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INTERNATIONAL STANDARD

colour inside

GROUP ENERGY EFFICIENCY PUBLICATION

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-23:2010. 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 61558-2-23 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) adjustment of structure and references in accordance with IEC 61558-1:2017;
b) new symbol for power supply units with linearly regulated output voltage.

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

Draft	Report on voting
96/590/FDIS	96/596/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 transformers and power supply units for construction sites.*

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.

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.

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

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

1 Scope

Replacement:

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

This document is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated transformers,** being **isolating** or **safety isolating dry-type transformers** for the use on construction sites. The windings ~~may~~ can be encapsulated or non-encapsulated.

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.

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

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.

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

~~**Isolating transformers** and **power supply units** incorporating~~ **Isolating transformers** for construction sites have a **no-load output voltage** and a **rated output voltage** exceeding 50 V AC and not exceeding 250 V AC.

~~**Safety isolating transformers** and **power supply units** incorporating~~ **Safety isolating transformers** for construction sites have a **no-load output voltage** and a **rated output voltage** not exceeding 50 V AC.

NOTE 3 This document is applicable to **transformers** for the supply of electricity in locations as specified in IEC 60364-7-704. The latter also specifies the protection by using an earthed midpoint or starpoint of the **output winding**.

NOTE 4 **Transformers** ~~and **power supply units**~~ covered by this document are used in applications where it is required by the installation rules or by the appliance specification for protection purposes.

When the **transformers** ~~or **power supply units**~~ are incorporated into **low voltage switchgear and controlgear assemblies for construction sites** as specified in ~~IEC 60439-4~~ IEC 61439-4, the additional requirements of ~~IEC 60439-4~~ IEC 61439-4 apply to the assembly.

NOTE ~~4~~ 5 For **transformers** filled with liquid dielectric or pulverised material, such as sand, additional requirements are under consideration.

~~NOTE 5~~ Attention is drawn to the following if necessary:

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

~~NOTE 6~~ It is possible that the future technological development of **transformers** ~~may necessitate a need to~~ will require an increase in 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 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 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

~~*IEC 60439-4, Low-voltage switchgear and controlgear assemblies – Part 4: Particular requirements for assemblies for construction sites (ACS)*~~

IEC 60245-4:2011, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

IEC 61558-1:~~2005~~2017, ~~*Safety of power transformers, power supplies, reactors and similar products*~~ *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 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

3.2 General terms

Addition:

3.2.101
low voltage switchgear and controlgear assembly for construction sites ~~(ACS)~~
combination of one or several transforming or switching devices with associated control, measuring, signalling, protective and regulating equipment complete with all their internal electrical and mechanical connections and structural parts, designed and built for use on all construction sites, indoors or outdoors~~.~~

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

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

Addition:

6.101 The **rated output voltage** shall not exceed:

- 250 V AC for **isolating transformers** with a non-earthed mid-point (single-phase) or a non-earthed star-point (three-phase) or delta connection (three-phase)~~ and for **power supply units** incorporating such **transformers**~~;
- ~~110~~ 115 V AC for **isolating transformers** with a mid-point (single-phase) earthed in the construction or a star-point (three-phase) earthed in the construction~~ and for **power supply units** incorporating such **transformers**~~;
- 50 V AC for **safety isolating transformers**~~ and for **power supply units** incorporating **safety isolating transformers**~~.

The **rated output voltage** shall exceed:

- 50 V AC for isolating transformers~~ and for **power supply units** incorporating **isolating transformers**.~~

Preferred values for the **rated output voltage** are

- ~~110~~ 115 V and 230 V for **portable**, single-phase **isolating transformers**;
- 72 V, ~~110~~ 115 V and 230 V for other **isolating transformers**;

– 6 V, 12 V, 24 V, 42 V and 48 V for **safety isolating transformers**.

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

– 25 kVA for single-phase isolating and **safety isolating transformers** ~~and **power supply units** incorporating such **transformers**~~;

– 40 kVA for polyphase isolating and **safety isolating transformers** ~~and **power supply units** incorporating such **transformers**~~;

Preferred values for the **rated output** are

– 25 VA, 40 VA, 63 VA, 100 VA, 160 VA, 250 VA, 400 VA, 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA and 25 kVA for single-phase **transformers**;

– 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA, 25 kVA and 40 kVA for polyphase **transformers**.

Intermittent duty cycle ~~may~~ can be assigned only to **portable transformers** ~~and **power supply units**~~ having a **rated output** not exceeding 6,3 kVA.

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

6.103 The **rated supply frequency** shall not exceed 500 Hz.

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

6.105 **Transformers** with **intermittent duty cycle** shall be intended for a **rated** operating time of 5 min "on" and a resting time of 15 min "off".

6.106 The supply current is limited to a maximum of 125 A, and in the case of flexible cable or socket outlet, to 63 A.

Compliance with 6.101 to 6.106 is checked by inspection of the marking.

7 Classification

IEC 61558-1:2017, Clause 7 is applicable, except as follows:

Replacement:

7.5 **Transformers** are classified in accordance with their duty type:

– **continuous duty**;

– **intermittent duty cycle**.

8 Marking and other information

IEC 61558-1:2017, Clause 8 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 with the following:

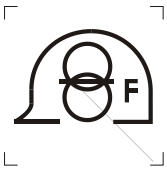
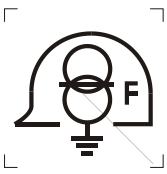
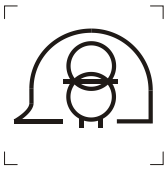
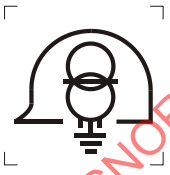
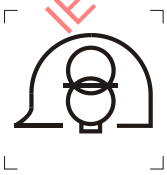
relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

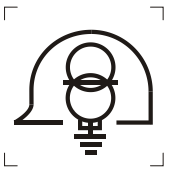
8.11

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
	**Isolating transformer for construction ~~site~~sites, fail-safe**	IEC 60417-6010-1:2007-02
	**Safety isolating transformer for construction ~~site~~sites, fail-safe~~, safety~~**	IEC 60417-6010-2:2007-02
	**Isolating transformer for construction ~~site~~sites, fail-safe**, mid-point or star-point earthed	IEC 60417-6010-3:2007-02
	**Isolating transformer for construction sites**, non-short-circuit proof	IEC 60417-6010-4:2007-02
	**Safety isolating transformer for construction sites**, non-short-circuit proof~~, safety~~	IEC 60417-6010-5:2007-02
	**Isolating transformer for construction sites**, non-short-circuit proof, mid-point or star-point earthed	IEC 60417-6010-6:2007-02
	**Isolating transformer for construction sites**, short-circuit proof (inherently or non-inherently)	IEC 60417-6010-7:2007-02
	**Safety isolating transformer for construction sites**, short-circuit proof~~, safety~~ (inherently or non-inherently)	IEC 60417-6010-8:2007-02

Symbol or graphical symbol	Explanation or title	Identification
	**Isolating transformer for construction sites**, short-circuit proof (inherently or non-inherently), mid-point or star-point earthed	IEC 60417-6010-9:2007-02
	**Power supply unit, linear** To identify the electronic device incorporating **transformer**(s) and electronic circuitry(ies), that converts electrical power into single or multiple power outputs, the output voltage is linearly regulated. The internal operating frequency does not exceed 500 Hz.	IEC 60417-6210:2013-10

9 Protection against electric shock

IEC 61558-1:2017, Clause 9 is applicable.

10 Change of input voltage setting

IEC 61558-1:2017, Clause 10 is applicable.

11 Output voltage and output current under load

IEC 61558-1:2017, Clause 11 is applicable.

