

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

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

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et produits analogues pour des tensions d'alimentation jusqu'à 1 100 V –

Partie 2-16: Règles particulières et essais pour les blocs d'alimentation à découpage et les transformateurs pour blocs d'alimentation à découpage



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Email: csc@iec.ch

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00



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CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references.....	8
3 Terms and definitions	9
4 General requirements	9
5 General notes on tests.....	9
6 Ratings.....	9
7 Classification.....	10
8 Marking and other information.....	10
9 Protection against electric shock.....	11
10 Change of input voltage setting.....	12
11 Output voltage and output current under load	12
12 No-load output voltage.....	12
13 Short circuit voltage	13
14 Heating.....	13
15 Short-circuit and overload protection.....	13
16 Mechanical strength.....	14
17 Protection against harmful ingress of dust, solid objects and moisture.....	14
18 Insulation resistance, dielectric strength and leakage current	14
19 Construction	14
20 Components	18
21 Internal wiring	18
22 Supply connection and other external flexible cables or cords.....	19
23 Terminals for external conductors	19
24 Provisions for protective earthing	19
25 Screws and connections	19
26 Creepage distances, clearances and distances through insulation.....	19
27 Resistance to heat, fire and tracking	32
28 Resistance to rusting	32
Annexes.....	33
Annex AA (informative) Partial discharge (PD) test.....	33
Annex BB (normative) Particular requirements for associated transformers for use in switch mode power supplies with internal frequencies > 500 Hz.....	33
Figure 101 – Diagram for dimensioning of clearances.....	20
Figure 102 – Diagram of dimensioning creepage distances.....	24
Figure 103 – Permissible field strength for dimensioning of solid insulation according to Equation (1).....	32
Table 101 – Output voltages ratio.....	13
Table 102 – Values of clearances for frequencies > 30 kHz with approximately homogeneous field condition according to 4.3 of IEC 60664-4	21

Table 103 – Values of clearances for transient overvoltages or recurring peak voltages produced in the primary circuit of the SMPS for frequencies ≤ 30 kHz	22
Table 104 – Minimum values of clearances in air for inhomogeneous field conditions for frequency > 30 kHz	22
Table 105 – Basic or supplementary insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 1)	25
Table 106 – Basic or supplementary insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 2)	26
Table 107 – Basic or supplementary insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 3)	27
Table 108 – Double or reinforced insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 1)	28
Table 109 – Double or reinforced insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 2)	29
Table 110 – Double or reinforced insulation – Minimum values of creepage distances for different frequency ranges (pollution degree 3)	30

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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International Standard IEC 61558-2-16 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and similar products for low voltage up to 1 100 V.

This first edition of IEC 61558-2-16 cancels and replaces IEC 61558-2-17, published in 1997. It constitutes a technical revision.

This part has the status of a group safety publication in accordance with IEC Guide 104 (1997): *The preparation of safety publications and the use of basic safety publications and group safety publications*.

The text of this standard is based on the following documents:

FDIS	Report on voting
96/330/CDV	96/333/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 2-16 is intended to be used in conjunction with the latest edition of IEC 61558-1 and its amendments. It is based on the second edition (2005) of that standard.

This part supplements or modifies the corresponding clauses in IEC 61558-1, so as to convert that publication into the IEC standard: *Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*.

A list of all parts of the IEC 61558 series can be found on the IEC website under the title: *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V*.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months from the date of publication.

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 Scope

Replacement:

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

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

This part applies to:

- switch mode power supply units** incorporating **safety isolating transformers** providing **SELV, PELV** or **FELV** a.c. or d.c. **output voltage(s)**, or a combination thereof according to IEC 61140 and IEC 60364-4-41 for use with household and other consumer products, except for products covered by IEC 60065, IEC 61347 series, IEC 61204-7 and IEC 60950-1;
- switch mode power supply units** with a maximum **output voltage** not exceeding 1 000 V a.c. or 1 414 V ripple-free d.c. for use with household and other consumer products, except for products covered in a) and products covered by IEC 60065, IEC 61347 series, IEC 61204-7 and IEC 60950-1;
- this standard may be used for **transformers** for use in **switch mode power supply units** (see Annex BB).

