IEC 61558-2-9

Edition 3.0 2024-06
EXTENDED VERSION

INTERNATIONAL STANDARD

colour inside

This extended version of IEC 61558-2-9:2024 includes the content of the references made to IEC 61558-1:2017

GROUP ENERGY EFFICIENCY PUBLICATION

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.180

ISBN 978-2-8322-9129-0

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 9
INTRODUCTION to IEC 61558-1:2017 12
INTRODUCTION to IEC 61558-2-9:2024 14
1 Scope 15
2 Normative references 16
3 Terms and definitions 19
3.1 Transformers 19
3.2 General terms 23
3.3 Operations and protections 24
3.4 Circuits and windings 26
3.5 Ratings 27
3.6 No-load values 29
3.7 Insulation 29
3.8 Touch current and protective earthing conductor current 33
4 General requirements 33
5 General notes on tests 34
6 Ratings 36
7 Classification 36
8 Marking and other information 37
9 Protection against electric shock 44
9.1 General 44
9.2 Protection against contact with hazardous-live-parts 44
9.2.1 Determination of hazardous-live-parts 44
9.2.2 Accessibility to hazardous-live-parts 45
9.2.3 Accessibility to non hazardous-live-part 48
9.3 Protection against hazardous electrical discharge 48
10 Change of input voltage setting 48
11 Output voltage and output current under load 49
12 No-load output voltage 49
13 Short-circuit voltage 50
14 Heating 51
14.1 General requirements 51
14.1.1 Temperature-rise test 51
14.1.2 Alternative temperature-rise test 53
14.1.3 Determination of steady-state conditions 55
14.2 Application of 14.1 or 14.3 according to the insulation system 57
14.3 Accelerated ageing test for undeclared class of insulation system 57
14.3.1 General 57
14.3.2 Heat run 58
14.3.3 Vibration 58
14.3.4 Moisture treatment 58
14.3.5 Measurements 58
15 Short circuit and overload protection 59
15.1 General requirements 59
15.1.1 Short circuit and overload test method 59

15.1.2 Alternative short circuit and overload test method 61
15.2 Inherently short-circuit proof transformers 61
15.3 Non-inherently short-circuit proof transformers 61
15.4 Non-short-circuit proof transformers 62
15.5 Fail-safe transformers 62
16 Mechanical strength 63
16.1 General 63
16.2 Stationary transformers 63
16.3 Portable transformers (except portable transformers with integral pins for introduction in socket-outlet in the fixed wiring) 64
16.4 Portable transformers provided with integral pins for introduction in socket-outlets of the fixed wiring 64
16.4.1 General requirements 64
16.4.2 Portable transformers provided with integral pins according to EN 50075 (IEC plug type C) for introduction in socket-outlets of the fixed wiring 65
16.5 Additional requirements for transformers to be used in vehicles and railway applications 66
16.5.1 Transformers to be used in vehicles and railway applications 66
16.5.2 Test requirements for the transportation of transformers 67
17 Protection against harmful ingress of dust, solid objects and moisture 68
17.1 Degrees of protection provided by enclosures (IP code) 68
17.1.1 General requirements 68
17.1.2 Tests on transformers with enclosure 69
17.2 Humidity treatment 71
18 Insulation resistance, dielectric strength and leakage current 72
18.1 General 72
18.2 Insulation resistance 72
18.3 Dielectric strength test 73
18.4 Insulation between and within windings 75
18.5 Touch current and protective earthing conductor current 75
18.5.1 General 75
18.5.2 Touch current 76
18.5.3 Protective earthing conductor current 77
19 Construction 77
19.1 General construction 77
19.2 Flammability of materials 79
19.3 Short-circuit characteristics of portable transformers 79
19.4 Class II transformer contact prevention of accessible conductive parts 79
19.5 Class II transformer insulation reassembling after service 80
19.6 Loosening of wires, screws or similar parts 80
19.7 Resistor or capacitor connection with accessible conductive parts 80
19.8 Bridging of separated conductive parts by resistors or capacitors 81
19.9 Insulating material separating input and output windings 81
19.10 Accidental contact protection against hazardous-live-parts provided by isolating coating 82
19.11 Insulating material of handles, operating levers, knobs and similar parts 83
19.12 Winding construction 83
19.13 Fixing of handles, operating levers and similar parts 87
19.14 Fixing of covers providing protection against electric shock 87

