IEC 61558-2-7

Edition 3.0 2023-06
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

GROUP SAFETY PUBLICATION

Safety of ~~power~~ transformers, ~~power supplies~~ reactors, ~~and similar products~~ power supply units and combinations thereof –
Part 2-7: Particular requirements and tests for transformers and power ~~supplies~~ supply units for toys

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Part 2-7: Particular requirements and tests for transformers and power ~~supplies~~ supply units for toys

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61558-2-7:2007. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 61558-2-7 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 2007. 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) new symbol for power supply unit with linearly regulated output voltage.

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

Draft	Report on voting
96/579/FDIS	96/581/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 International Standard 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/publications.

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

This International Standard 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 toys.*

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.

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

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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, 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 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.

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SAFETY OF ~~POWER~~ TRANSFORMERS, ~~POWER SUPPLIES~~ REACTORS, ~~AND SIMILAR PRODUCTS~~ POWER SUPPLY UNITS AND COMBINATIONS THEREOF –

Part 2-7: Particular requirements and tests for transformers and power ~~supplies~~ supply units for toys

1 Scope

Replacement:

~~This part of IEC 61558 deals with safety aspects of **transformers for toys** and **power supplies** incorporating **transformers for toys** such as electrical, thermal and mechanical safety.~~

~~This Part 2-7 is applicable to **transformers for toys** and **power supplies** incorporating both **transformers for toys** and **electronic circuits**. This Part 2-7 is not applicable to external circuits and their components intended to be connected to the input terminals, output terminals or socket-outlets of the **transformers** and **power supplies**.~~

~~This Part 2-7 applies to **stationary** and **portable**, single-phase, air-cooled (natural or forced), **transformers for toys** and **power supplies** incorporating **transformers for toys**, having a **rated supply voltage** not exceeding 250 V a.c., a **rated supply and internal operating frequency** not exceeding 500 Hz, a **rated output** not exceeding 200 VA and a **rated output current** not exceeding 10 A.~~

~~This Part 2-7 is applicable to **independent transformers** and **transformers for specific use**.~~

~~This Part 2-7 is applicable to **dry-type transformers for toys**. The windings may be encapsulated or non-encapsulated.~~

~~The **no-load output voltage** does not exceed 33 V a.c. for **transformers for toys** and **power supplies** incorporating **transformers for toys**, or 46 V ripple-free d.c. for **power supplies** incorporating **transformers for toys**, and the **rated output voltage** does not exceed 24 V a.c. for **transformers** and **power supplies**, or 33 V ripple-free d.c. for **power supplies**.~~

~~In general, this Part 2-7 does not take into consideration children playing with the **transformers for toys** and **power supplies** incorporating **transformers for toys**.~~

~~NOTE 1 Attention is drawn to the following:~~

~~– for **transformers for toys** and **power supplies** incorporating **transformers for toys** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) may be necessary;~~

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

~~– the different conditions for transportation, storage, and operation of the **transformers for toys** and **power supplies** incorporating **transformers for toys** should also be considered;~~

~~– additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers for toys** and **power supplies** incorporating **transformers for toys** intended for use in special environments, such as tropical environments.~~

~~NOTE 2 Future technological development of **transformers** and **power supplies** may necessitate a need to increase the upper limit of the frequencies; until then, this Part 2-7 may be used as a guidance document.~~

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This part of IEC 61558 deals with the safety of **transformers for toys** and **power supply units** incorporating **transformers for toys**. **Transformers for toys** 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 toys and **power supply units** incorporating **transformers** for toys.

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

This document is applicable to **independent transformers** and **transformers for specific use**.

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.

The **rated supply voltage** does not exceed 250 V AC. The **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **rated output** does not exceed 200 VA and a **rated output current** does not exceed 10 A.

The **no-load output voltage** does not exceed 33 V AC or 46 V ripple-free DC, and the **rated output voltage** does not exceed 24 V AC or 33 V ripple-free DC.

In general, this document does not take into consideration children playing with the **transformers**.