12 No-load output voltage

IEC 61558-1:2017, Clause 12 is applicable except as follows:

Addition:

12.101 The **no-load output voltage** shall not exceed:

- 250 V AC for **isolating transformers** with a non-earthed mid-point (single-phase) or a non-earthed star-point (three-phase) or delta connection (three-phase) ~~and for **power supply units** incorporating such **transformers**~~);
- ~~116~~ 115 V AC for **isolating transformers** with a mid-point (single-phase) earthed in the construction or a star-point (three-phase) earthed in the construction ~~and for **power supply units** incorporating such **transformers**~~;
- 50 V AC for **safety isolating transformers** ~~and for **power supply units** incorporating **safety isolating transformers**~~.

For **independent transformers**, the **no-load output voltage** limitation applies even when **output windings**, not intended for interconnection, are connected in series.

The **no-load output voltage** shall exceed:

- 50 V AC for isolating **transformers** ~~and **power supply units** incorporating **isolating transformers**~~.

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

~~*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 ~~*difference*~~ ratio between the **no-load output voltage** measured in Clause 12 and the **output voltage** under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed the values shown in Table 102 or Table 103.

~~NOTE~~ 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_{load} is the output voltage under load, expressed in V.

Table ~~101~~ 102 – ~~Ratio of output voltages~~ Output voltage ratio for safety isolating transformers

Type of transformer Rated output VA	Ratio between no-load output voltage and output voltage under load %
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

Table ~~102~~ 103 – ~~Ratio of output voltages~~ Output voltage ratio for isolating transformers

Type of transformer Rated output VA	Ratio between no-load output voltage and output voltage under load %
All type of transformers:	
– 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

For single-phase **transformers** with earthed midpoint, the voltage between any pole of the **output circuit** and earthing shall not exceed the result of Formula (2):

~~$\left(\frac{\text{no - load output voltage}}{2}\right) \pm 2{,}5\ \%$~~

$$\frac{U_{\text{no-load}}}{2} \pm 2{,}5\ \% \qquad (2)$$

For three-phase **transformers** with earthed star-point, the voltage between any pole of the **output circuit** and earthing shall not exceed the result of Formula (3):

~~$\left(\frac{\text{no - load output voltage}}{\sqrt{3}}\right) \pm 2{,}5\ \%$~~

$$\frac{U_{\text{no-load}}}{\sqrt{3}} \pm 2{,}5\ \% \qquad (3)$$

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

13 Short-circuit voltage

IEC 61558-1:2017, Clause 13 is applicable.

14 Heating

IEC 61558-1:2017, Clause 14 is applicable.

15 Short-circuit and overload protection

IEC 61558-1:2017, Clause 15 is applicable.

16 Mechanical strength

IEC 61558-1:2017, Clause 16 is applicable except as follows:

16.1 General

Replacement:

Transformers ~~and **power supply units**~~ for construction sites shall have adequate mechanical strength and be so constructed as to withstand such rough handling and transport as ~~may~~ can be expected in normal use.

*Compliance is checked by the tests of 16.2 for **stationary transformers** and ~~**power supply units** and~~ by the tests of 16.2, 16.3 and 16.4 as appropriate, for **portable transformers** ~~and **portable power supply units**~~.*

*After the tests, the **transformers** ~~or **power supply units**~~ shall show no damage within the meaning of this document. In particular, **hazardous live parts** shall not become accessible, when tested as described in 9.2. Insulating barriers shall not be damaged and handles, levers, knobs and the like shall not move on their shafts.*

NOTE 1 Damage to the finish, small dents which do not reduce **creepage distances** or **clearances** below the values specified in Clause 26, and small chips which do not adversely affect the protection against electric shock or moisture, are ignored.

NOTE 2 Cracks not visible with normal vision or corrected vision without magnification and surface cracks in fibre reinforced mouldings and the like are ignored.

In addition, with respect to the test of 16.4, bending of the pins during the test is considered acceptable.

16.2 Stationary transformers

Replacement:

16.2 Impact test and shock test

16.2.1 Impact test

NOTE This test simulates collisions between the **transformer** ~~or **power supply unit**~~ and mechanical handling equipment for construction site.

*The complete **transformer** ~~or **power supply unit**~~, as applicable, shall be subjected to a series of impacts of 6 J applied to the **enclosure** as follows:*

*The equipment to be tested shall be fixed on a support of adequate rigidity to restrict movement of the **transformers** ~~or **power supply units**~~ to 0,1 mm under the effect of the prescribed impact. Three successive impacts shall be applied to the most unfavourable point of the **enclosure** by means of either:*

*a) a solid smooth steel sphere approximately 50 mm in diameter and with a mass of 500 g ± 25 g, falling freely from a rest position from a vertical height of 1,2 m onto the **enclosure** surface held in a horizontal plane. The hardness of the sphere shall be not less than 50 HR and not more than 58 HR (see Figure 101), or*

b) a similar steel sphere, which shall be suspended by a cord and swung as a pendulum in order to apply a horizontal impact, falling through a vertical distance of 1,2 m (see Figure 102).

*Sloping surfaces ~~may~~ can be tested using the pendulum but if this is not convenient the surface will be aligned in the horizontal plane by turning the **transformers** ~~or the **power supply units**~~, as applicable, on the support and the test a) is used. Before each test, an inspection of the sphere shall be made to ensure that it is free of burrs and defects.*

*The test shall be so arranged that the impacts are applied at positions where the weaknesses are most likely to be revealed. A minimum of 18 impacts shall be applied to the **transformers** ~~or **power supply units**~~, as applicable.*

The test is not applicable to components such as socket-outlets, operating handles, illuminating lights, push buttons, actuators, etc., when these components are mounted in recesses with respect to the main surfaces, so that the distance between the most exposed parts of these components and the ~~said~~ surfaces is at least 10 mm.

*After the test, the **enclosure** shall continue to provide the degrees of protection specified in 19.16; any distortions or deformations of the **enclosure** and components shall neither be detrimental to the proper functioning of the **transformer**, nor decrease **creepage distances** and **clearances** to below the required values; actuators, handles, etc. shall still be operable.*

Superficial damage, removed paint, broken cooling ribs or similar parts, small indentations, cracks not visible with normal or corrected vision without further magnification, or surface cracks shall not constitute test failures.

16.2.2 Shock test

NOTE This test simulates the shocks received by **transformers** ~~and **power supply units**~~ carried loose on board vehicles on normal roads or on railway cars for long periods of time.

*The complete **transformers** ~~or **power supply units**~~, as applicable, in working order shall be tested in accordance with IEC 60068-2-27 with a severity of 500 m/s^2 peak acceleration and duration of 11 ms.*

*After the test, the **enclosure** shall continue to provide the degrees of protection specified in 19.16; any distortions or deformations of the **enclosure** and components shall neither be detrimental to the proper functioning of the **transformer**, nor decrease **creepage distances** and **clearances** to below the required values; actuators, handles, etc., shall still be operable.*

Superficial damage, removed paint, broken cooling ribs or similar parts, small indentations, cracks not visible with normal or corrected vision without further magnification, or surface cracks shall not constitute test failures.

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

IEC 61558-1:2017, Clause 17 is applicable.

18 Insulation resistance, dielectric strength and leakage current

IEC 61558-1:2017, Clause 18 is applicable.

19 Construction

IEC 61558-1:2017, Clause 19 is applicable except as follows:

19.1 General construction

Replacement:

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

Compliance is checked by inspection and measurements~~, taking Clauses 18 and 26 into consideration~~ in accordance with Clause 18 and Clause 26.

