

# INTERNATIONAL STANDARD



This extended version of IEC 61558-2-2:2022 includes the content of the references made to IEC 61558-1:2017

GROUP SAFETY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof –  
Part 2-2: Particular requirements and tests for control transformers and power  
supply units incorporating control transformers**

Document Preview

[IEC 61558-2-2:2022](#)

<https://standards.iteh.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022>





**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2022 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

**About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

**IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

**IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

**IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

**IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)**

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

**Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International  
Standards.iteh.ai)  
Document Preview

[IEC 61558-2-2:2022](https://standards.iteh.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022)

<https://standards.iteh.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022>



# INTERNATIONAL STANDARD



This extended version of IEC 61558-2-2:2022 includes the content of the references made to IEC 61558-1:2017

GROUP SAFETY PUBLICATION

**Safety of transformers, reactors, power supply units and combinations thereof –  
Part 2-2: Particular requirements and tests for control transformers and power  
supply units incorporating control transformers**

Document Preview

[IEC 61558-2-2:2022](#)

<https://standards.iteh.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 29.180

ISBN 978-2-8322-5932-0

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

## CONTENTS

FOREWORD .....	9
INTRODUCTION TO IEC 61558-1:2017 .....	12
INTRODUCTION .....	15
1 Scope .....	16
2 Normative references .....	17
3 Terms and definitions .....	20
4 General requirements .....	34
5 General notes on tests .....	35
6 Ratings .....	37
7 Classification .....	38
8 Marking and other information .....	39
9 Protection against electric shock .....	45
9.1 General .....	45
9.2 Protection against contact with hazardous-live-parts .....	45
9.2.1 Determination of hazardous-live-parts .....	45
9.2.2 Accessibility to hazardous-live-parts .....	46
9.2.3 Accessibility to non hazardous-live-part .....	49
9.3 Protection against hazardous electrical discharge .....	49
10 Change of input voltage setting .....	49
11 Output voltage and output current under load .....	50
12 No-load output voltage .....	50
13 Short-circuit voltage .....	51
14 Heating .....	51
14.1 General requirements .....	51
14.1.1 Temperature-rise test .....	51
14.1.2 Alternative temperature-rise test .....	54
14.1.3 Determination of steady-state conditions .....	56
14.2 Application of 14.1 or 14.3 according to the insulation system .....	58
14.3 Accelerated ageing test for undeclared class of insulation system .....	59
14.3.1 General .....	59
14.3.2 Heat run .....	59
14.3.3 Vibration .....	59
14.3.4 Moisture treatment .....	60
14.3.5 Measurements .....	60
15 Short-circuit and overload protection .....	60
15.1 General requirements .....	60
15.1.1 Short circuit and overload test method .....	60
15.1.2 Alternative short circuit and overload test method .....	62
15.2 Inherently short-circuit proof transformers .....	62
15.3 Non-inherently short-circuit proof transformers .....	62
15.4 Non-short-circuit proof transformers .....	63
15.5 Fail-safe transformers .....	63

16	Mechanical strength .....	64
16.1	General .....	64
16.2	Stationary transformers .....	64
16.3	Portable transformers (except portable transformers with integral pins for introduction in socket-outlet in the fixed wiring) .....	65
16.4	Portable transformers provided with integral pins for introduction in socket-outlets of the fixed wiring .....	65
16.4.1	General requirements .....	65
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 .....	66
16.5	Additional requirements for transformers to be used in vehicles and railway applications .....	67
16.5.1	Transformers to be used in vehicles and railway applications .....	67
16.5.2	Test requirements for the transportation of transformers .....	68
17	Protection against harmful ingress of dust, solid objects and moisture .....	69
17.1	Degrees of protection provided by enclosures (IP code) .....	69
17.1.1	General requirements .....	69
17.1.2	Tests on transformers with enclosure .....	70
17.2	Humidity treatment .....	72
18	Insulation resistance, dielectric strength and leakage current .....	73
18.1	General .....	73
18.2	Insulation resistance .....	73
18.3	Dielectric strength test .....	74
18.4	Insulation between and within windings .....	76
18.5	Touch current and protective earthing conductor current .....	76
18.5.1	General .....	76
18.5.2	Touch current .....	77
18.5.3	Protective earthing conductor current .....	78
19	Construction .....	78
19.1	General construction .....	78
19.1.3	Separating transformers .....	79
19.1.4	Isolating transformers and safety isolating transformers .....	80
19.2	Flammability of materials .....	82
19.3	Short-circuit characteristics of portable transformers .....	82
19.4	Class II transformer contact prevention of accessible conductive parts .....	83
19.5	Class II transformer insulation reassembling after service .....	83
19.6	Loosening of wires, screws or similar parts .....	83
19.7	Resistor or capacitor connection with accessible conductive parts .....	84
19.8	Bridging of separated conductive parts by resistors or capacitors .....	84
19.9	Insulating material separating input and output windings .....	84
19.10	Accidental contact protection against hazardous-live-parts provided by isolating coating .....	85
19.11	Insulating material of handles, operating levers, knobs and similar parts .....	86
19.12	Winding construction .....	86
19.13	Fixing of handles, operating levers and similar parts .....	90
19.14	Fixing of covers providing protection against electric shock .....	90
19.15	Strain on fixed socket-outlets caused by pin-transformers connection .....	90
19.16	Portable transformers for use in irregular or harsh conditions .....	91