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

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;
- for transformers for toys intended to be used as a battery charger for use with children additional requirements can apply.

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.

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2 Normative references

This clause of IEC 61558-1:2017 is applicable except as follows:

Addition:

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

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1:2003, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

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

IEC 61558-2-16, *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*

3 Terms and definitions

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

~~*Replacement of the third paragraph:*~~

~~When the term **transformer** is used from here forward, it covers **transformers for toys** and **power supplies** incorporating **transformers for toys where applicable**.~~

For the purposes of this document, the terms and definitions given in IEC 61558-1:2017 apply, except as follows:

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

Addition:

3.1.101
transformer for toys
independent safety isolating transformer designed to supply toys not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V AC

3.1.102
power supply unit for toys
power supply unit incorporating a **transformer for toys** not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V AC or 33 V ripple-free DC

4 General requirements

This clause of IEC 61558-1:2017 is applicable.

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5 General notes on tests

This clause of IEC 61558-1:2017 is applicable.

6 Ratings

This clause of IEC 61558-1:2017 is applicable except as follows:

~~*Replacement*~~

Addition:

6.101 The **rated output voltage** shall not exceed 24 V AC ~~for **transformers** and **power supplies**~~ or 33 V ripple-free DC ~~for **power supplies**~~**.**

6.102 The **rated output** shall not exceed 200 VA.

6.103 The **rated supply frequency** shall not exceed 500 Hz.

6.104 There shall be only one **rated supply voltage** not exceeding 250 V AC.

6.105 The **rated output current** shall not exceed 10 A.

Compliance with the requirements of 6.101 to 6.105 is checked by inspection of the marking.

7 Classification

This clause of IEC 61558-1:2017 is applicable, except as follows:

7.1

Replacement:

According to their protection against electric shock:

– **class II transformers** ~~shall be of class II construction~~.

7.2

Replacement:

According to short-circuit protection or protection against abnormal conditions:

- **inherently short-circuit proof transformers;**
- **non-inherently short-circuit-proof transformers;**
- **fail-safe transformers.**

7.4

Replacement:

According to their mobility:

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- **portable transformers;**
- **stationary transformers.**

7.5

Replacement:

According to their duty type:

- **continuous operation.**

7.8

Replacement:

According to their transient overvoltage condition:

- **overvoltage category II.**

8 Marking and other information

This clause of IEC 61558-1:2017 is applicable, except as follows:

~~**8.1** Item h) *Addition:*~~

~~**Transformers for toys** shall be marked with one of the graphical symbols shown in 8.11;~~

~~**8.1** Item n) *Modification:*~~

~~**transformers** suitable for outdoor use shall be marked with the appropriate IP code;~~

8.1

h)

Replacement of the content up to the first semi-colon by the following:

relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**.

m)

Replacement:

transformers suitable for outdoor use shall be marked with the appropriate degree of protection (IP code);

8.11

Addition:

The symbol for linear **power supply units** shall be used in conjunction with the symbol indicating the kind of **transformer**.

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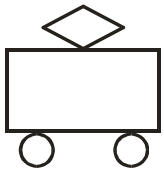
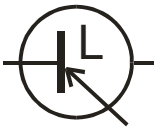
Table 101 – Symbols indicating the kind of transformer

Symbol or graphical symbol	Explanation or title	Identification
	**Safety isolating tranformers for toys** **(Inherently short-circuit proof transformers, non-inherently short-circuit proof transformers or fail-safe transformers)** To indicate a **fail-safe** function, the letter F may be used adjacent of the graphical symbol.	IEC 60417-5219 ~~(2002-10)~~:2006-12
	**Power supply unit, linear**	IEC 60417-6210:2013-10

Addition:

8.101

The instructions for use shall include the following statement or equivalent:

Instructions to parents: ”Transformers and power ~~supplies~~ supply units for toys are not intended to be used as toys, and the use of these products by children shall be under the full supervision of parents.”

8.102

The instructions for use of transformers using power supply cords with the degree of protection IP65 shall include the following statement or equivalent:

Instructions to parents: ”This transformer or power supply unit for toys is not intended for permanent outdoor usage and for instance rain conditions shall be avoided.”