19.15 Strain on fixed socket-outlets caused by pin-transformers connection 87
19.16 Portable transformers for use in irregular or harsh conditions 87
19.17 Drain hole of transformers protected against ingress of water 87
19.18 Plug connected transformers protected against ingress of water 87
19.19 Flexible cable or flexible cord connection for class I portable transformers 88
19.20 SELV- and PELV-circuit separation of live parts 88
19.21 Protection against contact for FELV-circuit 88
19.22 Protective earthing regarding class II transformers 89
19.23 Protective earthing regarding class III transformers 89
20 Components 89
21 Internal wiring 94
22 Supply connection and other external flexible cables or cords 95
23 Terminals for external conductors 102
24 Provisions for protective earthing 103
25 Screws and connections 105
26 Creepage distances, clearances and distances through insulation 107
26.1 General 107
26.2 Creepage distances and clearances 108
26.2.1 General 108
26.2.2 Windings covered with adhesive tape 108
26.2.3 Uncemented insulationing parts 108
26.2.4 Cemented insulating parts 108
26.2.5 Enclosed parts (e.g. by impregnation or potting) 109
26.3 Distance through insulation 110
27 Resistance to heat, fire and tracking 121
27.1 General 121
27.2 Resistance to heat 121
27.2.1 General 121
27.2.2 External accessible parts 121
27.2.3 Internal parts 122
27.3 Resistance to abnormal heat under fault conditions 122
27.4 Resistance to fire 123
27.4.1 General 123
27.4.2 External accessible parts 124
27.4.3 Internal parts 124
27.5 Resistance to tracking 125
28 Resistance to rusting 125
Annex A (normative) Measurement of creepage distances and clearances 126
Annex B (normative) Testing a series of transformers 130
B.1 General 130
B.2 Requirements 130
B.3 Constructional inspection 131
Annex C (void) 132
Annex D (void) 133
Annex E (normative) Glow-wire test 134
E.1 General 134
E.2 Severity 134

E.3 Conditioning 134
E.4 Test procedure 134
Annex F (normative) Requirements for manually operated switches which are parts of transformers assembly 135
F.1 General 135
F.2 Switches tested as a separate component 135
F.3 Switches tested as part of the transformer 135
Annex G (normative) Tracking test 138
G.1 General 138
G.2 Test specimen 138
G.3 Test apparatus 138
G.4 Procedure 138
Annex H (normative) Electronic circuits 139
H.1 General 139
H.2 General notes on tests (addition to Clause 5) 139
H.3 Short circuit and overload protection (addition to Clause 15) 139
H.4 Creepage distances, clearances and distances through insulation (addition to Clause 26) 141
Annex I (informative) Dimensions for rectangular cross-section connectors of transformers, basic dimensions and coordination 143
Annex J (normative) Measuring network for touch-currents 145
Annex K (normative) Insulated winding wires 146
K.1 General 146
K.2 Type tests 146
K.2.1 General 146
K.2.2 Dielectric strength test 146
K.2.3 Flexibility and adherence 146
K.2.4 Heat shock 147
K.2.5 Retention of dielectric strength after bending 147
K.3 Testing during manufacturing 148
K.3.1 General 148
K.3.2 Routine test 148
K.3.3 Sampling test 148
Annex L (normative) Routine tests (production tests) 149
L.1 General 149
L.2 Protective earthing continuity test 149
L.3 Checking of no-load output voltage 149
L.4 Dielectric strength test 149
L.5 Checking of protective devices mounting 150
L.6 Visual inspection 150
L.7 Repetition test after routine dielectric strength test 150
Annex M (informative) Examples to be used as a guide for 19.1 151
M.1 General 151
M.2 Coil-former 151
M.2.1 Concentric type 151
M.2.2 Side-by-side type 152
M.3 Windings 152
M.3.1 Without screen 152