19.1.~~1~~2 The insulation between **input** and **output winding(s)** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

In addition, the following applies:

- for **class I transformers** not intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** connected to earthing shall consist of at least **basic insulation** rated for the **input voltage**. The insulation between the **output windings** and the **body** connected to earthing, shall consist of at least **basic insulation** (rated for the **output voltage**);
- for **class I transformers** intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** shall consist of at least **basic insulation**, and the insulation between the **output windings** and the **body** shall consist of at least **supplementary insulation** (both basic and **supplementary insulations** rated for the **working voltage**);
- for **class II transformers**, the insulation between the **input windings** and the **body** shall consist of **double** or **reinforced insulation** (rated for the **input voltage**). The insulation between the **output windings** and the **body** shall consist of **double** or **reinforced insulation** (rated for the **output voltage**).

19.1.~~2~~3 For **transformers** with **intermediate conductive parts** (e.g. the iron core) not connected to the **body** and located between the **input** and **output windings** the insulation between the **input windings** and any **intermediate conductive part** shall consist of at least **basic insulation**, and the insulation between the **output windings** and any **intermediate conductive part** shall consist of at least **supplementary insulation** (both **basic** and **supplementary insulations** rated for the **working voltage**).

NOTE 1 An **intermediate conductive part** not separated from the **input** or **output windings** or the **body** by at least **basic insulation** is considered to be connected to the relevant part(s).

NOTE 2 **Basic insulation** and **supplementary insulation** are interchangeable.

In addition, the following applies:

- for **class I transformers**, the insulation between the **input** and **output windings** via the **intermediate conductive parts** (even if they are connected to earthing) shall consist of **double** or **reinforced insulation** (rated for the **working voltage**);
- for **class II transformers**, the insulation between the **input windings** and the **body**, and between the **output windings** and the **body** via the **intermediate conductive parts** shall consist of **double** or **reinforced insulation** (rated for the **input** and **output voltage);**
- for **transformers** different from independent transformers (IP00), the insulation between the **input** and **output windings** via the **intermediate conductive parts** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

~~NOTE 3~~ In this Subclause 19.1.3 the possibility to consider the **intermediate ~~metal~~ conductive part** connected to earthing and consequently to require **basic insulation** in both circuits (primary and secondary) is not allowed for the following reason:

- the **intermediate ~~metal~~ conductive part** is normally the iron core made by laminated strips insulated from other by oxide coatings. It is not assured that all laminations are correctly connected to earthing.
- for **transformers** different from independent, it is not assured that in the final applications the iron core will be connected to earthing.

19.1.~~3~~4 For **class I transformers** not intended for connection to the mains supply by means of a plug, the insulation between the **input** and **output windings ~~may~~** can consist of **basic insulation** plus **protective screening** instead of **double** or **reinforced insulation**, provided the following conditions are complied with:

- the insulation between the **input winding** and the **protective screen** shall comply with the requirements for **basic insulation** (rated for the **input voltage**);
- the insulation between the **protective screen** and the **output winding** shall comply with the requirements for **basic insulation** (rated for the **output voltage**);

- the **protective screen** shall, unless otherwise specified, consist of a metal foil or of a wire wound screen extending at least the full width of the **input winding** and shall have no gaps or holes;
- where the **protective screen** does not cover the entire width of the **input winding**, additional adhesive tapes or equivalent insulation shall be used to ensure **double insulation** in that area;
- if the **protective screen** is made of a foil, the turns shall be insulated from each other. In case of only one turn, it shall have an isolated overlap of at least 3 mm;
- the wire of a wire wound screen and the lead out wire of the **protective screen** shall have a cross-sectional area at least corresponding to the **rated current** of the overload device to ensure that if a breakdown of insulation should occur, the overload protective device will open the circuit before the lead-out wire is destroyed;
- the lead-out wire shall be soldered to the **protective screen** or secured in an equally reliable manner.

NOTE 4 For the purpose of this Subclause 19.1.4, the term "windings" does not include **internal circuits.**

NOTE 5 Examples of construction of windings are given in IEC 61558-1:2017, Annex M.

19.16 Portable transformers for use in irregular or harsh conditions

Addition:

Transformers ~~and **power supply units for construction sites**~~ shall be conform to the protection ~~code of~~ index not less than IP44 for **fixed transformers** ~~and **power supply units**~~, and not less than IP54 for **portable transformers** ~~and **portable power supply units**~~, except socket-outlet(s) shall have a protection ~~code~~ index not less than IP44.

Addition:

19.101 There shall be no connections between the **output circuit** and the protective earthing, unless this is allowed by the relevant equipment standard for **associated transformers** ~~and **power supply units**~~.

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

Compliance is checked by inspection.

19.103 The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier and it shall be of insulating material and be permanently fixed to the **transformer**.

*Compliance is checked by inspection and by measurement disregarding **intermediate conductive parts**.*

19.104 **Portable transformers** having a **rated output** not exceeding 630 VA shall be class II.

19.105 ~~to **19.110** Void~~

~~**19.111**~~ **Output circuits** shall provide protection against electric shock by one of the following means:

- the socket-outlets are supplied by **SELV**;

- the socket-outlets are supplied by an **output circuit** not exceeding ~~110~~ 115 V AC with the mid-point or star-point earthed to provide a line to earthing voltage not exceeding 55 V AC single-phase or 63,5 V AC three-phase;
- the socket-outlets are supplied by **output circuits** not connected to earthing and exceeding 50 V AC;
- each **output circuit** shall supply only one socket outlet.

~~NOTE~~ The above methods of protection do not require an additional protection by means of an RCD in accordance with 704.410.3 of IEC 60364-7-704:2017.

19.~~112~~106 For **transformers** with mid-point or star-point at **output windings** intended to be connected to earthing, the connection to earthing shall be made in the field. These **transformers** shall not have the **output winding** tapped at any other point.

20 Components

IEC 61558-1:2017, Clause 20 is applicable.

21 Internal wiring

IEC 61558-1:2017, Clause 21 is applicable.

22 Supply connection and other external flexible cable or cords

IEC 61558-1:2017, Clause 22 is applicable except as follows:

Replacement

22.5 Transformers ~~and **power supply units for use on construction sites**~~ shall be provided with at least heavy polychloroprene cords ~~according to code designation 66 of~~ in accordance with IEC 60245-4:2011 – type 60245 IEC 66.

23 Terminals for external conductors

IEC 61558-1:2017, Clause 23 is applicable.

24 Provisions for protective earthing

IEC 61558-1:2017, Clause 24 is applicable.

25 Screws and connections

IEC 61558-1:2017, Clause 25 is applicable.

26 Creepage distances, clearances and distances through insulation

IEC 61558-1:2017, Clause 26 is applicable.

27 Resistance to heat, fire and tracking

~~This clause of Part 1 is applicable.~~

27.1 IEC 61558-1:2017, 27.1 is applicable.

28 Resistance to rusting

IEC 61558-1:2017, Clause 28 is applicable.

