

BRITISH STANDARD

**BS EN
61558-2-17 :
1998
IEC 61558-2-17 :
1997**

Safety of power transformers, power supply units and similar

Part 2.17 Particular requirements for transformers for switch mode power supplies

The European Standard EN 61558-2-17 : 1997 has the status of a
British Standard

ICS 29.180

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BS EN 61558-2-17 : 1998

National foreword

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The BS EN 61558 series of standards will ultimately supersede BS 3535 : Part 1, dual numbered as BS EN 60742 : 1989, and BS 3535 : Part 2. Until that time arrives, these latter standards are only to be used for equipment not covered by the BS EN 61558 series.

The UK participation in its preparation was entrusted to Technical Committee PEL/96, Small transformers, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 12, an inside back cover and a back cover.

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EUROPEAN STANDARD
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Descriptors: Transformers, electric power supply, protective transformers, isolating transformers, safety requirements, detail specifications, characteristics, ability to withstand short circuit, overload protection, temperature rise, mechanical strength, insulation resistance

English version

Safety of power transformers, power supply units and similar
Part 2-17: Particular requirements for transformers
for switch mode power supplies
(IEC 61558-2-17:1997)

Sécurité des transformateurs, blocs
d'alimentation et analogues
Partie 2-17: Règles particulières pour les
transformateurs pour alimentation à
découpage
(CEI 61558-2-17:1997)

Sicherheit von Transformatoren,
Netzgeräten und dergleichen
Teil 2: Besondere Anforderungen an
Transformatoren für Schaltnetzteile
(IEC 61558-2-17:1997)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 96/52/FDIS, future edition 1 of IEC 61558-2-17, prepared by IEC TC 96, Small power transformers, reactors and power supply units and special transformers, reactors and power supply units: safety requirements, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61558-2-17 on 1997-07-01.

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) 1998-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2002-08-01

For products which have complied with the relevant national standard before 2002-08-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2003-08-01.

This part 2-17 of EN 61558 is to be used in conjunction with EN 61558-1:1997.

This part 2 supplements or modifies the corresponding clauses of EN 61558-1, so as to convert it into the European Standard "Particular requirements for transformers for switch mode power supplies".

When a particular clause or subclause of part 1 is not mentioned in this part 2, that clause or subclause applies as far as is reasonable. Where this part 2 states "addition", "modification" or "replacement", the relevant text of part 1 is to be adapted accordingly.

Subclauses which are additional to those in part 1 are numbered starting from 101.

There are no special national conditions (snc) causing a deviation from this European Standard other than those listed in annex ZA of EN 61558-1.

Endorsement notice

The text of the International Standard IEC 61558-2-17:1997 was approved by CENELEC as a European Standard without any modification.

SAFETY OF POWER TRANSFORMERS, POWER SUPPLY UNITS AND SIMILAR –

Part 2: Particular requirements for transformers for switch mode power supplies

1 Scope

Replacement:

This part 2 of IEC 61558 applies to associated power transformers for **switch mode power supplies**, single-phase or polyphase, air-cooled:

- **separating transformers;**
- **isolating transformers;**
- **safety isolating transformers,**

having a **rated supply voltage** not exceeding 1000 V a.c. and a **rated frequency** of 500 Hz to 1 MHz, the **rated output** not exceeding:

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

NOTE 1 – For higher frequencies, this standard may be used as a guide.

The **no-load output voltage** or the **rated output voltage** do not exceed:

- 1000 V a.c. or 1 415 V ripple-free d.c for **separating transformers;**
- 500 V a.c. or 708 V ripple-free d.c for **isolating transformers.**

NOTE 2 – For **isolating transformers**, the **rated output voltage** may be up to 1000 V a.c. or 1415 V ripple-free d.c. in accordance with the national wiring rules or designed for special purposes.

- 50 V a.c. r.m.s. and/or 120 V ripple-free d.c for **safety isolating transformers.**

This standard is applicable to **dry type transformers**. The windings may be encapsulated or non-encapsulated.

NOTES

3 For transformers filled with liquid dielectric or pulverized material, such as sand, additional requirements are under consideration.

4 In locations where special environmental conditions prevail, particular requirements may be necessary in accordance with IEC 364-5-51.

5 For higher output no-load voltages, additional requirements are necessary but this section may be used as a guide.

2 Normative references

This clause of part 1 is applicable.

3 Definitions

This clause of part 1 is applicable except as follows:

Addition:

3.1.101 switch mode power supply: A power supply incorporating a transformer for which the rated frequency is different from the frequency of the input circuit.

4 General requirements

This clause of part 1 is applicable.

5 General notes on tests

This clause of part 1 is applicable except as follows:

5.2 Addition:

If the tests of 14.101 and of clause 15 are made on a specially prepared specimen, one additional specimen is needed.