M.3.2 With screen 153
Annex N (informative) Examples for checking points of dielectric strength test voltages 154
Annex O (void) 156
Annex P (informative) Examples for measurement points of creepage distances and clearances 157
Annex Q (informative) Explanation of IP numbers for degrees of protection 160
Q.1 General 160
Q.2 Degrees of protection against access to hazardous parts and against solid foreign objects 160
Q.3 Degrees of protection against ingress of water 162
Annex R (normative) Explanations of the application of 6.1.2.2.1 of IEC 60664-1:2007 163
R.1 Impulse dielectric test 163
R.2 Example 163
Annex S (void) 165
Annex T (void) 166
Annex U (void) 167
Annex V (informative) Symbols to be used for thermal cut-outs 168
V.1 General 168
V.2 Non-self-resetting thermal cut-out (see 3.3.4) 168
V.3 Self-resetting thermal cut-out (see 3.3.3) 168
Annex W (normative) Coated printed circuit boards 169
W.1 Preamble 169
W.2 General 169
W.3 Cold 169
W.4 Rapid change of temperature 169
W.5 Additional tests 169
Bibliography 170
Index of defined terms 172

Figure 1 – IEC 61558 principle 13
Figure 2 – Mounting box for flush-type transformer 35
Figure 3 – Test pin (see IEC 61032, test probe 13) 46
Figure 4 – Standard test finger (see IEC 61032, test probe B) 47
Figure 5 – Example of back-to-back method – Single phase 55
Figure 6 – Example of back-to-back method – Three phase 55
Figure 7 – Amplitude spectrum density for random testing 67
Figure 8 – Normalised spectrum of shock 68
Figure 9 – Test voltage sequence 75
Figure 10 – Test configuration: single-phase equipment on star TN or TT system 77
Figure 11 – Abrasion resistance test for insulating coated layers 82
Figure 12 – Flexing test apparatus 99
Figure 13 – Test arrangement for checking mechanical withstanding of insulating materials in thin sheet layers 113
Figure 14 – Ball-pressure apparatus 121
Figure A.1 – Example 1 126
Figure A.2 – Example 2 127

Figure A.3 – Example 3 127
Figure A.4 – Example 4 127
Figure A.5 – Example 5 128
Figure A.6 – Example 6 128
Figure A.7 – Example 7 129
Figure A.8 – Example 8 129
Figure H.1 – Example of an electronic circuit with low-power points 142
Figure J.1 – Measuring network for touch-current 145
Figure M.1 – Examples for concentric type constructions 151
Figure M.2 – Examples for side-by-side type constructions 152
Figure M.3 – Examples for winding constructions without screen 152
Figure M.4 – Examples for wrapped winding constructions 153
Figure M.5 – Examples for winding constructions with screen 153
Figure N.1 – Transformer of class I construction with metal enclosure 154
Figure N.2 – Transformer of class II construction with metal enclosure 155
Figure N.3 – Transformer of class II construction with enclosure of insulating material 155
Figure P.1 – Transformer of class I construction 157
Figure P.2 – Transformer of class I construction with earthed metal screen 158
Figure P.3 – Transformer of class II construction with metal enclosure 158
Figure P.4 – Transformer of class II construction with enclosure of insulating material 159
Figure V.1 – Restored by manual operation 168
Figure V.2 – Restored by disconnection of the supply 168
Figure V.3 – Thermal link (see 3.3.5) 168
Figure V.4 – Self-resetting thermal cut-out 168

Table 1 – Symbols used on equipment or in instructions 41
Table 101 – Symbols indicating the kind of transformer 42
Table 102 – Output voltage ratio 50
Table 2 – Values of maximum temperatures in normal use 56
Table 3 – Explanation of the maximum winding temperatures required in Table 2 57
Table 4 – Test temperature and testing time (in days) per cycle 58
Table 5 – Maximum values of temperatures under short-circuit or overload conditions 60
Table 6 – Values of T and k for fuses 61
Table 7 – Pull force on pins 65
Table 8 – Conditions for vibration testing (random) 66
Table 9 – Amplitude spectrum density ASD values for accelerated life testing 66
Table 10 – Frequency values depending on the weight of the specimen 67
Table 11 – Excitation values for vibration testing 67
Table 12 – Solid-object-proof transformer test 70
Table 13 – Values of insulation resistance 73
Table 14 – Table of dielectric strength test voltages 74
Table 15 – Limits for currents 77
Table 16 – Nominal cross-sectional areas of external flexible cables or cords 97

