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Full document details: 19/30398821 DC

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 61558-2-16 ED2	
DATE OF CIRCULATION: 2019-08-23	CLOSING DATE FOR VOTING: 2019-11-15
SUPERSEDES DOCUMENTS: 96/481/RR	

IEC TC 96 : TRANSFORMERS, REACTORS, POWER SUPPLY UNITS, AND COMBINATIONS THEREOF	
SECRETARIAT: Germany	SECRETARY: Mr Wolfgang Reichelt
OF INTEREST TO THE FOLLOWING COMMITTEES: SC 3C,TC 14,TC 22,SC 22E,SC 34C,TC 51,TC 55,TC 61,SC 62A,TC 64,TC 66,TC 77,TC 97,TC 106,TC 108,TC 109,TC 111,TC 112	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	
☐ SUBMITTED FOR CENELEC PARALLEL VOTING	☒ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

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

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

The closing date of vote for this document is 2019-11-15. In order for comments to be discussed at the TC 96 MT1 meeting to be held in Shanghai on 23 and 24 October 2019, National Committees are requested to submit their comments early, before 14 October 2019.

The provisional comments will be sent to TC 96 Secretary and MT 1 convenor for preparation of the MT 1 meeting, and subsequently reporting to TC 96 plenary meeting on 25 October 2019.

Please note that the final list of comments would be available after the closing date of vote, as per the usual procedure.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

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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International Standard IEC 61558-2-16 Edition 2 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof.

This second edition cancels and replaces the first edition published in 2009 and Amendment 1:2013. 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 Edition 3
- b) Definitions of different voltage characteristics,
- c) Partial discharge and description of constructions moved in IEC 61558-1,
- d) Alternative method for dimensioning of **clearances**
- e) Removal of requirements for homogeneous field conditions

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

FDIS	Report on voting
96/XX/FDIS	96/XX/RVD

117 Full information on the voting for the approval of this International Standard can be found in
118 the report on voting indicated in the above table.

119 IEC/TC 96 has group safety function in accordance with IEC Guide 104 for transformers other
120 than those intended to supply distribution networks, in particular transformers and power
121 supply units intended to allow the application of protective measures against electric shock as
122 defined by TC 64, but in certain cases including limitation of voltage and horizontal safety
123 function for SELV according to IEC 60364-4-41 of IEC/TC 64

124 The group safety function (GSF) is necessary because of responsibility e.g. for safety extra-
125 low voltage (SELV) according to IEC 61140:2016 Clause 5.2.6 and IEC 60364-4-41:2017
126 Clause 414.3.1 or control circuits according to IEC 60204-1: 2016 Clause 7.2.4.

127 The reason of the needed group safety function for each part of IEC 61558-2 is that different
128 standards of the IEC 61558 series can be combined in one construction but in certain cases
129 with no limitation of rated output power.

130 For example an autotransformer according to IEC 61558-2-13 can be designed with a
131 separate SELV-circuit according to the particular requirements for IEC 61558-2-6 relating to
132 the general requirements of IEC 61558-1.

133 IEC 61558-2-16 has been drafted in accordance with the ISO/IEC Directives, Part 2.

134 IEC 61558-2-16 has the status of a group safety publication in accordance with IEC Guide
135 104.

136 IEC 61558-2-16 is intended to be used in conjunction with the last edition of IEC 61558-1 and
137 its amendments. It is based on the third edition of IEC 61558-1:2017.

138 Note: When "Part 1" is mentioned in this standard, it refers to IEC 61558-1.

139 IEC 61558-2-16 supplements or modifies the corresponding clauses in IEC 61558-1, so as to
140 convert that publication into the IEC standard: *Particular requirements and tests for switch*
141 *mode power supply units and transformers for switch mode power supply units.*

142 A list of all documents of the IEC 61558 series can be found on the IEC website under the
143 title: *Safety of transformers, reactors, power supply units and combinations thereof.*

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

146 Where IEC 61558-2-16 states "addition", "modification" or "replacement", the relevant text of
147 IEC 61558-1 is to be adapted accordingly.