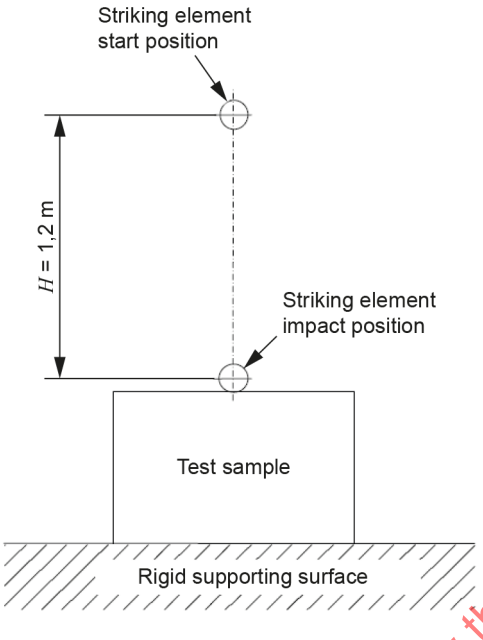


Figure 101 – Impact test for horizontal surface

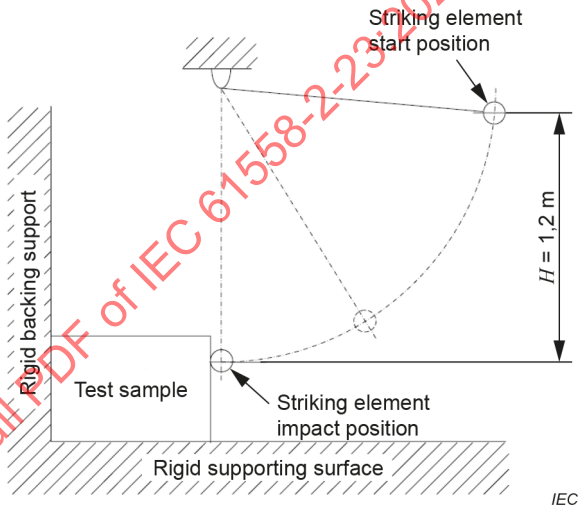


Figure 102 – Impact test for vertical surface

Annexes

The annexes of IEC 61558-1 are applicable except as follows:

Annex L
(normative)

Routine tests (production tests)

IEC 61558-1:2017, Annex L is applicable except as follows:

L.~~1~~2 ~~Protective~~ Earthing continuity test

Addition:

The earthing contact tubes of socket outlets of the **output circuit(s)** are considered to be accessible metal parts and included in the test as they are connected to the **body**.

L.~~2~~3 Checking of no-load output voltage

Addition:

Transformers with the mid-point or star-point of the **output circuits** earthed shall not exceed ~~116~~ 115 V AC. The voltage from the **output winding** to earthing shall not exceed the result of Formula (L.101) for single-phase **transformers** or Formula (L.102) for three-phase **transformers**.

$$\left(\frac{\text{output voltage}}{2}\right) \qquad \left(\frac{U_{\text{out}}}{2}\right) \tag{L.101}$$

$$\left(\frac{\text{output voltage}}{\sqrt{3}}\right) \qquad \left(\frac{U_{\text{out}}}{\sqrt{3}}\right) \tag{L.102}$$

Bibliography

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

Addition:

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

IEC 60364-7-704:~~2005~~2017, *Low-voltage electrical installations – Part 7-704: Requirements for special installations or locations – Construction and demolition site installations*

IEC 61439-4:2023, *Low-voltage switchgear and controlgear assemblies – Part 4: Particular requirements for assemblies for construction sites (ACS)*

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

~~IEC 61558-2-16:2009, *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 61558-2-16:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

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

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

IEC 61558-2-23

Edition 3.0 2024-06

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GROUP ENERGY EFFICIENCY PUBLICATION
PUBLICATION GROUPÉE SUR L'EFFICACITÉ ÉNERGÉTIQUE

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces élements – Partie 2-23: Règles particulières et essais pour les transformateurs et les blocs d'alimentation pour chantiers

IEC 61558-2-23:2024-06(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

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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IEC 61558-2-23 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) adjustment of structure and references in accordance with IEC 61558-1:2017;
b) new symbol for power supply units with linearly regulated output voltage.

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

Draft	Report on voting
96/590/FDIS	96/596/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 transformers and power supply units for construction sites.*

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.

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.

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

Part 2-23: Particular requirements and tests for transformers and power supply units for construction sites

1 Scope

Replacement:

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

This document is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated transformers,** being **isolating** or **safety isolating dry-type transformers** for the use on construction sites. The windings can be encapsulated or non-encapsulated.

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.

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

Isolating transformers for construction sites have a **no-load output voltage** and a **rated output voltage** exceeding 50 V AC and not exceeding 250 V AC.

Safety isolating transformers for construction sites have a **no-load output voltage** and a **rated output voltage** not exceeding 50 V AC.

NOTE 3 This document is applicable to **transformers** for the supply of electricity in locations as specified in IEC 60364-7-704. The latter also specifies the protection by using an earthed midpoint or starpoint of the **output winding**.

NOTE 4 **Transformers** covered by this document are used in applications where it is required by the installation rules or by the appliance specification for protection purposes.

When the **transformers** are incorporated into **low voltage switchgear and controlgear assemblies for construction sites** as specified in IEC 61439-4, the additional requirements of IEC 61439-4 apply to the assembly.

NOTE 5 For **transformers** filled with liquid dielectric or pulverised material, such as sand, additional requirements are under consideration.

Attention is drawn to the following if necessary:

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

It is possible that the future technological development of **transformers** will require an increase in 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 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 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60245-4:2011, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

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 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

3.2 General terms

Addition:

3.2.101
low voltage switchgear and controlgear assembly for construction sites
combination of one or several transforming or switching devices with associated control, measuring, signalling, protective and regulating equipment complete with all their internal electrical and mechanical connections and structural parts, designed and built for use on all construction sites, indoors or outdoors

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

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

Addition:

6.101 The **rated output voltage** shall not exceed:

- 250 V AC for **isolating transformers** with a non-earthed mid-point (single-phase) or a non-earthed star-point (three-phase) or delta connection (three-phase);
- 115 V AC for **isolating transformers** with a mid-point (single-phase) earthed in the construction or a star-point (three-phase) earthed in the construction;
- 50 V AC for **safety isolating transformers**.

The **rated output voltage** shall exceed:

- 50 V AC for isolating transformers

Preferred values for the **rated output voltage** are

- 115 V and 230 V for **portable**, single-phase **isolating transformers**;
- 72 V, 115 V and 230 V for other **isolating transformers**;
- 6 V, 12 V, 24 V, 42 V and 48 V for **safety isolating transformers**.

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

- 25 kVA for single-phase isolating and **safety isolating transformers**;
- 40 kVA for polyphase isolating and **safety isolating transformers**;

Preferred values for the **rated output** are

- 25 VA, 40 VA, 63 VA, 100 VA, 160 VA, 250 VA, 400 VA, 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA and 25 kVA for single-phase **transformers**;
- 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA, 25 kVA and 40 kVA for polyphase **transformers**.

Intermittent duty cycle can be assigned only to **portable transformers** having a **rated output** not exceeding 6,3 kVA.

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

6.103 The **rated supply frequency** shall not exceed 500 Hz.

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

6.105 **Transformers** with **intermittent duty cycle** shall be intended for a **rated** operating time of 5 min "on" and a resting time of 15 min "off".

6.106 The supply current is limited to a maximum of 125 A, and in the case of flexible cable or socket outlet, to 63 A.

Compliance with 6.101 to 6.106 is checked by inspection of the marking.

7 Classification

IEC 61558-1:2017, Clause 7 is applicable, except as follows:

Replacement:

7.5 **Transformers** are classified in accordance with their duty type:

- **continuous duty**;
- **intermittent duty cycle**.