Table 17 – Pull and torque to be applied to external flexible cables or cords fixed to stationary and portable transformers 101
Table 18 – Torque to be applied to screws and connections 106
Table 19 – Torque test on glands 107
Table 20 – Clearances in mm 114
Table 21 – Creepage distances in mm 115
Table 22 – Distance through insulation in mm 116
Table 23 – Creepage distances and clearance between terminals for external connection 117
Table 24 – Values of FIW wires with minimum overall diameter and minimum test voltages according to the total enamel increase 119
Table A.1 – Width of groove values depending on the pollution degree 126
Table F.1 – Peak surge current of additional loads 136
Table I.1 – Dimensions of rectangular copper connectors 143
Table K.1 – Mandrel diameter 147
Table K.2 – Oven temperature 147
Table Q.1 – Degrees of protection against access to hazardous parts indicated by the first characteristic numeral 161
Table Q.2 – Degrees of protection against solid foreign objects indicated by the first characteristic numeral 161
Table Q.3 – Degrees of protection indicated by the second characteristic numeral 162
Table R.1 – Impulse test voltage according to 6.1.2.2.1 of IEC 60664-1:2007 163

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

This extended version (EXV) of the official IEC Standard provides the user with the comprehensive content of the Standard.

IEC 61558-2-9:2024 EXV includes the content of IEC 61558-2-9:2024, and the references made to IEC 61558-1:2017.

The specific content of IEC 61558-2-9:2024 is displayed on a blue background.

IEC 61558-2-9 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) addition of a new symbol for power supply unit with linearly regulated output voltage;
c) document is not only valid for transformers for tungsten filament handlamps.

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

Draft	Report on voting
96/593/FDIS	96/597/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 document 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 document 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 class III handlamps.*

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 adopted 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 to IEC 61558-1:2017

This document covers safety requirements for **transformers**. Where the term **transformer** is used, it covers **transformers**, **reactors** and **power supply units** where applicable.

During the development of this document, to the extent possible, the requirements of IEC 60364 (all parts) were taken into consideration, so that a **transformer** can be installed in accordance with the wiring rules contained in that document. However, national wiring rules can differ.

This document recognizes the internationally accepted levels of protection against the possible electrical, mechanical, and fire hazards caused by **transformers** operating under normal conditions in accordance with the manufacturer's instructions. It also covers abnormal conditions which can occur in practice.

A **transformer** complying with this document will not necessarily be judged to comply with the safety principles of this document if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

A **transformer** employing materials or having forms of construction differing from those detailed in this document may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the safety principles of this document.

The document dealing with non-safety aspects of electromagnetic compatibility (EMC) of **transformers** is IEC 62041. However, that document also includes tests that can subject the **transformer** to conditions involving safety aspects.

The objective of of IEC 61558-1 is to provide a set of requirements and tests considered to be generally applicable to most types of **transformers**, and which can be called up as required by the relevant part of IEC 61558-2. IEC 61558-1 is thus not to be regarded as a specification by itself for any type of **transformer**, and its provisions apply only to particular types of **transformers** to the extent determined by the appropriate part of IEC 61558-2. IEC 61558-1 also contains normative routine tests.

Each part of IEC 61558-2 in conjunction with this document contains all the necessary requirements for the **transformer** being covered and does not contain references to other parts of IEC 61558-2. For **transformers** with a protection index IP00 and associated **transformers**, it is possible to have circuits corresponding to different parts of IEC 61558-2 within the same construction (e.g. SELV output circuit according to IEC 61558-2-6 and a 230 V output circuit according to IEC 61558-2-4). However, if the **transformer** is covered by different parts IEC 61558-2, to the extent reasonable, the relevant part of IEC 61558-2 is applied to each function/application separately. If applicable, the effect of one function on the other is taken into consideration.

If an appropriate part of IEC 61558-2 does not exist for a particular **transformer** or group of **transformer**s, the nearest applicable part may be used as a guide to the requirements and tests.

However, individual countries may wish to consider its application, to the extent reasonable, to transformers not mentioned in the IEC 61558-2 series, and to transformers designed on new principles.

Where the requirements of any of the clauses of a part of IEC 61558-2 refer to IEC 61558-1 by the phrase "This clause of Part 1 is applicable", this phrase means that all the requirements of that clause of IEC 61558-1 are applicable, except those requirements that are clearly not applicable to the particular type of **transformer** covered by that part of IEC 61558-2.

The principle for the preparation of the different parts of IEC 61558-2 is as shown in Figure 1.

