

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

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

**Sécurité des transformateurs, alimentations, bobines d'inductance et produits
analogues –
Partie 1: Exigences générales et essais**

IEC 61558-1:2005

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF POWER TRANSFORMERS, POWER SUPPLIES,
REACTORS AND SIMILAR PRODUCTS –****Part 1: General requirements and tests**

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International Standard IEC 61558-1 has been prepared by IEC technical committee 96: Small power transformers, reactors and power supply units and similar products

It has the status of a group safety publication in accordance with IEC Guide 104.

This new edition represents a complete revision of the previous edition. The changes were necessitated by the introduction of new technology and implementation of requirements from equipment committees.

This consolidated version of IEC 61558-1 consists of the second edition (2005) [documents 96/224/FDIS and 96/228/RVD], its amendment 1 (2009) [documents 96/314/FDIS and 96/320/RVD] and its corrigenda of March 2008, March 2010 and April 2011.

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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

This second edition of Part 1 is only to be used in conjunction with parts 2 based on this edition. The parts 2 contain clauses to supplement or modify the corresponding clauses of this Part 1 in order to provide the relevant requirements for each type of transformer.

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

NOTE Annex U contains the optional t_w system (marking, requirements and tests).

IEC 61558 consists of the following parts, under the general title *Safety of power transformers, power supplies, reactors and similar products*:¹⁾

- Part 1: General requirements and tests
- Part 2-1: Particular requirements for separating transformers for general use
- Part 2-2: Particular requirements for control transformers
- Part 2-3: Particular requirements for ignition transformers for gas and oil burners
- Part 2-4: Particular requirements for isolating transformers for general use
- Part 2-5: Particular requirements for shaver transformers and shaver supply units
- Part 2-6: Particular requirements for safety isolating transformers for general use
- Part 2-7: Particular requirements for transformers for toys
- Part 2-8: Particular requirements for bell and chime transformers
- Part 2-9: Particular requirements for transformers for class III handlamps for tungsten filament lamps
- Part 2-12: Particular requirements for constant voltage transformers
- Part 2-13: Particular requirements for auto-transformers for general use
- Part 2-14: Particular requirements for variable transformers (*in preparation*)
- Part 2-15: Particular requirements for isolating transformers for the supply of medical locations
- Part 2-16: Particular requirements for switch mode power supplies and transformers for switch mode power supplies (*in preparation*)
- Part 2-17: Particular requirements for transformers for switch mode power supplies
- Part 2-19: Particular requirements for perturbation attenuation transformers
- Part 2-20: Particular requirements for small reactors

¹⁾ Some of the parts of this series published earlier appeared under the general title *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 2-23: Particular requirements for transformers for construction sites

Other parts are under consideration.

In this standard, 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 the standard, the words in **bold** are defined in Clause 3.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

This International Standard covers safety requirements for **transformers**. Where the term **transformer** is used, it covers **transformers**, **reactors** and **power supplies** where applicable.

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

This standard 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 may occur in practice.

A **transformer** complying with this standard will not necessarily be judged to comply with the safety principles of this standard 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 standard 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 standard.

The standard dealing with non-safety aspects of electromagnetic compatibility (EMC) of **transformers** is IEC 62041: *Power transformers, power supply units, reactors and similar products – EMC requirements*. However, that standard also includes tests which may subject the **transformer** to conditions involving the safety aspects.

The objective of Part 1 of IEC 61558 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 2 of IEC 61558. Part 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 2. Part 1 of IEC 61558 also contains normative routine tests.

Each part 2 in conjunction with Part 1 contains all the necessary requirements for the **transformer** being covered and does not contain references to other parts 2. For **transformers** with a protection index IP00 and associated **transformers**, it is possible to have circuits corresponding to different parts 2 within the same construction (e.g. SELV output circuit according to Part 2-6 and 230 V output circuit according to Part 2-4). However, if the **transformer** is covered by different parts 2 of IEC 61558, to the extent reasonable, the relevant part 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 2 for a particular **transformer** or group of **transformers** does not exist, the nearest applicable part 2 may be used as a guide to the requirements and tests.