8 Marking and other information

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

8.1 h)

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

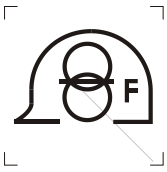
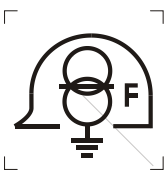
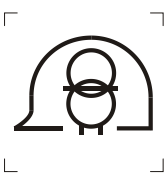
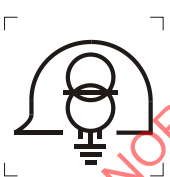
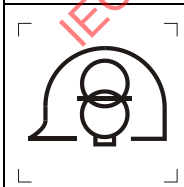
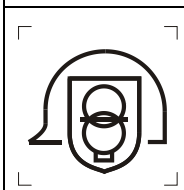
relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**

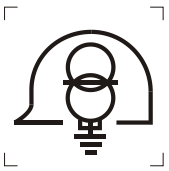
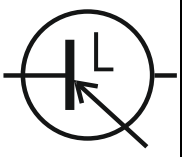
8.11

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
	**Isolating transformer for construction sites, fail-safe**	IEC 60417-6010-1:2007-02
	**Safety isolating transformer for construction sites, fail-safe**	IEC 60417-6010-2:2007-02
	**Isolating transformer for construction sites, fail-safe**, mid-point or star-point earthed	IEC 60417-6010-3:2007-02
	**Isolating transformer for construction sites**, non-short-circuit proof	IEC 60417-6010-4:2007-02
	**Safety isolating transformer for construction sites**, non-short-circuit proof	IEC 60417-6010-5:2007-02
	**Isolating transformer for construction sites**, non-short-circuit proof, mid-point or star-point earthed	IEC 60417-6010-6:2007-02
	**Isolating transformer for construction sites**, short-circuit proof (inherently or non-inherently)	IEC 60417-6010-7:2007-02
	**Safety isolating transformer for construction sites**, short-circuit proof (inherently or non-inherently)	IEC 60417-6010-8:2007-02

Symbol or graphical symbol	Explanation or title	Identification
	**Isolating transformer for construction sites**, short-circuit proof (inherently or non-inherently), mid-point or star-point earthed	IEC 60417-6010-9:2007-02
	**Power supply unit, linear** To identify the electronic device incorporating **transformer**(s) and electronic circuitry(ies), that converts electrical power into single or multiple power outputs, the output voltage is linearly regulated. The internal operating frequency does not exceed 500 Hz.	IEC 60417-6210:2013-10

9 Protection against electric shock

IEC 61558-1:2017, Clause 9 is applicable.

10 Change of input voltage setting

IEC 61558-1:2017, Clause 10 is applicable.

11 Output voltage and output current under load

IEC 61558-1:2017, Clause 11 is applicable.

12 No-load output voltage

IEC 61558-1:2017, Clause 12 is applicable except as follows:

Addition:

12.101 The **no-load output voltage** shall not exceed:

- 250 V AC for **isolating transformers** with a non-earthed mid-point (single-phase) or a non-earthed star-point (three-phase) or delta connection (three-phase);
- 115 V AC for **isolating transformers** with a mid-point (single-phase) earthed in the construction or a star-point (three-phase) earthed in the construction;
- 50 V AC for **safety isolating transformers**.

For **independent transformers**, the **no-load output voltage** limitation applies even when **output windings**, not intended for interconnection, are connected in series.

The **no-load output voltage** shall exceed:

- 50 V AC for isolating **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 or Table 103.

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_{load} is the output voltage under load, expressed in V.

Table 102 – Output voltage ratio for safety isolating transformers

Type of transformer **Rated output** VA	**Ratio between no-load output voltage and output voltage under load** %
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

Table 103 – Output voltage ratio for isolating transformers

Type of transformer **Rated output** VA	**Ratio between no-load output voltage and output voltage under load** %
All type of transformers:	
– 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

For single-phase **transformers** with earthed midpoint, the voltage between any pole of the **output circuit** and earthing shall not exceed the result of Formula (2):

$$\frac{U_{\text{no-load}}}{2} \pm 2{,}5\ \% \tag{2}$$

For three-phase **transformers** with earthed star-point, the voltage between any pole of the **output circuit** and earthing shall not exceed the result of Formula (3):

$$\frac{U_{\text{no-load}}}{\sqrt{3}} \pm 2{,}5\ \% \tag{3}$$

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

13 Short-circuit voltage

IEC 61558-1:2017, Clause 13 is applicable.

14 Heating

IEC 61558-1:2017, Clause 14 is applicable.

15 Short-circuit and overload protection

IEC 61558-1:2017, Clause 15 is applicable.

16 Mechanical strength

IEC 61558-1:2017, Clause 16 is applicable except as follows:

16.1 General

Replacement:

Transformers for construction sites shall have adequate mechanical strength and be so constructed as to withstand such rough handling and transport as can be expected in normal use.

*Compliance is checked by the tests of 16.2 for **stationary transformers** and by the tests of 16.2, 16.3 and 16.4 as appropriate, for **portable transformers**.*

*After the tests, the **transformers** shall show no damage within the meaning of this document. In particular, **hazardous live parts** shall not become accessible, when tested as described in 9.2. Insulating barriers shall not be damaged and handles, levers, knobs and the like shall not move on their shafts.*

NOTE 1 Damage to the finish, small dents which do not reduce **creepage distances** or **clearances** below the values specified in Clause 26, and small chips which do not adversely affect the protection against electric shock or moisture, are ignored.

NOTE 2 Cracks not visible with normal vision or corrected vision without magnification and surface cracks in fibre reinforced mouldings and the like are ignored.

In addition, with respect to the test of 16.4, bending of the pins during the test is considered acceptable.

16.2 Stationary transformers

Replacement:

16.2 Impact test and shock test

16.2.1 Impact test

NOTE This test simulates collisions between the **transformer** and mechanical handling equipment for construction site.

*The complete **transformer**, as applicable, shall be subjected to a series of impacts of 6 J applied to the **enclosure** as follows:*

*The equipment to be tested shall be fixed on a support of adequate rigidity to restrict movement of the **transformers** to 0,1 mm under the effect of the prescribed impact. Three successive impacts shall be applied to the most unfavourable point of the **enclosure** by means of either:*

*a) a solid smooth steel sphere approximately 50 mm in diameter and with a mass of 500 g ± 25 g, falling freely from a rest position from a vertical height of 1,2 m onto the **enclosure** surface held in a horizontal plane. The hardness of the sphere shall be not less than 50 HR and not more than 58 HR (see Figure 101), or*

b) a similar steel sphere, which shall be suspended by a cord and swung as a pendulum in order to apply a horizontal impact, falling through a vertical distance of 1,2 m (see Figure 102).

*Sloping surfaces can be tested using the pendulum but if this is not convenient the surface will be aligned in the horizontal plane by turning the **transformers**, as applicable, on the support and the test a) is used. Before each test, an inspection of the sphere shall be made to ensure that it is free of burrs and defects.*

*The test shall be so arranged that the impacts are applied at positions where the weaknesses are most likely to be revealed. A minimum of 18 impacts shall be applied to the **transformers**, as applicable.*

The test is not applicable to components such as socket-outlets, operating handles, illuminating lights, push buttons, actuators, etc., when these components are mounted in recesses with respect to the main surfaces, so that the distance between the most exposed parts of these components and the surfaces is at least 10 mm.

*After the test, the **enclosure** shall continue to provide the degrees of protection specified in 19.16; any distortions or deformations of the **enclosure** and components shall neither be detrimental to the proper functioning of the **transformer**, nor decrease **creepage distances** and **clearances** to below the required values; actuators, handles, etc. shall still be operable.*

Superficial damage, removed paint, broken cooling ribs or similar parts, small indentations, cracks not visible with normal or corrected vision without further magnification, or surface cracks shall not constitute test failures.

16.2.2 Shock test

NOTE This test simulates the shocks received by **transformers** carried loose on board vehicles on normal roads or on railway cars for long periods of time.

*The complete **transformers**, as applicable, in working order shall be tested in accordance with IEC 60068-2-27 with a severity of 500 m/s^2 peak acceleration and duration of 11 ms.*

*After the test, the **enclosure** shall continue to provide the degrees of protection specified in 19.16; any distortions or deformations of the **enclosure** and components shall neither be detrimental to the proper functioning of the **transformer**, nor decrease **creepage distances** and **clearances** to below the required values; actuators, handles, etc., shall still be operable.*

Superficial damage, removed paint, broken cooling ribs or similar parts, small indentations, cracks not visible with normal or corrected vision without further magnification, or surface cracks shall not constitute test failures.