9 Protection against electric shock

This clause of IEC 61558-1:2017 is applicable except as follows:

9.~~1~~2.2 Accessibility to hazardous-live-parts

Modification:

The standard test finger of Figure ~~2~~ 4 is replaced by the small test finger of Figure 101.

~~**9.1.2**~~

Addition:

It shall not be possible to gain access to **live parts** of the **input circuit** or to the metal parts separated from live parts by **basic insulation** only, even after removal of the covers that can be removed with the aid of a tool.

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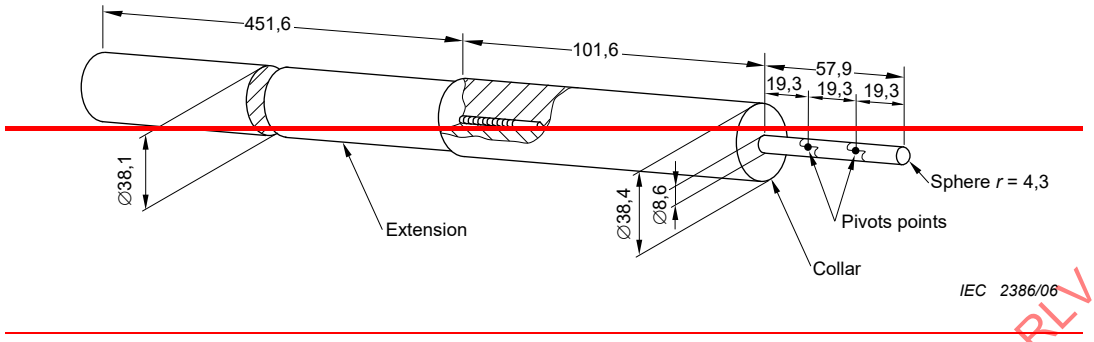


~~Matière: métal~~

~~Dimensions en millimètres~~

~~Tolérances sur les dimensions ±0,125 mm~~

~~Les deux articulations doivent permettre un mouvement, dans le même sens, de 90° avec une tolérance de 0° à +10°~~

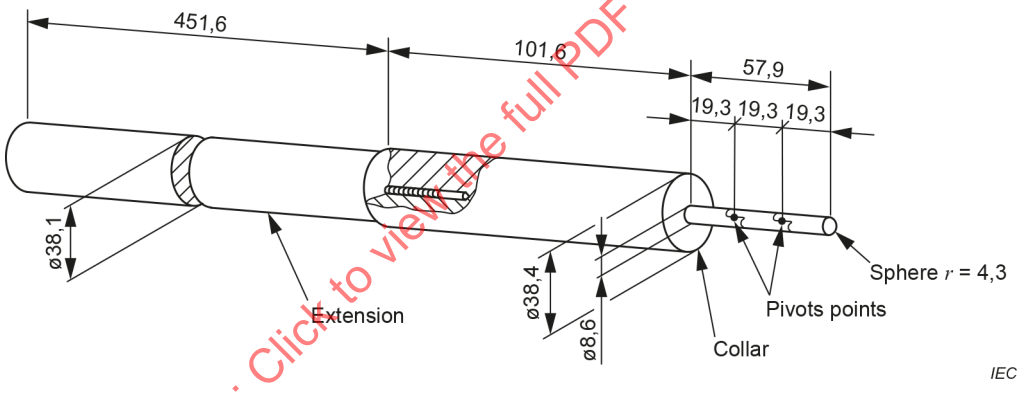
~~Material: metal~~

~~Dimensions in millimetres~~

~~Tolerances on dimensions ±0,125 mm~~

~~Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0° to +10° tolerance~~

Dimensions in millimetres



where

Material is metal

Tolerances on dimensions are ±0,125 mm

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0° to 10° tolerance

Figure 101 – Small test finger

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10 Change of input voltage setting

This clause of IEC 61558-1:2017 is applicable, except as follows:

Replacement:

Transformers shall have only one **rated supply voltage** or one **rated supply voltage range**.