This part covers the safety requirements for:

- separating SMPS for general use corresponding to Part 2-1;
- isolating SMPS for general use corresponding to Part 2-4;
- safety isolating SMPS for general use corresponding to Part 2-6;
- auto-SMPS for general use corresponding to Part 2-13.

For SMPS for specific application corresponding to the other Parts 2 of 61558 series, the necessary requirements of the relevant Parts 2 are applicable. In addition, the requirements listed in this part apply. Where the two requirements are in conflict, the most severe take precedence.

NOTE 2 As the maximum **rated supply voltage** of the internal **transformer** is 1 000 V, the maximum **rated supply voltage** of the **switch mode power supply** may be lower due to type of rectification.

Switch mode power supply units covered by this standard are air cooled (natural or forced) **independent, associated, stationary, portable**, single-phase, or polyphase, with the **rated supply voltage** not exceeding 1 100 V a.c., the **rated supply frequency** not exceeding 500 Hz, the **rated internal operating frequency** exceeding 500 Hz, but not exceeding 100 MHz, and the **rated output** not exceeding 1 kVA or 1 kW, incorporating **dry-type transformers** with encapsulated or non-encapsulated windings.

Associated transformers for switch mode power supply units covered by Annex BB of this standard shall have a **rated output** not exceeding:

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

NOTE 3 For higher frequencies, additional requirements may be necessary. However, this standard may be used as a guide.

The **no-load output voltage** or the **rated output voltage** of **switch mode power supply units** shall not exceed:

- 1 000 V a.c. or 1 415 V ripple-free d.c. when **separating transformers** or **auto-transformers** are used;
- 500 V a.c. or 708 V ripple-free d.c. when **isolating transformers** are used;
- 50 V a.c. or 120 V ripple-free d.c. when **safety isolating transformers** are used.

The **no-load output voltage** or the **rated output voltage** of **independent switch mode power supply units** shall not be less than:

- 50 V a.c. or 120 V ripple-free d.c. when **separating transformers** or **autotransformers** are used.

This standard is also applicable to **switch mode power supply units**, converters and inverters without limitation of the **rated output**. However, such **switch mode power supply units** are for special applications and are subject to an agreement between the purchaser and the manufacturer.

NOTE 4 In the context of this standard, converters and invertors are considered to be **switch mode power supply units**.

This standard may also be used as a guide for products not covered by the scope of this standard, the scope of IEC 61204-7, or the scope of IEC 61347 series.

This standard does not apply to:

- motor-generator sets;
- uninterruptible power supplies (UPS) according to IEC 62040;
- **switch mode power supply units** covered by IEC 61204-7 (i.e., low-voltage power supply devices, d.c. output, performance characteristics) and d.c. power and distribution equipment and **switch mode power supply units** for use in applications covered by IEC 60950-1, IEC 61010-1, IEC 60601-1, and IEC 60065;
- lamp control gear covered by IEC 61347-1;
- external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

NOTE 5 IEC 61204-7 will be updated by SC 22E.

NOTE 6 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, such as tropical environment.

NOTE 7 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.

Unless otherwise specified, from here onward, the term **SMPS** covers **switch mode power supply units**.

2 Normative references

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

Addition:

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60601-1, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61204-7:2006, *Low voltage power supplies, d.c. output – Part 7: Safety requirements*

IEC 61347 (all parts), *Lamp controlgear*

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

IEC 61558-2-1, *Safety of power transformers, power supplies, reactors and similar products – Part 2-1: Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for general applications*

IEC 61558-2-4, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers*

IEC 61558-2-6, *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 61558-2-13, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-13: Particular requirements and tests for auto transformers and power supply units incorporating auto transformers*

IEC 62040 (all parts), *Uninterruptible power systems (UPS)*