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

IEC 61558-1:2017, Clause 17 is applicable.

18 Insulation resistance, dielectric strength and leakage current

IEC 61558-1:2017, Clause 18 is applicable.

19 Construction

IEC 61558-1:2017, Clause 19 is applicable except as follows:

19.1 General construction

Replacement:

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

Compliance is checked by inspection and measurements in accordance with Clause 18 and Clause 26.

19.1.2 The insulation between **input** and **output winding(s)** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

In addition, the following applies:

- for **class I transformers** not intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** connected to earthing shall consist of at least **basic insulation** rated for the **input voltage**. The insulation between the **output windings** and the **body** connected to earthing, shall consist of at least **basic insulation** (rated for the **output voltage**);
- for **class I transformers** intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** shall consist of at least **basic insulation**, and the insulation between the **output windings** and the **body** shall consist of at least **supplementary insulation** (both basic and **supplementary insulations** rated for the **working voltage**);

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

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

NOTE 1 An **intermediate conductive part** not separated from the **input** or **output windings** or the **body** by at least **basic insulation** is considered to be connected to the relevant part(s).

NOTE 2 **Basic insulation** and **supplementary insulation** are interchangeable.

In addition, the following applies:

– for **class I transformers**, the insulation between the **input** and **output windings** via the **intermediate conductive parts** (even if they are connected to earthing) shall consist of **double** or **reinforced insulation** (rated for the **working voltage**);

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

– for **transformers** different from independent transformers (IP00), the insulation between the **input** and **output windings** via the **intermediate conductive parts** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**).

In this Subclause 19.1.3 the possibility to consider the **intermediate conductive part** connected to earthing and consequently to require **basic insulation** in both circuits (primary and secondary) is not allowed for the following reason:

– the **intermediate conductive part** is normally the iron core made by laminated strips insulated from other by oxide coatings. It is not assured that all laminations are correctly connected to earthing.

– for **transformers** different from independent, it is not assured that in the final applications the iron core will be connected to earthing.

19.1.4 For **class I transformers** not intended for connection to the mains supply by means of a plug, the insulation between the **input** and **output windings** can consist of **basic insulation** plus **protective screening** instead of **double** or **reinforced insulation**, provided the following conditions are complied with:

– the insulation between the **input winding** and the **protective screen** shall comply with the requirements for **basic insulation** (rated for the **input voltage**);

– the insulation between the **protective screen** and the **output winding** shall comply with the requirements for **basic insulation** (rated for the **output voltage**);

– the **protective screen** shall, unless otherwise specified, consist of a metal foil or of a wire wound screen extending at least the full width of the **input winding** and shall have no gaps or holes;

– where the **protective screen** does not cover the entire width of the **input winding**, additional adhesive tapes or equivalent insulation shall be used to ensure **double insulation** in that area;

– if the **protective screen** is made of a foil, the turns shall be insulated from each other. In case of only one turn, it shall have an isolated overlap of at least 3 mm;

- the wire of a wire wound screen and the lead out wire of the **protective screen** shall have a cross-sectional area at least corresponding to the **rated current** of the overload device to ensure that if a breakdown of insulation should occur, the overload protective device will open the circuit before the lead-out wire is destroyed;
- the lead-out wire shall be soldered to the **protective screen** or secured in an equally reliable manner.

NOTE 4 For the purpose of this Subclause 19.1.4, the term "windings" does not include **internal circuits.**

NOTE 5 Examples of construction of windings are given in IEC 61558-1:2017, Annex M.

19.16 Portable transformers for use in irregular or harsh conditions

Addition:

Transformers shall be conform to the protection index not less than IP44 for **fixed transformers,** and not less than IP54 for **portable transformers**, except socket-outlet(s) shall have a protection index not less than IP44.

Addition:

19.101 There shall be no connections between the **output circuit** and the protective earthing, unless this is allowed by the relevant equipment standard for **associated transformers**.

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

Compliance is checked by inspection.

19.103 The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier and it shall be of insulating material and be permanently fixed to the **transformer**.

*Compliance is checked by inspection and by measurement disregarding **intermediate conductive parts**.*

19.104 **Portable transformers** having a **rated output** not exceeding 630 VA shall be class II.

19.105 **Output circuits** shall provide protection against electric shock by one of the following means:

- the socket-outlets are supplied by **SELV**;
- the socket-outlets are supplied by an **output circuit** not exceeding 115 V AC with the mid-point or star-point earthed to provide a line to earthing voltage not exceeding 55 V AC single-phase or 63,5 V AC three-phase;
- the socket-outlets are supplied by **output circuits** not connected to earthing and exceeding 50 V AC;
- each **output circuit** shall supply only one socket outlet.

The above methods of protection do not require an additional protection by means of an RCD in accordance with 704.410.3 of IEC 60364-7-704:2017.

19.106 For **transformers** with mid-point or star-point at **output windings** intended to be connected to earthing, the connection to earthing shall be made in the field. These **transformers** shall not have the **output winding** tapped at any other point.

20 Components

IEC 61558-1:2017, Clause 20 is applicable.

21 Internal wiring

IEC 61558-1:2017, Clause 21 is applicable.

22 Supply connection and other external flexible cable or cords

IEC 61558-1:2017, Clause 22 is applicable except as follows:

Replacement

22.5 Transformers shall be provided with at least heavy polychloroprene cords in accordance with IEC 60245-4:2011 – type 60245 IEC 66.

23 Terminals for external conductors

IEC 61558-1:2017, Clause 23 is applicable.

24 Provisions for protective earthing

IEC 61558-1:2017, Clause 24 is applicable.

25 Screws and connections

IEC 61558-1:2017, Clause 25 is applicable.

26 Creepage distances, clearances and distances through insulation

IEC 61558-1:2017, Clause 26 is applicable.

27 Resistance to heat, fire and tracking

27.1 IEC 61558-1:2017, 27.1 is applicable.

28 Resistance to rusting

IEC 61558-1:2017, Clause 28 is applicable.

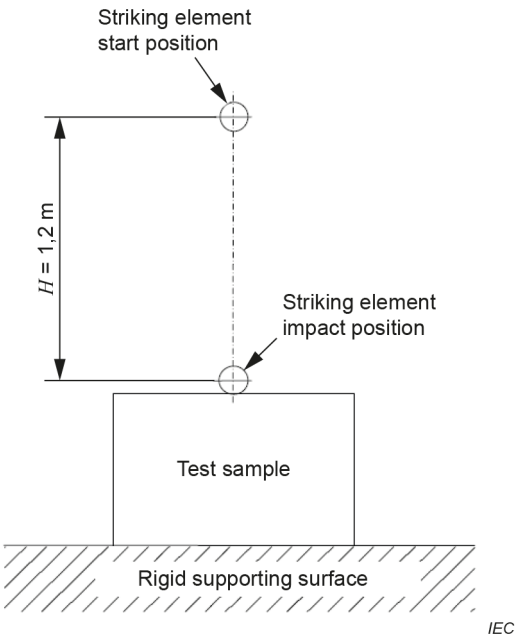


Figure 101 – Impact test for horizontal surface

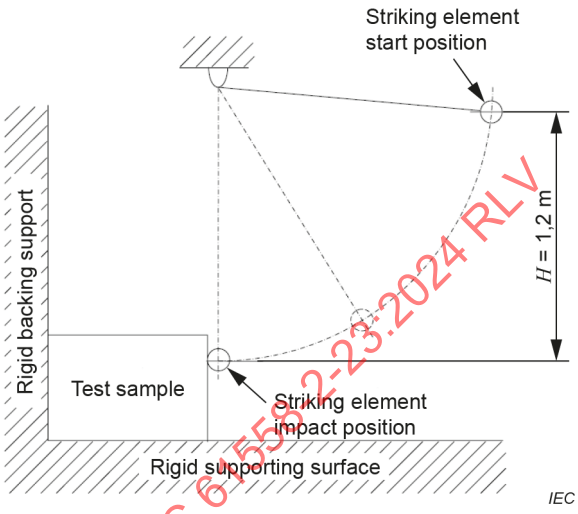


Figure 102 – Impact test for vertical surface

Annexes

The annexes of IEC 61558-1 are applicable except as follows:

Annex L
(normative)

Routine tests (production tests)

IEC 61558-1:2017, Annex L is applicable except as follows:

L.2 Earthing continuity test

Addition:

The earthing contact tubes of socket outlets of the **output circuit(s**) are considered to be accessible metal parts and included in the test as they are connected to the **body**.