Compliance is checked by inspection.

11 Output voltage and output current under load

This clause of IEC 61558-1:2017 is applicable except as follows:

11.1

Modification:

When the **transformer** is connected to the **rated supply voltage**, at the **rated supply frequency** and loaded with an impedance resulting in the **rated output** at the **rated output voltage** and, for an AC rated power factor, the **output voltage** shall not differ from the rated value by more than 10 % for AC or 15 % for DC.

This requirement is applicable to all the **output windings** and their tappings.

12 No-load output voltage

This clause of IEC 61558-1:2017 is applicable, except as follows:

Addition:

12.101 The **no-load output voltage** shall not exceed 33 V AC or 46 V ripple-free DC. For toy transformers, this output voltage limitation applies even when **output windings** not intended for interconnection are connected in series.

12.102 The difference between the **no-load output voltage** and the output voltage under load shall not be excessive.

The ~~difference~~ ratio between the **no-load output voltage** measured in Clause 12 and the **output voltage** under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed ~~100 %~~ 10 % for AC or 15 % for DC.

~~NOTE The ratio is defined as follows:~~

The ratio is determined by Formula (1):

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100(\%) \qquad (1)$$

where

$U_{\text{no-load}}$ is the no-load output voltage, expressed in V;

U_{load} is the output voltage under load, expressed in V.

*Compliance with the requirements of 12.101 and 12.102 is checked by measuring the **no-load output voltage** at the **ambient temperature** when the **transformer** is connected to **the rated supply voltage** at the **rated supply frequency**.*

13 Short-circuit voltage

This clause of IEC 61558-1:2017 is not applicable.

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14 Heating

This clause of IEC 61558-1:2017 is applicable, except as follows:

~~Table 1~~

Modification:

Replace ~~all~~ the requirements for external **enclosures** of Table 2 of **stationary transformers** by the following:

Table 2 – Values of maximum temperatures in normal use

Parts	Temperature °C
External **enclosures** (which can be touched with the small test finger of Figure 101), handles and the like, if made of	
– metal;	~~50~~58
– other material.	~~60~~71
External **enclosures** (which cannot be touched with the small test finger of Figure 101).	85

15 Short circuit and overload protection

This clause of IEC 61558-1:2017 is applicable, except as follows:

15.1.1 Short circuit and overload test method

Addition:

Transformers shall be of either **short-circuit-proof** or **fail-safe** construction. **Short-circuit-proof transformers** shall withstand overloads that ~~may~~ can occur during normal use. They shall not incorporate fuses.

If the short-circuit output current exceeds 20 A, a non-self-resetting overload protective device shall be incorporated.

Non-self-resetting overload protective devices, if any, shall be incorporated in the **input circuit**.

~~Table 3~~

Replace the requirements for external **enclosures** of Table 5 by the following:

Table 5 – Maximum values of temperatures under short-circuit or overload conditions

Parts	Maximum temperature °C
External **enclosures** (which ~~may~~ can be touched with the small test finger of Figure 101), if made of	
– metal;	~~50~~58
– other material.	~~60~~71

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Addition:

15.3.101 ~~*The input circuit of*~~ *The* ***transformer*** *having a short-circuit output current exceeding 20 A shall be connected to the* ***rated supply voltage*** *in the cold condition (i.e., as received and in the normal room ambient), and each* ***output circuit*** *or winding shall be short-circuited, one at a time, while the other windings or* ***output circuits*** *are open-circuited.*

Only the ***output circuits*** *with a short-circuit current exceeding 20 A shall be short-circuited in the case of more than one output current.*

The overload protective device shall operate within 1 s.