19.17	Drain hole of transformers protected against ingress of water .....	91
19.18	Plug connected transformers protected against ingress of water .....	91
19.19	Flexible cable or flexible cord connection for class I portable transformers .....	91
19.20	SELV- and PELV-circuit separation of live parts.....	91
19.21	Protection against contact for FELV-circuit .....	92
19.22	Protective earthing regarding class II transformers .....	92
19.23	Protective earthing regarding class III transformers .....	92
20	Components .....	93
21	Internal wiring .....	98
22	Supply connection and other external flexible cables or cords .....	98
23	Terminals for external conductors.....	104
24	Provisions for protective earthing.....	106
25	Screws and connections.....	107
26	Creepage distances, clearances and distances through insulation .....	110
26.1	General.....	110
26.2	Creepage distances and clearances.....	111
26.2.1	General.....	111
26.2.2	Windings covered with adhesive tape.....	111
26.2.3	Uncemented insulating parts .....	111
26.2.4	Cemented insulating parts .....	111
26.2.5	Enclosed parts (e.g. by impregnation or potting).....	112
26.3	Distance through insulation.....	113
27	Resistance to heat, fire and tracking.....	124
27.1	General.....	124
27.2	Resistance to heat.....	124
27.2.1	General.....	124
27.2.2	External accessible parts.....	124
27.2.3	Internal parts.....	125
27.3	Resistance to abnormal heat under fault conditions .....	125
27.4	Resistance to fire.....	126
27.4.1	General.....	126
27.4.2	External accessible parts .....	127
27.4.3	Internal parts.....	127
27.5	Resistance to tracking .....	128
28	Resistance to rusting.....	128
Annex A	(normative) Measurement of creepage distances and clearances .....	129
Annex B	(normative) Testing a series of transformers.....	133
B.1	General.....	133
B.2	Requirements .....	133
B.3	Constructional inspection.....	134
Annex C	(void).....	135
Annex D	(void).....	136
Annex E	(normative) Glow-wire test .....	137
E.1	General.....	137
E.2	Severity.....	137
E.3	Conditioning .....	137

E.4	Test procedure .....	137
Annex F (normative) Requirements for manually operated switches which are parts of transformers assembly .....		138
F.1	General .....	138
F.2	Switches tested as a separate component .....	138
F.3	Switches tested as part of the transformer .....	138
Annex G (normative) Tracking test.....		141
G.1	General .....	141
G.2	Test specimen .....	141
G.3	Test apparatus .....	141
G.4	Procedure .....	141
Annex H (normative) Electronic circuits.....		142
H.1	General .....	142
H.2	General notes on tests (addition to Clause 5) .....	142
H.3	Short circuit and overload protection (addition to Clause 15) .....	142
H.4	Creepage distances, clearances and distances through insulation (addition to Clause 26).....	144
Annex I (informative) Dimensions for rectangular cross-section connectors of transformers, basic dimensions and coordination .....		146
Annex J (normative) Measuring network for touch-currents.....		149
Annex K (normative) Insulated winding wires .....		150
K.1	General .....	150
K.2	Type tests .....	150
K.2.1	General.....	150
K.2.2	Dielectric strength test.....	150
K.2.3	Flexibility and adherence .....	150
K.2.4	Heat shock.....	151
K.2.5	Retention of dielectric strength after bending.....	151
K.3	Testing during manufacturing.....	152
K.3.1	General.....	152
K.3.2	Routine test.....	152
K.3.3	Sampling test .....	152
Annex L (normative) Routine tests (production tests).....		153
L.1	General .....	153
L.2	Protective earthing continuity test.....	153
L.3	Checking of no-load output voltage .....	153
L.4	Dielectric strength test.....	153
L.5	Checking of protective devices mounting.....	154
L.6	Visual inspection .....	154
L.7	Repetition test after routine dielectric strength test .....	154
Annex M (informative) Examples to be used as a guide for 19.1 .....		155
M.1	General .....	155
M.2	Coil-former .....	155
M.2.1	Concentric type .....	155
M.2.2	Side-by-side type.....	156
M.3	Windings .....	156
M.3.1	Without screen .....	156
M.3.2	With screen .....	157