L.3 Checking of no-load output voltage

Addition:

Transformers with the mid-point or star-point of the **output circuits** earthed shall not exceed 115 V AC. The voltage from the **output winding** to earthing shall not exceed the result of Formula (L.101) for single-phase **transformers** or Formula (L.102) for three-phase **transformers**.

$$\left(\frac{U_{\text{out}}}{2}\right) \quad \text{(L.101)}$$

$$\left(\frac{U_{\text{out}}}{\sqrt{3}}\right) \quad \text{(L.102)}$$

Bibliography

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

Addition:

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

IEC 60364-7-704:2017, *Low-voltage electrical installations – Part 7-704: Requirements for special installations or locations – Construction and demolition site installations*

IEC 61439-4:2023, *Low-voltage switchgear and controlgear assemblies – Part 4: Particular requirements for assemblies for construction sites (ACS)*

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

IEC 61558-2-16:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

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

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

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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

Partie 2-23: Exigences particulières et essais pour les transformateurs et les blocs d'alimentation pour chantiers

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L'IEC 61558-2-23 a été établie par le comité d'études 96 de l'IEC: Transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2010. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) la structure et les références ont été alignées sur l'IEC 61558-1:2017;

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

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
96/590/FDIS	96/596/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Il a le statut de publication groupée de sécurité conformément au Guide 104 de l'IEC.

La présente Norme internationale doit être utilisée conjointement avec l'IEC 61558-1:2017.

Le présent document complète ou modifie les articles correspondants de l'IEC 61558-1:2017, de façon à transformer cette publication en norme IEC: *Exigences particulières et essais pour les transformateurs et les blocs d'alimentation pour chantiers.*

Une liste de toutes les parties de la série IEC 61558, publiées sous le titre général *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments,* se trouve sur le site web de l'IEC.

Les futures normes de cette série porteront le nouveau titre général cité ci-dessus. Le titre des normes qui existent déjà dans cette série sera mis à jour lors de leur prochaine édition.

Lorsque le présent document mentionne "*addition*", "*modification*" ou "*remplacement*", le texte correspondant de l'IEC 61558-1:2017 doit être adapté en conséquence.

Dans le présent document, les caractères d'imprimerie suivants sont utilisés:

– exigences proprement dites: caractères romains;

– *modalités d'essais: caractères italiques*;

– commentaires: petits caractères romains.

Dans le texte du présent document, les termes en **gras** sont définis à l'Article 3.

Les paragraphes, notes, figures et tableaux qui s'ajoutent à ceux de l'IEC 61558-1:2017 sont numérotés à partir de 101; les annexes qui sont ajoutées sont désignées AA, BB, etc.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé ou
- révisé.

INTRODUCTION

Le CE 96 de l'IEC a une fonction groupée de sécurité, conformément au Guide 104 de l'IEC relatif aux transformateurs autres que ceux destinés à alimenter les réseaux de distribution, notamment les transformateurs et les blocs d'alimentation destinés à permettre l'application de mesures de protection contre les chocs électriques, comme cela est défini par le CE 64, qui traite des installations électriques et de la protection contre les chocs électriques, mais qui incluent également dans certains cas la limitation de la tension et de la fonction de sécurité horizontale pour la **TBTS**, conformément à l'IEC 60364-4-41.

La fonction groupée de sécurité (GSF, *Group Safety Function*) est utilisée en raison de la responsabilité de la **très basse tension de sécurité** (**TBTS**), conformément au 5.2.6 de l'IEC 61140:2016 et au 414.3.1 de l'IEC 60364-4-41:2005, ou des circuits de commande, conformément au 7.2.4 de l'IEC 60204-1:2016.

La fonction groupée de sécurité est utilisée pour chacune des parties de l'IEC 61558-2, car différentes normes de la série IEC 61558 peuvent être combinées en une seule et même construction, mais dans certains cas sans aucune limitation de la **puissance assignée**.

Un **autotransformateur** conforme à l'IEC 61558-2-13 peut par exemple être conçu avec un **circuit TBTS** distinct, conformément aux exigences particulières de l'IEC 61558-2-6 liées aux exigences générales de l'IEC 61558-1.

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

Partie 2-23: Exigences particulières et essais pour les transformateurs et les blocs d'alimentation pour chantiers

1 Domaine d'application

Remplacement:

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

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

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

Le présent document s'applique aux **transformateurs fixes** ou **mobiles**, monophasés ou polyphasés, à refroidissement par air (naturel ou forcé) **indépendants** ou **associés**, qu'il s'agisse de **transformateurs de type sec de séparation des circuits** ou de **transformateurs de type sec de sécurité**, destinés à être utilisés sur les chantiers. Les enroulements peuvent être enrobés ou non enrobés.

Pour les **blocs d'alimentation** (linéaires), le présent document s'applique. Pour les **blocs d'alimentation à découpage**, l'IEC 61558-2-16 et le présent document s'appliquent. Lorsque deux exigences sont contradictoires, la plus contraignante prévaut.

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

La **puissance assignée** ne dépasse pas:

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

Le présent document s'applique aux **transformateurs** sans limitation de la **puissance assignée**, qui font l'objet d'un accord entre l'acheteur et le fabricant.

NOTE 2 Le domaine d'application ne couvre pas les **transformateurs** destinés à alimenter les réseaux de distribution.

Les **transformateurs de séparation des circuits** pour chantiers ont une **tension secondaire à vide** et une **tension secondaire assignée** supérieures à 50 V en courant alternatif et inférieures ou égales à 250 V en courant alternatif.

Les **transformateurs de sécurité** pour chantiers ont une **tension secondaire à vide** et une **tension secondaire assignée** inférieures ou égales à 50 V en courant alternatif.

NOTE 3 Le présent document s'applique aux **transformateurs** pour l'alimentation des locaux en électricité, comme cela est spécifié dans l'IEC 60364-7-704. Cette dernière spécifie également les mesures de protection obtenues par la mise à la terre d'un point milieu ou point étoile de l'**enroulement secondaire**.

NOTE 4 Les **transformateurs** couverts par le présent document sont utilisés dans le cadre d'applications, où leur emploi est exigé par les règles d'installation ou la spécification de l'appareil à des fins de protection.

Lorsque les **transformateurs** sont incorporés dans des **ensembles d'appareillage à basse tension utilisés sur les chantiers** comme cela est spécifié dans l'IEC 61439-4, les exigences supplémentaires de l'IEC 61439-4 s'appliquent aux ensembles.

NOTE 5 Pour les **transformateurs** à remplissage par diélectrique liquide ou par des matières pulvérulentes telles que le sable, des exigences supplémentaires sont à l'étude.