15.5.2 *Modification of the first dash as follows:*

– *the temperature of any part of the* ***enclosure*** *of the* ***fail-safe transformer*** *that* ~~*may*~~ *can be touched with the small test finger of Figure 101 shall not exceed*

- ~~*50*~~*58 °C if made of metal;*
- ~~*60*~~*71 °C if made of other material.*

16 Mechanical strength

This clause of IEC 61558-1:2017 is applicable, except as follows:

16.1 General

Replacement of the second paragraph as follows:

Compliance is checked by the test of 16.2 for ***stationary transformers*** *and by the tests of 16.2, 16.3, 16.4, and 16.101, as appropriate, for* ***portable transformers****.*

Dimensions in millimetres

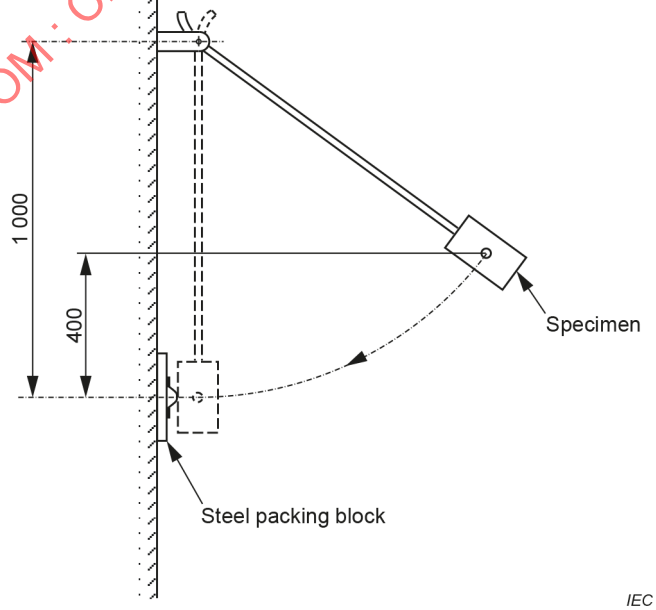

Figure 102 – Arrangement for impact test for transformers (see 16.101)

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Addition:

16.101 *In addition, **transformers** are subjected to the following test:*

*The **transformer** is dropped against a steel bar mounted on a solid wall of brick, stone, concrete or the like, as shown in Figure 102.*

The bar is of 40 mm × 40 mm × 5 mm right-angle section with the corner rounded to a radius of 5 mm. It is mounted in contact with the wall, or, if necessary, in contact with a steel packing block which is in contact with the wall.

*The **transformer** is suspended by its flexible cable or cord so that it rests against the corner of the bar, the point of suspension being 1 m above the bar. It is then drawn away from the bar in a plane perpendicular to the wall until it has risen through a height of 400 mm.*

*The **transformer** is allowed to fall against the bar. For **transformers** shaped as a cube or parallelogram, one blow is applied to each of the six sides of the **transformer**; for **transformers** shaped differently, one blow is applied to each similarly exposed side.*

*The steel packing block is only necessary if the shape of the **transformer** is such that, without it, the **transformer** does not hit the bar.*

*In addition, the **transformer** is allowed to fall freely from a height of 400 mm onto a steel plate, at least 5 mm thick, placed on a flat concrete base.*

*The number of falls is 10 times with the **transformer** cable mounted as in normal use, and the orientation of the **transformer** is different for each fall.*

*After the test, the **transformer** shall show no damage within the meaning of this document. In particular, live parts shall not become accessible.*

17 Protection against harmful ingress of dust, solid objects and moisture

This clause of IEC 61558-1:2017 is applicable.

18 Insulation resistance, dielectric strength and leakage current

This clause of IEC 61558-1:2017 is applicable, except as follows:

Addition:

18.101 The **touch current** shall in no operating condition exceed the values of Table 15.

NOTE Certain **transformer** types can have high initial **touch current** when first switched on, which does not decrease rapidly in a low-load condition.

19 Construction

This clause of IEC 61558-1:2017 is applicable, except as follows:

19.1 General construction

Replacement:

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The **input** and **output circuits** shall be electrically separated from each other and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other metal parts, except by deliberate action.

Compliance is checked by inspection and measurements, taking Clause 18 and Clause 26 into consideration.

19.1.101 The **insulation** between the **input** and **output winding(s)** shall consist of **double** or **reinforced insulation**. In addition, the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body** shall consist of **double** or **reinforced insulation**.