Annex N (informative) Examples for checking points of dielectric strength test voltages.....	158
Annex O (void).....	160
Annex P (informative) Examples for measurement points of creepage distances and clearances .....	161
Annex Q (informative) Explanation of IP numbers for degrees of protection.....	164
Q.1 General .....	164
Q.2 Degrees of protection against access to hazardous parts and against solid foreign objects.....	164
Q.3 Degrees of protection against ingress of water .....	166
Annex R (normative) Explanations of the application of 6.1.2.2.1 of IEC 60664-1:2007.....	167
R.1 Impulse dielectric test.....	167
R.2 Example .....	167
Annex S (void) .....	169
Annex T (void) .....	170
Annex U (void).....	171
Annex V (informative) Symbols to be used for thermal cut-outs.....	172
V.1 General .....	172
V.2 Non-self-resetting thermal cut-out (see 3.3.4).....	172
V.3 Self-resetting thermal cut-out (see 3.3.3).....	172
Annex W (normative) Coated printed circuit boards .....	173
W.1 Preamble.....	173
W.2 General .....	173
W.3 Cold.....	173
W.4 Rapid change of temperature .....	173
W.5 Additional tests.....	173
Bibliography.....	174
Index of defined terms.....	176
Figure 1 – IEC 61558 principle .....	13
Figure 2 – Mounting box for flush-type transformer.....	37
Figure 3 – Test pin (see IEC 61032, test probe 13).....	47
Figure 4 – Standard test finger (see IEC 61032, test probe B) .....	48
Figure 5 – Example of back-to-back method – Single phase .....	55
Figure 6 – Example of back-to-back method – Three phase .....	56
Figure 7 – Amplitude spectrum density for random testing .....	68
Figure 8 – Normalised spectrum of shock.....	69
Figure 9 – Test voltage sequence .....	76
Figure 10 – Test configuration: single-phase equipment on star TN or TT system.....	78
Figure 11 – Abrasion resistance test for insulating coated layers .....	86
Figure 12 – Flexing test apparatus.....	102
Figure 13 – Test arrangement for checking mechanical withstanding of insulating materials in thin sheet layers .....	116
Figure 14 – Ball-pressure apparatus .....	124
Figure A.1 – Example 1 .....	129
Figure A.2 – Example 2 .....	130
Figure A.3 – Example 3 .....	130



