067</p> |
|  | <p>Separating transformer, output voltages exceeding 1 kV, short-circuit-proof</p> <p>To identify the short-circuit-proof (inherently or non-inherently) separating transformer with output voltages exceeding 1 000 V and not exceeding 15 000 V.</p> | <p>IEC 60417-6068</p> |