BS EN 61558-2-6:2009

BSI Standards Publication

Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V —

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

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National foreword

This British Standard is the UK implementation of EN 61558-2-6:2009. It is identical to IEC 61558-2-6:2009. It supersedes BS EN 61558-2-6:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/96, Small transformers.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers

(IEC 61558-2-6:2009)

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et produits analogues pour des tensions d'alimentation jusqu'à 1 100 V - Partie 2-6: Règles particulières et essais pour les transformateurs de sécurité et les blocs d'alimentation incorporant des transformateurs de sécurité (CEI 61558-2-6:2009)

Sicherheit von Transformatoren, Drosseln, Netzgeräten und dergleichen für Versorgungsspannungen bis 1 100 V - Teil 2-6: Besondere Anforderungen und Prüfungen an Sicherheitstransformatoren und Netzgeräte, die Sicherheitstransformatoren enthalten (IEC 61558-2-6:2009)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 96/317/FDIS, future edition 2 of IEC 61558-2-6, prepared by IEC TC 96, Transformers, reactors, power supply units and similar products for low voltage up to 1 100 V, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61558-2-6 on 2009-07-01.

This European Standard supersedes EN 61558-2-6:1997.

The main changes consist of updating EN 61558-2-6:1997, in accordance with EN 61558-1:2005, and increasing the supply voltages up to 1 100 V to be in line with the standards of TC 14.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-07-01

This standard is to be used in conjunction with EN 61558-1 and its amendments. It is based on EN 61558-1:2005.

This Part 2-6 supplements or modifies the corresponding clauses in EN 61558-1, so as to convert that publication into the European Standard: *Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers.*

When a particular subclause of Part 1 is not mentioned in this part, that subclause applies as far as is reasonable. Where this standard states "addition", "modification" or "replacement", the relevant text of Part 1 is to be adapted accordingly.

In this part, 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 standard, the words in **bold** are defined in Clause 3.

Subclauses, notes, figures and tables additional to those in Part 1 are numbered starting from 101; supplementary annexes are entitled AA, BB, etc.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61558-2-6:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61558-2-16	NOTE Harmonized as EN 61558-2-16:200X (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

Addition *to Annex ZA of EN 61558-1:*

Publication	Year	Title	EN/HD	Year
IEC 61558-1	2005	Safety of power transformers, power supplies, reactors and similar products - Part 1: General requirements and tests	EN 61558-1 + corr. August	2005 2006

CONTENTS

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

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

1 Scope

Replacement:

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

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

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

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

This part is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry- type transformers.** The windings may be encapsulated or non-encapsulated.

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

The **rated output** does not exceed:

– 10 kVA for single-phase **transformers;**

– 16 kVA for polyphase **transformers.**

This part is applicable to **transformers** without limitation of the **rated output** subject to an agreement between the purchaser and the manufacturer.

NOTE 3 **Transformers** intended to supply distribution networks are not included in the scope.

The **no-load output voltage** or the **rated output voltage** does not exceed 50 V a.c. or 120 V ripple-free d.c.

This part is not applicable to external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

Transformers covered by this part are used in applications where **double or reinforced insulation** between circuits is required by the installation rules or by the end product standard.

NOTE 4 Attention is drawn to the following:

– for **transformers** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) may be necessary;

– measures to protect the **enclosure** and the components inside the enclosure against external influences such as fungus, vermin, termites, solar-radiation, and icing should also be considered;

– the different conditions for transportation, storage, and operation of the **transformers** should also be considered;

– additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers** intended for use in special environments.

NOTE 5 Future technological development of **transformers** may necessitate a need to increase the upper limit of the frequencies, until then this part may be used as a guidance document.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 61558-1 :2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

3 Terms and definitions

This clause of Part 1 is applicable.

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

This clause of Part 1 is applicable except as follows.

Addition:

6.101 The **rated output voltage** shall not exceed 50 V a.c. or 120 V ripple-free d.c.

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

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

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

6.103 The **rated supply frequency** and the **internal operating frequencies** shall not exceed 500 Hz.

6.104 The **rated supply voltage** shall not exceed 1 100 V a.c.

Compliance with the requirements of 6.101 to 6.104 is checked by inspection of the marking.

7 Classification

This clause of Part 1 is applicable.

8 Marking and other information

This clause of Part 1 is applicable except as follows:

8.1 h) *Replacement*:

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

8.11 *Addition:*

Symbol or graphical symbol	Explanation or title	Identification
 F	**Fail-safe safety isolating transformer**	60417-5222
	**Non-short-circuit-proof safety isolating transformer**	60417-5946
	**Short-circuit-proof safety isolating transformer** (inherently or non-inherently)	60417-5947

9 Protection against electric shock

This clause of Part 1 is applicable.

10 Change of input voltage setting

This clause of Part 1 is applicable.

11 Output voltage and output current under load

This clause of Part 1 is applicable.