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

The principle for preparation of the different parts 2 is as follows:

IEC 61558 principle

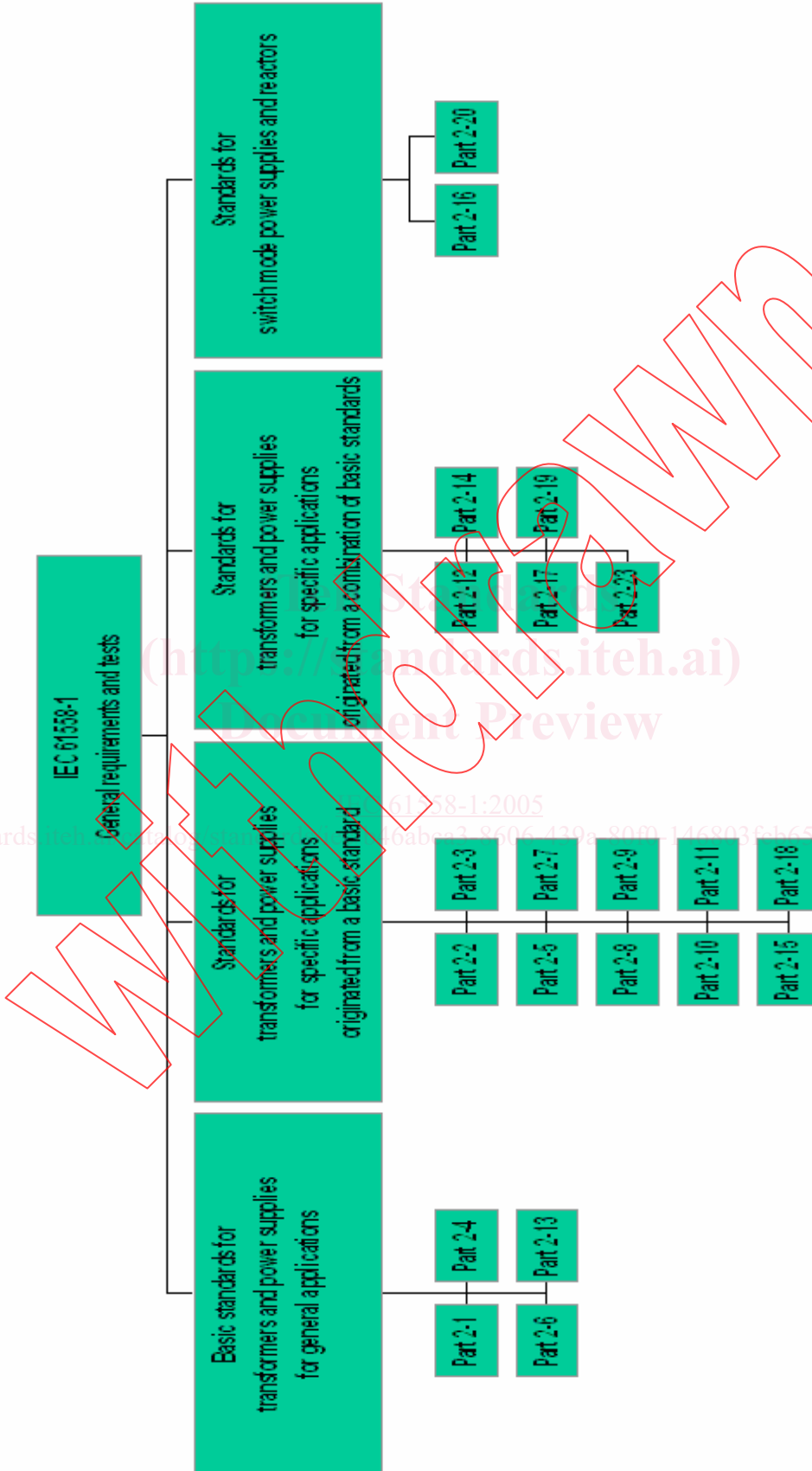


Figure 0 – IEC 61558 principle

Relevant clauses of this standard (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.

As an option, the thermal characteristics of **transformers** can be specified by the rated maximum operating temperature of the winding (symbol t_w) which shall not be exceeded to ensure a minimum lifetime as specified in Annex U. In addition, for **transformers** subjected to abnormal conditions as specified in Clause 15, the specified temperature limit shall not be exceeded when the **transformer** is built into an appliance or used as an independent **transformer**.

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SAFETY OF POWER TRANSFORMERS, POWER SUPPLIES, REACTORS AND SIMILAR PRODUCTS –

Part 1: General requirements and tests

1 Scope

This International Standard deals with safety aspects of power **transformers**, power supplies, reactors and similar products such as electrical, thermal and mechanical safety.