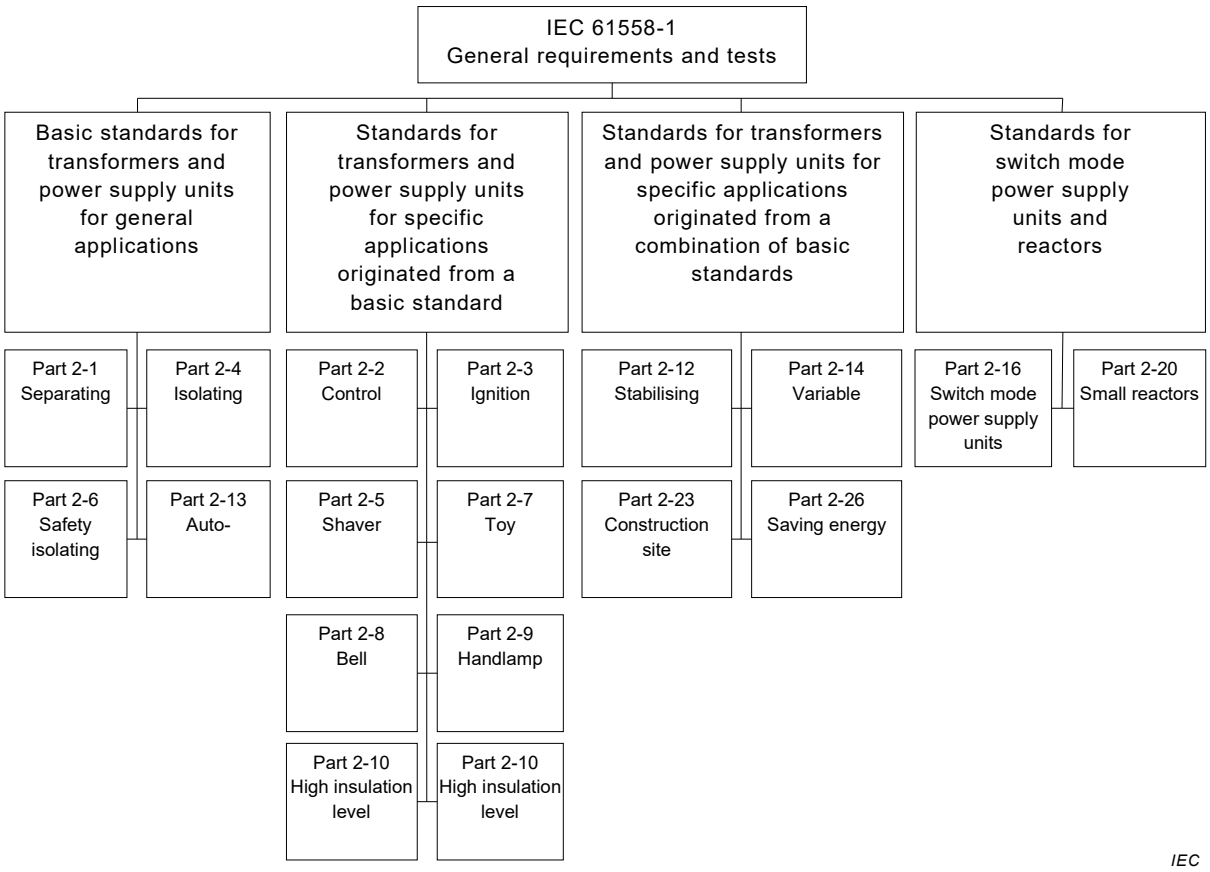


Figure 1 – IEC 61558 principle

Relevant clauses of this document (e.g. clauses dealing with thermal endurance test for windings) apply also to **transformers** forming an integral part of an appliance and which cannot be tested separately.

The IEC 61558 series consists of the following parts, under the general title *Safety of transformers, reactors, power supply units and combination thereof:*[1]

Part 1: General requirements and tests

Part 2-1: Particular requirements and tests for separating transformers for general applications

Part 2-2: Particular requirements and tests for control transformers

Part 2-3: Particular requirements and tests for ignition transformers for gas and oil burners

Part 2-4: Particular requirements and tests for isolating transformers

Part 2-5: Particular requirements and tests for shaver transformers and shaver supply units

Part 2-6: Particular requirements and tests for safety isolating transformers

Part 2-7: Particular requirements and tests for transformers for toys

Part 2-8: Particular requirements and tests for transformers for bells and chimes

Part 2-9: Particular requirements and tests for transformers for class III handlamps for tungsten filament lamps

[1] Some of the parts of this series published earlier appeared under the general title *Safety of power transformers, power supplies, reactors and similar products or Safety of power transformers, power supply units and similar or Safety of power transformers, power supply units and similar devices*. Future editions of these parts will be issued under the new general title indicated above.