5.12 Replacement:

*The transformers for **switch mode power supplies** shall comply with the relevant section of IEC 61558-2 and the conditions under which they are used in the appliance or equipment shall be in accordance with their marking. However, if they are used in an appliance or equipment for which a relevant appliance or equipment standard exists, they may be tested under the conditions present in the appliance or equipment for which they are intended.*

*Consequently a transformer for **switch mode power supply** tested under conditions present in the appliance or equipment for which it is intended has to comply with the following clauses, subclauses or parts thereof, all other clauses, subclauses or parts thereof being considered to be covered by the relevant product standard:*

1 - 2 - 3 - 4 - 5.1 - 5.2 - 5.3 - 5.4 - 5.5 - 5.6 - 5.7 - 5.12 - 7.1 - 7.2 - 7.5 - 8.2 - 8.11 - 14.101 - 18.1 - 18.2 - 18.3 - 19.1 - 19.12 - 20.9 - 26.1 - 26.2 - 26.3 - 26.101 - 26.102 - 26.103 - Annexes A, C, D, G, K, L, M, N, P.

NOTE – Attention is drawn to the fact that if the appliance or equipment standard does not include tests for short-circuit or overload protection of the transformer, relevant tests of clause 15 may have to be made.

6 Ratings

This clause of part 1 is applicable except as follows:

Addition:

6.101 The no-load output voltage shall not exceed:

- 1000 V a.c. or 1415 V ripple-free d.c. for **separating transformers**, for a.c. the preferred values for the **rated output voltage** being: 72 V, 120 V, 230 V, 400 V, 440 V and 660 V;

- 500 V a.c. or 708 V ripple-free d.c. for isolating transformers, for a.c. the preferred values for the **rated output voltage being**: 72 V, 120 V, 230 V, 400 V and 440 V;
- 50 V a.c. and/or 120 V ripple-free d.c. for **safety isolating transformers**, for a.c. the preferred values for the **rated output voltage being**: 6 V, 12 V, 24 V, 42 V and 48 V.

6.102 The **rated output** shall not exceed 10 kVA for single-phase transformers and 16 kVA for polyphase transformers.

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

10 VA, 16 VA, 25 VA, 40 VA, 63 VA, 100 VA, 160 VA, 250 VA, 400 VA, 630 VA, 1000 VA, 1600 VA, 2500 VA, 4000 VA, 6300 VA and 10 000 VA for single-phase transformers;

100 VA, 160 VA, 250 VA, 400 VA, 630 VA, 1000 VA, 1600 VA, 2500 VA, 4000 VA, 6300 VA, 10000 VA and 16 000 VA for polyphase transformers.

6.103 **Rated frequencies** range from 500 Hz to 1 MHz

6.104 The **rated supply voltage** shall not exceed 1000 V a.c.

7 Classification
















This clause of part 1 is applicable.

8 Marking and other information

This clause of part 1 is applicable except as follows:

*
2
*

8.11 Addition:

 F or  F	Fail-safe separating transformer
 or 	Non-short-circuit-proof separating transformer
 or 	Short-circuit-proof separating transformer (inherently or non-inherently)
 F or 	Fail-safe isolating transformer
 or 	Non-short-circuit-proof isolating transformer
 or 	Short-circuit-proof isolating transformer (inherently or non-inherently)
 F	Fail-safe safety isolating transformer
	Non-short-circuit-proof safety isolating transformer
	Short-circuit-proof safety isolating transformer (inherently or non-inherently)

9 Protection against accessibility to hazardous live parts

This clause of part 1 is applicable except as follows:

9.2 Addition before the first paragraph:

- For safety isolating transformers:

Live parts of the output circuit, at a no-load output voltage not exceeding 35 V peak a.c. or 60 V ripple-free d.c., may be accessible in all cases.

Addition of the following new text after the second dash:

- for isolating and safety isolating transformers:
 - parts giving access to live parts which are normally connected to an output circuit, which because of the nature of its use, is accessible, provided that, for no-load output voltages exceeding 35 V peak a.c. or 60 V ripple-free d.c. only one pole becomes accessible.

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:

12.101 The no-load output voltage shall not exceed:

- 1000 V a.c. or 1415 V ripple-free d.c. for **separating transformers**;
- 500 V a.c. or 708 V ripple-free d.c for **isolating transformers**;
- 50 V a.c. and/or 120 V ripple-free d.c. for **safety isolating transformers**,

under any circumstance even when independent output windings which are not intended to be connected in series are connected in series.

13 Short-circuit voltage

This clause of part 1 is applicable.

14 Heating

This clause of part 1 does not apply except as follows:

14.101 For transformers where the switching frequencies are not higher than 40 kHz in general the test methods and the values from table 1 can be used.

NOTE - For transformers in which frequencies are higher than 40 kHz, test methods and values are under consideration.

For transformers where switching frequencies are not higher than 40 kHz an additional thermocouple or equivalent temperature measurement method shall be used to determine the temperature of the insulation material between the windings. In particular, the temperature of the insulation material between input and output windings shall be measured to ensure that the maximum temperature of the classified material is not exceeded by the additional losses caused by high switching frequencies and the voltage wave shapes, which contain even higher harmonics frequencies.

This can be achieved by preparing a special specimen with a thermocouple or equivalent placed in the hottest area in agreement with the manufacturer so that the effect on the normal functioning of the unit is minimized.