12 No-load output voltage

This clause of Part 1 is applicable except as follows:

Addition:

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

12.101 The **no-load output voltage** shall not exceed 50 V a.c. or 120 V ripple-free d.c.

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

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

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

The difference is expressed as a percentage of the latter voltage calculated according to the following formula:

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

where $U_{\text{no-load}}$ is the no-load output voltage and U_{load} is the output voltage under load.

*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 shall not exceed the values shown in Table 101.

Table 101 – Output voltage difference

Type of transformer **Rated output** VA	**Difference 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

13 Short-circuit voltage

This clause of Part 1 is applicable.

14 Heating

This clause of Part 1 is applicable.

15 Short-circuit and overload protection

This clause of Part 1 is applicable.

16 Mechanical strength

This clause of Part 1 is applicable.

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

This clause of Part 1 is applicable.

18 Insulation resistance, dielectric strength and leakage current

This clause of Part 1 is applicable.

19 Construction

This clause of Part 1 is applicable except as follows:

Replace 19.1 of Part 1 by the following:

19.1 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.

19.1.1 The insulation between **input** and **output winding(s)** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**) unless the requirements in 19.1.3 are complied with.

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 earth shall consist of at least **basic insulation** rated for the **input voltage**. The insulation between the **output windings** and the **body** connected to earth, 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**), for SELV circuits **basic insulation** only is required.

19.1.2 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 following requirements are applicable:

> **19.1.2.1** for **class I** and **class II transformers**, 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**);

– 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 SELV circuits **basic insulation** only is required;

– for **transformer** different from independent (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**).

19.1.2.2 as alternative to 19.1.2.1 for **class I transformer** not intended to be connected by means of a plug and for **transformer** different from independent (IP00), if the construction assure that all laminated plates of the iron core are connected to earth (e.g by soldering / welding) and if in the data sheet or instruction sheet clearly state that the safety of the **transformer** depends on the earth connection and that is not possible to use in **class II** equipment, than the following apply: the insulation between the **input windings** and the intermediate **conductive part** connected to earth, and between the **output windings** and the intermediate **conductive part** connected to earth, shall consist of at least **basic insulation** (rated for the **input** and **output voltage**);

19.1.2.3 in addition to 19.1.2.1 and 19.1.2.2 the insulation between the intermediate **conductive parts** and the **input windings**, and between the intermediate **conductive parts** and the **output windings** shall consist of at least **basic insulation** (rated for the **input** and **output voltage**). 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).

19.1.3 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 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 For the purpose of this subclause, the term "winding" does not include **internal circuits**

Examples of construction of windings are given in Annex M of Part 1.

19.1.4 There shall be no connection between **output circuits** and the protective earth, unless this is allowed for **associated transformers** by the relevant equipment standard.

19.1.5 There shall be no connection between **output circuits** and the **body,** unless this is allowed for **associated transformers** by the relevant equipment standard.

Compliance is checked by inspection.

19.1.6 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 which shall be of insulating material and permanently fixed to the **transformer**.

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

Addition:

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

19.102 There shall be no connection between the **output circuits** and the **body,** unless - for **associated transformers** - allowed by the relevant equipment standard.

19.103 For **transformers** for connection to the mains by the means of a plug of any type (incorporating or not), the alternative with **basic insulation** plus **protective screening** is not allowed.

20 Components

This clause of Part 1 is applicable.

21 Internal wiring

This clause of Part 1 is applicable.

22 Supply connection and other external flexible cable or cords

This clause of Part 1 is applicable.

23 Terminals for external conductors

This clause of Part 1 is applicable.

24 Provisions for protective earthing

This clause of Part 1 is applicable.

25 Screws and connections

This clause of Part 1 is applicable.

26 Creepage distances, clearances and distances through insulation

This clause of Part 1 is applicable except as follows:

Addition:

26.101 The values for creepage distances, clearances and distances through insulation for working voltages above 1 000 V may be found by extrapolation.

27 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

28 Resistance to rusting

This clause of Part 1 is applicable.

Annexes

The annexes of Part 1 are applicable except as follows:

Annex C

Creepage distances (cr), clearances (cl) and distances through insulation (dti) Material group II (400 ≤CTI <600)

This annex of Part 1 is applicable, except as follows:

Addition:

The values for creepage distances, clearances and distances through insulation for working voltages above 1 000 V may be found by extrapolation.

Annex D

Creepage distances (cr), clearances (cl) and distances through insulation (dti) Material group I (CTI ≥600)

This annex of Part 1 is applicable, except as follows:

Addition:

The values for creepage distances, clearances and distances through insulation for working voltages above 1 000 V may be found by extrapolation.

Annex R

Explanations of the application of 4.2 of IEC 60664-1:2007 (see IEC 61558-1 Subclause 26.2)

This annex of Part 1 is applicable, except as follows:

Addition:

The values for working voltage above 1 000 V may be found by extrapolation.

Bibliography

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

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1 To be published.

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