L'attention est attirée sur les points suivants, si nécessaire:

– exigences supplémentaires (issues d'autres normes applicables, règles nationales, etc.) pour les **transformateurs** destinés à être utilisés dans des véhicules, à bord de navires et d'avions;
– mesures qui visent à protéger l'**enveloppe** et les composants situés à l'intérieur de celle-ci contre les facteurs d'influence externes comme les champignons, la vermine, les termites, les rayonnements solaires et le givre;
– différentes conditions de transport, de stockage et de fonctionnement pour les **transformateurs**;
– exigences supplémentaires qui peuvent s'appliquer aux **transformateurs** destinés à être utilisés dans un environnement particulier, au regard d'autres normes et règles nationales applicables.

Il est possible que les évolutions techniques futures des **transformateurs** exigent une augmentation de la limite supérieure des fréquences. En attendant, le présent document peut être utilisé à titre de recommandation.

La présente publication groupée de sécurité portant sur des recommandations de sécurité est avant tout destinée à être utilisée en tant que norme en matière de sécurité des produits pour les produits cités dans le domaine d'application, mais elle est également destinée à être utilisée par les comités d'études dans le cadre de l'élaboration de publications pour des produits similaires à ceux cités dans le domaine d'application de la présente publication groupée de sécurité, conformément aux principes établis dans le Guide 104 de l'IEC et le Guide 51 de l'ISO/IEC.

L'une des responsabilités d'un comité d'études consiste, le cas échéant, à utiliser les publications fondamentales de sécurité et/ou les publications groupées de sécurité dans le cadre de l'élaboration de ses publications.

2 Références normatives

L'Article 2 de l'IEC 61558-1:2017 s'applique, avec l'exception suivante:

Addition:

IEC 60068-2-27:2008, *Essais d'environnement – Partie 2-27: Essais – Essai Ea et guide: Chocs*

IEC 60245-4:2011, *Conducteurs et câbles isolés au caoutchouc – Tension assignée au plus égale à 450/750 V – Partie 4: Câbles souples*

IEC 61558-1:2017, *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 1: Exigences générales et essais*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 61558-1 s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.2 Termes généraux

Addition:

3.2.101
ensemble d'appareillage à basse tension utilisé sur les chantiers
combinaison d'un ou de plusieurs appareils de transformation ou de connexion avec équipements associés de commande, de mesure, de signalisation, de protection et de régulation complètement assemblés avec toutes leurs liaisons internes électriques et mécaniques et leurs éléments de construction, conçue et construite pour être utilisée sur tous les chantiers, à l'intérieur ou à l'extérieur

4 Exigences générales

L'Article 4 de l'IEC 61558-1:2017 s'applique.

5 Généralités sur les essais

L'Article 5 de l'IEC 61558-1:2017 s'applique.

6 Caractéristiques assignées

L'Article 6 de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

Addition:

6.101 La **tension secondaire assignée** ne doit pas dépasser:

– 250 V en courant alternatif pour les **transformateurs de séparation des circuits** avec un point milieu non relié à la terre (monophasé) ou un point étoile non relié à la terre (triphasé) ou un couplage en triangle (triphasé);
– 115 V en courant alternatif pour les **transformateurs de séparation des circuits** avec un point milieu relié à la terre dans la construction (monophasé) ou un point étoile relié à la terre dans la construction (triphasé);
– 50 V en courant alternatif pour les **transformateurs de sécurité**.

La **tension secondaire assignée** doit dépasser:

– 50 V en courant alternatif pour les transformateurs de séparation des circuits.

Les valeurs préférentielles pour la **tension secondaire assignée** sont

– 115 V et 230 V pour les **transformateurs de séparation des circuits mobiles** monophasés;
– 72 V, 115 V et 230 V pour les autres **transformateurs de séparation des circuits**;
– 6 V, 12 V, 24 V, 42 V et 48 V pour les **transformateurs de sécurité**.

6.102 La **puissance assignée** ne doit pas dépasser:

- 25 kVA pour les transformateurs de séparation des circuits et les **transformateurs de sécurité** monophasés;
- 40 kVA pour les transformateurs de séparation des circuits et les **transformateurs de sécurité** polyphasés.

Les valeurs préférentielles pour la **puissance assignée** sont

- 25 VA, 40 VA, 63 VA, 100 VA, 160 VA, 250 VA, 400 VA, 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA et 25 kVA pour les **transformateurs** monophasés;
- 630 VA, 1 000 VA, 1 600 VA, 2 500 VA, 4 000 VA, 6 300 VA, 10 kVA, 16 kVA, 25 kVA et 40 kVA pour les **transformateurs** polyphasés.

Un **service intermittent** peut être attribué uniquement aux **transformateurs mobiles** dont la **puissance assignée** ne dépasse pas 6,3 kVA.

Les **transformateurs** sans limitation de la **puissance assignée** doivent faire l'objet d'un accord entre l'acheteur et le fabricant.

6.103 La **fréquence d'alimentation assignée** ne doit pas dépasser 500 Hz.

6.104 La **tension primaire assignée** ne doit pas dépasser 1 000 V en courant alternatif.

6.105 Les **transformateurs** pour **service intermittent** doivent être prévus pour un temps de fonctionnement **assigné** de 5 min "marche" et un temps de repos de 15 min "arrêt".

6.106 Le courant d'alimentation est limité à une valeur maximale de 125 A et, dans le cas d'un câble souple ou d'un socle de prise de courant, de 63 A.

La conformité aux 6.101 à 6.106 est vérifiée par examen du marquage.

7 Classification

L'Article 7 de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

Remplacement:

7.5 Les **transformateurs** sont classés selon le type de service:

- **service permanent**;
- **service intermittent**.

8 Marquage et indications

L'Article 8 de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

8.1 h)

Remplacement du contenu jusqu'au premier point-virgule par le texte suivant:

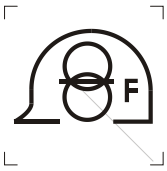
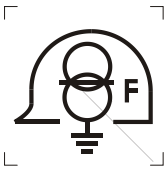
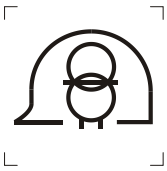
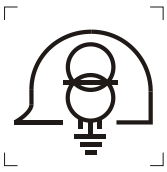
les symboles graphiques correspondants représentés dans le Tableau 101, qui indiquent le type de **transformateur**

8.11

Addition:

Le symbole des **blocs d'alimentation** linéaires doit être utilisé conjointement avec le symbole qui indique le type de **transformateur**.

Tableau 101 – Symboles qui indiquent le type de transformateur

Symbole graphique ou pictogramme	Explication ou titre	Identification
	**Transformateur de séparation des circuits pour chantiers, non dangereux en cas de défaillance**	IEC 60417-6010-1:2007-02
	**Transformateur de sécurité pour chantiers, non dangereux en cas de défaillance**	IEC 60417-6010-2:2007-02
	**Transformateur de séparation des circuits pour chantiers, non dangereux en cas de défaillance**, point milieu ou point étoile mis à la terre	IEC 60417-6010-3:2007-02
	**Transformateur de séparation des circuits pour chantiers**, non résistant aux courts-circuits	IEC 60417-6010-4:2007-02
	**Transformateur de sécurité pour chantiers**, non résistant aux courts-circuits	IEC 60417-6010-5:2007-02
	**Transformateur de séparation des circuits pour chantiers**, non résistant aux courts-circuits, point milieu ou point étoile mis à la terre	IEC 60417-6010-6:2007-02
	**Transformateur de séparation des circuits pour chantiers**, résistant aux courts-circuits (par construction ou par dispositif incorporé)	IEC 60417-6010-7:2007-02