This standard covers the following types of **dry-type transformers**, **power supplies**, including **switch mode power supplies**, and **reactors**, the windings of which may be encapsulated or non-encapsulated :

NOTE 1 The distinction between **transformers**, **power supplies** and **switch mode power supplies** is as follows:

- for **transformers**, there is no change in frequency .However, **transformers** (e.g. constant voltage **transformers**) may have an internal resonance frequency not exceeding 30 kHz;
- for **power supplies**, the **internal operational frequency** and waveform are different from the **supply frequency** and waveform, and the **internal operational frequency** does not exceed 500 Hz (see definition 3.1.19);
- for **switch mode power supplies**, the **internal operational frequency** and waveform are different from the **supply frequency** and waveform and the **internal operational frequency** exceeds 500 Hz and does not exceed 100 MHz.

The relevant parts 2 may be found in the introduction of this standard.

a) Stationary or portable, single-phase or poly-phase, air-cooled (natural or forced), **isolating** and **safety isolating transformers**, **independent** or **associated**, not forming a part of distribution networks and with the following characteristics:

- **rated supply voltage** not exceeding 1 000 V a.c.;
- **rated supply frequency** not exceeding 500 Hz;

and complying with the following values, unless otherwise specified in the relevant part 2:

- for **isolating transformers**:
 - **rated output** for single phase **transformers**, not exceeding 25 kVA, and for poly-phase **transformers** not exceeding 40 kVA.
 - **no-load output voltage** and the **rated output voltage** exceeding 50 V a.c., and not exceeding 500 V a.c, or 1 000 V a.c. to be in accordance with the National Wiring Rules or for a special application.
- for **safety isolating transformers**:
 - **rated output** for single phase **transformers** not exceeding 10 kVA, and for poly-phase **transformers** not exceeding 16 kVA.
 - **no-load output voltage** and the **rated output voltage** not exceeding 50 V a.c. between conductors, or between any conductor and protective earth.

NOTE 1 **Isolating** and **safety isolating transformers** are used where **double** or **reinforced insulation** between circuits is required by the installation rules or by the appliance specification (for example toys, bells, portable **tools**, handlamps).

b) **Stationary or portable, single-phase or polyphase, air-cooled (natural or forced) separating transformers, auto-transformers, variable transformers and small reactors, independent or associated**, not forming a part of distribution networks and with the following characteristics:

- **rated supply voltage** not exceeding 1 000 V a.c.;
- **rated supply frequency** not exceeding 500 Hz;

and complying with the following values, unless otherwise specified in the relevant part 2:

- no-load output voltage or a rated output voltage for both independent and associated **transformers** not exceeding 15 kV a.c., and for independent **transformers**, a rated output voltage not less than 50 V a.c.;
- **rated output** not exceeding the following values:
 - 1 kVA for single-phase **transformers**;
 - 2 kVAR for single-phase **reactors**;
 - 5 kVA for poly-phase **transformers**;
 - 10 kVAR for poly-phase **reactors**.

NOTE 2 **Separating transformers** are used where **double or reinforced insulation** between circuits is not required by the installation rules or by the appliance specification.

NOTE 3 Normally, the **transformers** of type b) are intended to be associated with the equipment to provide voltages different from the supply voltage for the functional requirements of the equipment. The protection against electric shock may be provided or completed by other features of the equipment, such as the **body**. Parts of **output circuits** may be connected to the **input circuit** or to the protective earth.

c) **Stationary or portable, single-phase or polyphase, air-cooled (natural or forced), independent or associated power supplies and switch mode power supplies** incorporating one or more **transformer(s)** of type a) or b), not forming a part of distribution networks and with the following characteristics:

- **rated supply voltage** not exceeding 1 000 V a.c.;
- **rated supply frequency** not exceeding 500 Hz;
- internal operational frequency for power supplies not exceeding 500 Hz and for switch mode power supplies not exceeding 100 MHz;

and with the following values, unless otherwise specified in the relevant part 2:

- for power supplies and switch mode power supplies incorporating isolating **transformers**:
 - **rated output** for single- phase or polyphase **power supplies** or **switch mode power supplies** not exceeding 1 kVA;
 - **no-load output voltage** and the **rated output voltage** exceeding 50 V a.c. or 120 V ripple- free d.c., and not exceeding 500 V a.c. or 708 V ripple- free d.c., or 1 000 V a.c. or 1 415 V ripple- free d.c. to be in accordance with national wiring rules or for a special application;
- for **power supplies** and **switch mode power supplies** incorporating **safety isolating transformers**:
 - **rated output** for single- phase or polyphase **power supplies** and **switch mode power supplies** not exceeding 1 kVA;
 - **no-load output voltage** and **rated output voltage** not exceeding 50 V a.c. or 120 V ripple- free d.c. between conductors, or between any conductor and protective earth.