148 In IEC 61558-2-16, the following print types are used:

- 149 – requirements proper: in roman type;
- 150 – *test specifications: in italic type;*
- 151 – explanatory matter: in smaller roman type.

152 In the text of IEC 61558-2-16, the words in **bold** are defined in Clause 3.

153 Subclauses, notes, figures and tables additional to those in IEC 61558-1 are numbered
154 starting from 101; supplementary annexes are entitled AA, BB, etc.

155 The committee has decided that the contents of this document will remain unchanged until the
156 stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related

157 to the specific document. At this date, the document will beThe committee has decided that
158 the contents of this document will remain unchanged until the stability date indicated on the
159 IEC web site under "<http://webstore.iec.ch>" in the data related to the specific document. At
160 this date, the document will be

- 161 • reconfirmed,
162 • withdrawn,
163 • replaced by a revised edition, or
164 • amended.

165

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

1 Scope

Replacement

This document of the IEC 61558 series 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.

IEC 61558-2-16 applies to:

- a) **switch mode power supply units** incorporating **safety isolating transformers** providing **SELV, PELV** or **FELV** AC or DC **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 61347 series, IEC 61204-7, IEC 60065, IEC 60950-1 and IEC 62368 series;
- b) **switch mode power supply units** with a maximum **output voltage** not exceeding 1 000 V AC or 1 415 V ripple-free DC for use with household and other consumer products, except for products covered in a) and products covered by IEC 61347 series, IEC 61204-7, IEC 60065, IEC 60950-1 and IEC 62368 series;
- c) IEC 61558-2-16 can be used for **transformers** for use in **switch mode power supply units** (see Annex BB).

IEC 61558-2-16 covers the safety requirements for:

- **separating SMPS** for general use corresponding to IEC 61558-2-1;
- **isolating SMPS** for general use corresponding to IEC 61558-2-4;
- **safety isolating SMPS** for general use corresponding to IEC 61558-2-6;
- **auto-SMPS** for general use corresponding to IEC 61558-2-13.

For **SMPS** for specific applications corresponding to the other documents of the IEC 61558-2 series, the necessary requirements of the relevant documents of the IEC 61558-2 series are applicable. In addition, the requirements listed in IEC 61558-2-16 apply. Where 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 unit** 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 1 000 V AC, 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.

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

IEC 61558-2-16 is applicable to **switch mode power supply units**, converters and inverters without limitation of the **rated output** subject to an agreement between the purchaser and the manufacturer.

211 NOTE 5 In the context of this standard, converters and invertors are considered to be **switch mode power**
212 **supply units**.

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

215 – 1 000 V AC or 1 415 V ripple-free DC when **separating transformers** or **auto-**
216 **transformers** are used;

217 – 500 V AC or 708 V ripple-free DC when **isolating transformers** are used;

218 – 50 V AC or 120 V ripple-free DC when **safety isolating transformers** are used.

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

221 – 50 V AC or 120 V ripple-free DC when **separating transformers, isolating transformer**
222 **or autotransformers** are used.

223 IEC 61558-2-16 may also be used as a guide for products not covered by the scope of this
224 standard, the scope of IEC 61204-7 or the scope of IEC 61347 series.

225 IEC 61558-2-16 does not apply to:

226 – motor-generator sets;

227 – uninterruptible power supplies (UPS) according to IEC 62040 (Part 1 or series);

228 – **switch mode power supply units** covered by IEC 61204-7 (i.e., low-voltage power supply
229 devices, DC output, performance characteristics) and DC power and distribution
230 equipment and **switch mode power supply units** for use in applications covered by,
231 IEC 61010-1, and IEC 60601-1

232 – light source control gear covered by IEC 61347 series;

233 – external circuits and their components intended to be connected to the input terminals and
234 output terminals of the **switch mode power supply units** and **transformers** for **switch**
235 **mode power supply units**.