NOTE - Care has to be taken that the magnetic behaviour of the thermocouple has no effect on the reading of the temperature.

Compliance is checked by calculation or measurements.

15 Short-circuit and overload protection

This clause of part 1 does not apply except for the cases covered by the note of 5.12 and the following:

15.1 Addition:

The specimen used for tests of clause 14 shall be used also for the tests of this subclause.

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 and electric strength

This clause of part 1 is applicable except as follows:

18.4 This subclause does not apply.

19 Construction

This clause of part 1 is applicable except as follows:

19.1 Replacement:

Applicable for isolating and safety isolating transformers

The input and output circuits of **isolating and safety isolating transformers** 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, through other metal parts.

Compliance is checked by inspection, taking clauses 18, 19 and 26 into consideration.

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

In addition, the following applies:

- for **class I transformers**, the insulation between the input windings and the body shall consist of **basic insulation**, and the insulation between the output windings and the body shall consist of **supplementary insulation**;
- for **class II transformers**, the insulation between the input windings and the body, and between the output windings and the body, shall consist of **double or reinforced insulation**.

19.1.2 For **class I transformers**, where an intermediate metal part (e.g. the iron core) not connected to the body is located between the input and output windings, the insulation between the input and output windings via the intermediate metal part shall consist of **double or reinforced insulation**. For **class II transformers**, the insulation between the input windings and the body and between the output windings and the body via the intermediate metal part, shall consist of **double or reinforced insulation**.

The insulation between the intermediate metal part and the input or output windings shall in both cases consist of at least **basic insulation**.

NOTE – An intermediate part which is separated from one of the windings by double or reinforced insulation is considered as being connected to the other winding.

19.1.3 For **class I transformers** the insulation between the input and output windings may consist of **basic insulation** plus **protective screening** instead of **double or reinforced insulation** provided that 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 one of the windings adjacent to the screen; a wire wound screen shall be wound tight without space between the turns;
- the wire of a wire wound screen and the lead-out wire of the **protective screen** shall have a cross-section at least corresponding to the rated current of the overload device to ensure that, if a breakdown of insulation should occur, the overload device will open the circuit before the lead-out wire is destroyed;
- the lead-out wire shall be soldered to the **protective screen** or fixed in an equally reliable manner.

NOTE – For the purpose of this subclause, the term "windings" does not include internal circuits.

Examples of construction of windings are given in annex M of part 1.

Addition:

19.101 There shall be no connection between the output winding and the body or the protective earthing circuit, if any, unless it is allowed by the relevant equipment standard for **associated transformers**.

19.102 For **isolating** and **safety isolating transformers** the input and output terminals for the connection of external wiring shall be so located that the distance, measured at the point of introduction of the conductor, from input to output clamping units of these terminals is not less than 25 mm. If the distance is achieved by a barrier, this barrier shall be of insulating material and be permanently fixed to the transformer.

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 does not apply.

23 Terminals for external conductors

This clause of part 1 is applicable.

24 Provision 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 Creepage distances, clearances and distances through insulation, shown in table 13, table C.1 and table D.1 are generally applicable for frequencies not exceeding 40 kHz.

NOTE – An increase of the value 40 kHz will be reconsidered.

26.102 Values for frequencies of more than 40 kHz are under consideration. Provisionally values in table 13, table C.1 and table D.1 can be used with a multiplying factor of 1,1.

Box 2 of table 13, table C.1 and table D.1 is not applicable for separating transformers.

Box 1 of table 13, table C.1 and table D.1 is not applicable for isolating and safety isolating transformers.

26.103 When not subjected to any mechanical stress which, at nominal operating temperature, would be likely to lead to deformation or deterioration of the insulating material and provided that they fulfil the test of 14.3, the following values for distances through insulation can be used when the test of 26.2 is carried out:

- for **working voltages** not exceeding 50 V (71 V peak or d.c.), there is no thickness requirement;
- **supplementary insulation** shall have a minimum thickness of 0,4 mm;

– **reinforced insulation** with working voltages not exceeding 600 V shall have a minimum thickness of 0,4 mm.

NOTE – Under mechanical stress conditions, the thickness may have to be increased to comply with the requirements of clauses 4 and 5.

The above requirements are not applicable to insulation in thin sheets form irrespective of their thickness, provided that:

- they are used within the equipment protective enclosure and are not subjected to handling or abrasion during operator servicing;
- for **supplementary insulation**, at least two layers of material are used, of which any one layer will pass the electric strength test for supplementary insulation;
- for **reinforced insulation**, at least three layers of material are used, of which any two layers will pass the electric strength test for reinforced insulation.

27 Resistance to heat, abnormal 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

Material group II

This annex of part 1 is applicable except as follows:

Box 1 of table C.1 is not applicable for isolating and safety isolating transformers.

Box 2 of table C.1 is not applicable for separating transformers.

Annex D

Material group I

This annex of part 1 is applicable except as follows:

Box 1 of table D.1 is not applicable for isolating and safety isolating transformers.

Box 2 of table D.1 is not applicable for separating transformers.

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