Part 2-10: Particular requirements and tests for separating transformers with high insulation level and separating transformers with output voltages exceeding 1 000 V

Part 2-12: Particular requirements and tests for constant voltage transformers

Part 2-13: Particular requirements and tests for auto transformers

Part 2-14: Particular requirements and tests for variable transformers

Part 2-15: Particular requirements and tests for isolating transformers for the supply of medical locations

Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units

Part 2-20: Particular requirements and tests for small reactors

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

Part 2-26: Particular requirements and tests for transformers and power supply units all for saving energy and other purposes

Other parts are under consideration.

INTRODUCTION to IEC 61558-2-9:2024

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 example 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 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

1 Scope

This part of IEC 61558 deals with the safety of **transformers for class III handlamps** and **power supply units incorporating transformers for class III handlamps**. **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 class III handlamps** and **power supply units incorporating transformers for class III handlamps**.

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.

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

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.

Transformers have the following additional characteristics:

– **the no-load output voltage** and the **rated output voltage** do not exceed 50 V AC or 120 V ripple-free DC;
– there is only a small difference between the **no-load output voltage** and the **rated output voltage**.

The **rated output** does not exceed 10 kVA.

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

NOTE 2 **Transformers** covered by this document are only used in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

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.

Future technological development of **transformers** can necessitate a need to increase the upper limit of the frequencies. Until then this document can 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

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60065:2014, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test FC: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60076-1, *Power transformers – Part 1: General*

IEC 60076-11:2004, *Power transformers – Part 11: Dry-type transformers*

IEC TR 60083, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60127 (all parts), *Miniature fuses*

IEC 60127-3, *Miniature fuses – Part 3: Sub-miniature fuse-links*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

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

IEC 60227-5:2011, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 5: Flexible cables (cords)*

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

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

IEC 60269 (all parts), *Low voltage fuses*

IEC 60269-2:2013, *Low voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to K*

IEC 60269-3:2010, *Low voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household or similar applications) – Examples of standardized systems of fuses A to F*

IEC 60309 (all parts), *Plugs, socket-outlets and couplers for industrial purposes*

IEC 60317 (all parts), *Specifications for particular types of windings wires*

IEC 60317-0-7:2012, *Specifications for particular types of winding wires – Part 0-7: General requirements – Fully insulated (FIW) zero-defect enamelled round copper wire with nominal conductor diameter of 0,040 mm to 1,600 mm*

IEC 60317-56, *Specifications for particular types of winding wires – Part 56: Solderable fully insulated (FIW) zero-defect polyurethane enamelled round copper wire with nominal conductor diameter 0,040 mm to 1,600 mm, class 180*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60320-2-3, *Appliance couplers for household and similar general purposes – Part 2-3: Appliance couplers with a degree of protection higher than IPX0*

IEC 60384-14:2013, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60417*, Grapahical symbols for use on equipment*
(available at http://www.graphical-symbols.info/equipment)

IEC 60454 (all parts), *Pressure-sensitive adhesive tapes for electrical purposes*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60664-1:2007, *Insulation coordination for equipment within low voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60691:2015, *Thermal-links – Requirements and application guide*

IEC 60695-2-10:2013, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2014, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60730 (all parts), *Automatic electrical controls*

IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*

IEC 60851-3:2009, *Winding wires – Test methods: Part 3: Mechanical properties*

IEC 60851-5:2008, *Winding wires – Test methods: Part 5: Electrical properties*

IEC 60851-6:2012, *Winding wires – Test methods: Part 6: Thermal properties*

IEC 60884-1:2002, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*
IEC 60884-1:2002/AMD1:2006
IEC 60884-1:2002/AMD2:2013

IEC 60884-2-4, *Plugs and socket-outlets for household and similar purposes – Part 2-4: Particular requirements for plugs and socket-outlets for SELV*

IEC 60898 (all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60906-1, *IEC system of plugs and socket-outlets for household and similar purposes – Part 1: Plugs and socket-outlets 16 A 250 V a.c.*