236 NOTE 4 IEC 61204-7 will be updated by SC 22E.

237 Attention is drawn to the following:

238 – for **switch mode power supply units** and **transformers** for **switch mode power**
239 **supply units** intended to be used in vehicles, on board ships and aircraft, additional
240 requirements (from other applicable standards, national rules, etc.) may be necessary;

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

244 – the different conditions for transportation, storage, and operation of the **switch mode**
245 **power supply units** and **transformers** for **switch mode power supply units** should also be
246 considered;

247 – additional requirements in accordance with other appropriate standards and national
248 rules may be applicable to **switch mode power supply units** and **transformers** for **switch**
249 **mode power supply units** intended for use in special environments, such as tropical
250 environment.

251 Future technological development of **switch mode power supply units** can necessitate a
252 need to increase the upper limit of the frequencies; until then, IEC 61558-2-16 can be used as
253 a guidance document.

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

256 This group safety publication is primarily intended to be used as a product safety standard for
257 the products mentioned in the scope, but shall also be used by technical committees in the
258 preparation of standards for products similar to those mentioned in the scope of this standard,
259 in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

260 One of the responsibilities of a technical committee is, wherever applicable, to make use of
261 basic safety publications and/or group safety publications in the preparation of its
262 publications.

263 **2 Normative references**

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

265 *Addition*

266 IEC 60601-1:2005, *Medical electrical equipment – Part 1: General requirements for basic*
267 *safety and essential performance*

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

270 IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control,*
271 *and laboratory use – Part 1: General requirements*

272 IEC 61558-2-1:20XX, *Safety of power transformers, power supplies, reactors and*
273 *combinations thereof – Part 2-1: Particular requirements and tests for separating transformers*
274 *and power supplies incorporating separating transformers for general applications*¹

275 IEC 61558-2-4:20XX, *Safety of transformers, reactors, power supply units and combinations*
276 *thereof – Part 2-4: Particular requirements and tests for isolating transformers and power*
277 *supply units incorporating isolating transformers*¹

278 IEC 61558-2-6:20XX, *Safety of transformers, reactors, power supply units and combinations*
279 *thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and*
280 *power supply units incorporating safety isolating transformers*¹

281 IEC 61558-2-13:20XX, *Safety of transformers, reactors, power supply units and combinations*
282 *thereof – Part 2-13: Particular requirements and tests for auto transformers and power supply*
283 *units incorporating auto transformers*¹

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

285

¹ To be published.

3 Terms and definitions

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

Addition

The term **transformer** in Part 1 also designates a **SMPS** as defined in this document.

In Annex BB of this standard, the term **transformer** applies to a **transformer** for **SMPS**.

Replacement

3.3.8

working voltage

highest RMS value of the AC or DC voltage which may occur (locally) across any insulation at **rated supply voltage** under no-load or normal operating conditions, transients being disregarded. The **working voltage** between any point in the circuit supplied by electrical power sources and other isolated parts shall be assumed:

- the **rated supply voltage**, or
- the measured **working voltage**

whichever is greater.

NOTE 1 When considering the insulation system between windings not intended to be connected together, the **working voltage** is considered to be the highest voltage occurring on any of these windings.

NOTE 2 On three phase systems, the **working voltage** can be different from the nominal voltage.

Addition

3.5.101

peak working voltage

peak value of the **working voltage**, including any DC component and any repetitive peak impulses generated in the SMPS

[SOURCE: IEC 60050-903:2014, 903-04-02, modified – “equipment by SMPS” replaced]

NOTE Details about **peak working voltages** can be found in IEC 60664-1:2007 Figure 1.

Addition

3.5.102

rated impulse voltage

impulse withstand voltage value assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages

[SOURCE: IEC 60664-1:2007, 3.9.2]

3.7.101

inhomogeneous electric field

electric field which does not have an essentially constant voltage gradient between electrodes (non-uniform field)

NOTE The inhomogeneous field condition of a point-plane electrode configuration is the worst case with regard to voltage withstand capability and is referred to as case A in IEC 60664-1:2007. It is represented by a point electrode having a 30 µm radius and a plane of 1 m × 1 m.

NOTE For frequencies exceeding 30 kHz, the field is considered to be inhomogeneous when the radius of curvature of the conductive parts is less than 20 % of the clearance