Figure A.4 – Example 4 .....	130
Figure A.5 – Example 5 .....	131
Figure A.6 – Example 6 .....	131
Figure A.7 – Example 7 .....	132
Figure A.8 – Example 8 .....	132
Figure H.1 – Example of an electronic circuit with low-power points .....	145
Figure J.1 – Measuring network for touch-current .....	149
Figure M.1 – Examples for concentric type constructions .....	155
Figure M.2 – Examples for side-by-side type constructions .....	156
Figure M.3 – Examples for winding constructions without screen .....	156
Figure M.4 – Examples for wrapped winding constructions .....	157
Figure M.5 – Examples for winding constructions with screen .....	157
Figure N.1 – Transformer of class I construction with metal enclosure .....	158
Figure N.2 – Transformer of class II construction with metal enclosure .....	159
Figure N.3 – Transformer of class II construction with enclosure of insulating material .....	159
Figure P.1 – Transformer of class I construction .....	161
Figure P.2 – Transformer of class I construction with earthed metal screen .....	162
Figure P.3 – Transformer of class II construction with metal enclosure .....	162
Figure P.4 – Transformer of class II construction with enclosure of insulating material .....	163
Figure V.1 – Restored by manual operation .....	172
Figure V.2 – Restored by disconnection of the supply .....	172
Figure V.3 – Thermal link (see 3.3.5) .....	172
Figure V.4 – Self-resetting thermal cut-out .....	172
<a href="https://standards.iteh.ai/Document/Preview/IEC-61558-2-2-2022">IEC 61558-2-2:2022</a>	
<a href="https://standards.iteh.ai/Document/Preview/IEC-61558-2-2-2022">https://</a> Table 1 – Symbols used on equipment or in instructions .....	42
Table 101 – Symbols indicating the kind of transformer .....	43
Table 2 – Values of maximum temperatures in normal use .....	57
Table 3 – Explanation of the maximum winding temperatures required in Table 2 .....	58
Table 4 – Test temperature and testing time (in days) per cycle .....	59
Table 5 – Maximum values of temperatures under short-circuit or overload conditions .....	61
Table 6 – Values of $T$ and $k$ for fuses .....	62
Table 7 – Pull force on pins .....	66
Table 8 – Conditions for vibration testing (random) .....	67
Table 9 – Amplitude spectrum density ASD values for accelerated life testing .....	67
Table 10 – Frequency values depending on the weight of the specimen .....	68
Table 11 – Excitation values for vibration testing .....	68
Table 12 – Solid-object-proof transformer test .....	71
Table 13 – Values of insulation resistance .....	74
Table 14 – Table of dielectric strength test voltages .....	75
Table 15 – Limits for currents .....	78
Table 16 – Nominal cross-sectional areas of external flexible cables or cords .....	100
Table 17 – Pull and torque to be applied to external flexible cables or cords fixed to stationary and portable transformers .....	104

Table 18 – Torque to be applied to screws and connections .....	108
Table 19 – Torque test on glands.....	110
Table 20 – Clearances in mm .....	117
Table 21 – Creepage distances in mm .....	118
Table 22 – Distance through insulation in mm .....	119
Table 23 – Creepage distances and clearance between terminals for external connection ..	120
Table 24 – Values of FIW wires with minimum overall diameter and minimum test voltages according to the total enamel increase .....	122
Table A.1 – Width of groove values depending on the pollution degree .....	129
Table F.1 – Peak surge current of additional loads .....	139
Table I.1 – Dimensions of rectangular copper connectors .....	147
Table K.1 – Mandrel diameter.....	151
Table K.2 – Oven temperature .....	151
Table Q.1 – Degrees of protection against access to hazardous parts indicated by the first characteristic numeral .....	165
Table Q.2 – Degrees of protection against solid foreign objects indicated by the first characteristic numeral .....	165
Table Q.3 – Degrees of protection indicated by the second characteristic numeral .....	166
Table R.1 – Impulse test voltage according to 6.1.2.2.1 of IEC 60664-1:2007.....	167

ITeH Standards  
(<https://standards.iteh.ai>)  
Document Preview

[IEC 61558-2-2:2022](#)

<https://standards.iteh.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022>

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF TRANSFORMERS, REACTORS,  
POWER SUPPLY UNITS AND COMBINATIONS THEREOF –****Part 2-2: Particular requirements and tests for control transformers  
and power supply units incorporating control transformers**

## 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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. 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 a comprehensive content of the Standard.**

**IEC 61558-2-2:2022 EXV includes the content of the references made to IEC 61558-1:2017.**

**Particular subclauses of IEC 61558-1:2017 are displayed in the content on a blue background.**

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

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- adjustment of structure and references in accordance with IEC 61558-1:2017;
- new general symbol for control transformers;
- new symbol for power supply unit with linearly regulated output voltage.

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

Draft	Report on voting
96/548/FDIS	96/554/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://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 control transformers and power supply units incorporating control transformers*.

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 [www.webstore.iec.ch](http://www.webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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

**IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.**

**iTeh Standards**  
**(<https://standards.itih.ai>)**  
**Document Preview**

[IEC 61558-2-2:2022](#)

<https://standards.itih.ai/catalog/standards/iec/c53767d1-5c83-4159-b410-5b6203429740/iec-61558-2-2-2022>

## 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 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 **transformers**, 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.