IEC 60906-3, *IEC system of plugs and socket-outlets for household and similar purposes – Part 3: SELV plugs and socket-outlets, 16 A 6 V, 12 V, 24 V, 48 V, a.c. and d.c.*

IEC 60947-7-1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

IEC 60998-2-1, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-1: Particular requirements for connecting devices as separate entities with screw-type clamping units*

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61058-1:2016, *Switches for appliances – Part 1: General requirements*

IEC 61058-1-1:2016, *Switches for appliances – Part 1-1: Requirements for mechanical switches*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC 61558-1:2017, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

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*

ISO 8820 (all parts), *Road vehicles – Fuse-links*

EN 50075:1990*, Specification for flat non-wirable two-pole plugs 2.5 A 250 V, with cord, for the connection of class II-equipment for household and similar purposes*

DIN 43671:1975*, Copper bus bars; design for continuous current*

DIN 43670:1975*, Aluminium bus bars; design for continuous current*

DIN 43670-2:1985*, Aluminium bus bars copper cladding; design for continuous current*

IEC 61558-2-9

Edition 3.0 2024-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP ENERGY EFFICIENCY PUBLICATION
PUBLICATION GROUPÉE SUR L'EFFICACITÉ ÉNERGÉTIQUE

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments –
Partie 2-9: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour lampes baladeuses de classe III



IEC 61558-2-9:2024-06(en-fr)

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 7
3 Terms and definitions 7
4 General requirements 8
5 General notes on tests 8
6 Ratings 8
7 Classification 8
8 Marking and other information 9
9 Protection against electric shock 10
10 Change of input voltage setting 10
11 Output voltage and output current under load 10
12 No-load output voltage 10
13 Short-circuit voltage 11
14 Heating 11
15 Short-circuit and overload protection 11
16 Mechanical strength 11
17 Protection against harmful ingress of dust, solid objects and moisture 11
18 Insulation resistance, dielectric strength and leakage current 11
19 Construction 12
20 Components 14
21 Internal wiring 14
22 Supply connection and other external flexible cables or cords 14
23 Terminals for external conductors 14
24 Provisions for protective earthing 14
25 Screws and connections 14
26 Creepage distances, clearances and distances through insulation 14
27 Resistance to heat, fire and tracking 15
28 Resistance to rusting 15
Annexes 16
Bibliography 17

Table 101 – Symbols indicating the kind of transformer 9
Table 102 – Output voltage ratio 11

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61558-2-9 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) addition of a new symbol for power supply unit with linearly regulated output voltage;
c) document is not only valid for transformers for tungsten filament handlamps.

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

Draft	Report on voting
96/593/FDIS	96/597/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 document 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 document 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 class III handlamps.*

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 adopted 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 example 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 2-9: Particular requirements and tests for transformers and power supply units for class III handlamps

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **transformers for class III handlamps** and **power supply units incorporating transformers for class III handlamps**. **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 class III handlamps** and **power supply units incorporating transformers for class III handlamps**.

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.

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

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.

Transformers have the following additional characteristics:

– **the no-load output voltage** and the **rated output voltage** do not exceed 50 V AC or 120 V ripple-free DC;
– there is only a small difference between the **no-load output voltage** and the **rated output voltage**.

The **rated output** does not exceed 10 kVA.

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

NOTE 2 **Transformers** covered by this document are only used in applications where **double** or **reinforced insulation** between circuits is required by the installation rules or by the end product standard.

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.

Future technological development of **transformers** can necessitate a need to increase the upper limit of the frequencies. Until then this document can 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 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*

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*

SOMMAIRE

AVANT-PROPOS 19
INTRODUCTION 22
1 Domaine d'application 23
2 Références normatives 24
3 Termes et définitions 24
4 Exigences générales 25
5 Généralités sur les essais 25
6 Caractéristiques assignées 25
7 Classification 26
8 Marquage et autres indications 26
9 Protection contre les chocs électriques 27
10 Changement de la tension primaire d'alimentation 27
11 Tension secondaire et courant secondaire en charge 27
12 Tension secondaire à vide 28
13 Tension de court-circuit 28
14 Échauffements 28
15 Protection contre les courts-circuits et les surcharges 29
16 Résistance mécanique 29
17 Protection contre les effets nuisibles dus à la pénétration de poussière, d'objets solides et de l'humidité 29
18 Résistance d'isolement, rigidité diélectrique et courant de fuite 29
19 Construction 29
20 Composants 31
21 Conducteurs internes 31
22 Raccordement à l'alimentation et câbles souples externes 32
23 Bornes pour conducteurs externes 32
24 Dispositions en vue de la mise à la terre de protection 32
25 Vis et connexions 32
26 Lignes de fuite, distances d'isolement et distances à travers l'isolation 32
27 Résistance à la chaleur, au feu et aux courants de cheminement 32
28 Protection contre la rouille 32
Annexes 33
Bibliographie 34

Tableau 101 – Symboles qui indiquent le type de transformateur 27
Tableau 102 – Rapport de la tension secondaire 28

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

_____

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

Partie 2-9: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour lampes baladeuses de classe III

AVANT-PROPOS

1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'IEC attire l'attention sur le fait que la mise en application du présent document peut entraîner l'utilisation d'un ou de plusieurs brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à l'applicabilité de tout droit de brevet revendiqué à cet égard. À la date de publication du présent document, l'IEC n'avait pas reçu notification qu'un ou plusieurs brevets pouvaient être nécessaires à sa mise en application. Toutefois, il y a lieu d'avertir les responsables de la mise en application du présent document que des informations plus récentes sont susceptibles de figurer dans la base de données de brevets, disponible à l'adresse https://patents.iec.ch. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 61558-2-9 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;
c) le document ne s'applique pas seulement aux transformateurs pour lampes baladeuses à filament de tungstène.

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

Projet	Rapport on vote
96/593/FDIS	96/597/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 ce document est l'anglais.

Le présent 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 d'une publication groupée de sécurité conformément au Guide IEC 104.

Le présent document doit être utilisé 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 blocs d'alimentation pour lampes baladeuses de classe III.*

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 des 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 pour les transformateurs autres que ceux destinés à alimenter les réseaux de distribution, en particulier les transformateurs et les blocs d'alimentation destinés à permettre l'application de mesures de protection contre les chocs électriques telles que définies par le CE 64, qui traite des Installations électriques et de la protection contre les chocs électriques, mais, dans certains cas, comprenant la limitation de tension, ainsi qu'une fonction horizontale de sécurité pour les très basses tensions de sécurité (TBTS), conformément à l'IEC 60364-4-41.

La fonction groupée de sécurité (GSF, *Group Safety Function*) est utilisée en raison, par exemple, 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 2-9: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour lampes baladeuses de classe III

1 Domaine d'application

Remplacement:

La présente partie de l'IEC 61558 traite de la sécurité des **transformateurs pour lampes baladeuses de classe III** et des **blocs d'alimentation qui incorporent des transformateurs pour lampes baladeuses de classe III**. 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 lampes baladeuses de classe III** et les **blocs d'alimentation qui incorporent des transformateurs pour lampes baladeuses de classe III**.

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.

Le présent document s'applique aux **transformateurs** de **type sec fixes** ou **mobiles**, monophasés, à refroidissement par air (naturel ou forcé) **indépendants** ou **associés**. Les enroulements peuvent être enrobés ou non enrobés.

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.

Les **transformateurs** présentent les caractéristiques supplémentaires suivantes:

– la **tension secondaire à vide** et la **tension secondaire assignée** ne dépasse pas 50 V en courant alternatif ou 120 V en courant continu lissé;

– il n'existe qu'une faible différence entre la **tension secondaire à vide** et la **tension secondaire assignée**.

La **puissance assignée** ne dépasse pas 10 kVA.

Le présent document ne s'applique pas aux circuits externes et à leurs composants destinés à être connectés aux bornes primaires et bornes secondaires des **transformateurs**.

NOTE 2 Les **transformateurs** couverts par le présent document ne sont utilisés que dans le cadre d'applications pour lesquelles les règles d'installation ou la norme du produit final exigent une **isolation double** ou **renforcée** entre les circuits.

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 ou 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.

Les évolutions techniques futures des **transformateurs** peuvent nécessiter 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'IEC 61558-1:2017, Article 2 s'applique, avec l'exception suivante:

Addition:

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*

IEC 61558-2-16:2021, *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments – Partie 2-16: Exigences particulières et essais pour les blocs d'alimentation à découpage et les transformateurs pour blocs d'alimentation à découpage pour applications d'ordre général*