19.1.102 For **transformers** with **intermediate conductive parts** (for example, the iron core), not connected to the **body** and located between the **input** and **output windings**, the **insulation** between the **intermediate conductive part** and the **input windings** or between the **intermediate conductive part** and the **output windings** shall consist of at least **basic insulation**.

NOTE An **intermediate conductive part,** not separated from the **input** or **output windings** or the **body** by at least **basic insulation**, is considered to be connected to the relevant part(s).

In addition, the **insulation** between the **input** and **output windings**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**; the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**.

~~**19.16** *Addition:*~~

19.101 **Transformers** shall comply with the requirements for degree of protection ~~code~~ IP4X or higher with the exception of output terminals.

Transformers for outdoor use shall have a degree of protection ~~code~~ of IP65 / IP67 or higher.

Compliance is checked by the tests of Clause 17.

~~*Addition:*~~

19.~~101~~102 There shall be no connections between the **output circuit** and the protective earth.

19.~~102~~103 There shall be no connections between the **output circuit** and the **body**.

Compliance is checked by inspection.

19.~~103~~104 The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier and it shall be of insulating material and be permanently fixed to the **transformer**.

*Compliance is checked by inspection and by measurement disregarding **intermediate conductive parts**.*

19.~~107~~105 **Transformers** shall be class II.

19.~~108~~106 **Transformers** shall not be fixed to or incorporated in toys.

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Compliance is checked by inspection.

19.~~111~~107 **Transformers** with AC terminals in the **output circuit** shall be designed such that when

– the **output circuits** of two or more **transformers** are connected together, and
– the **input circuit** of at least one of the **transformers** is connected to the mains supply, and
– the **input circuit** of at least one of the **transformers** is not connected to the mains supply,

the voltage across the bare pins of the plug of the **transformers** not connected to the mains supply shall not exceed 33 V AC.

*Compliance is checked by measurement of the voltage between the pins of the plug when the **output circuit** is supplied by the **rated output voltage(s)**.*

20 Components

This clause of IEC 61558-1:2017 is applicable, except as follows:

20.~~4~~5

Addition:

Transformers shall not be provided with switches connected to the flexible supply cables or cords.

20.~~5~~6

Addition:

~~It shall not be possible to make permanent contact with any of the pins of the plugs accepted by socket-outlets in the **output circuit** of the **transformer** and connectors of **appliance couplers** according to IEC 60320.~~

Socket-outlets in the **output circuit** of the **transformers** and plugs accepted by those socket-outlets shall not be interchangeable with plugs and socket outlets listed in IEC TR 60083. This requirement is not applicable to socket-outlets with corresponding plugs which are too large to be introduced into the mains socket outlets or that are too small so they can only be loosely inserted and do not stay firmly in place in the socket outlet aperture while in contact with the supply mains.

Socket-outlets for connectors such as jack types, USB types, RCA phono types with a diameter or diagonal measurement between 3,75 mm and 5,25 mm and length greater than 7 mm are considered to fail this requirement.

Compliance is checked by inspection.

20.~~7~~8.1

Modification:

For **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices, the number of cycles of operation is increased from 300 to 1 000.

Addition:

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20.101 It shall be possible to reset the **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices without removing their covers.

*Compliance is checked by short-circuiting the output terminals and connecting the **transformer** to the **rated supply voltage** until the device operates. If more than one set of output terminals are provided, each set shall be tested separately.*

*It shall not be possible to maintain the **thermal cut-out** or the overload protective device in the "ON" position by operating the resetting means.*

After removal of the short circuit, it shall be possible to put the overload protective device in the "ON" position without removing any covers. If necessary, after cooling.

20.102 Control devices, if any, shall be in the **output circuit** and shall operate reliably.

Compliance is checked by inspection and by the following test:

*The control is operated 5 000 times. Each time from one extreme end of the range to the other at a uniform rate of approximately 30 cycles per minute with the **transformer** connected to the **rated supply voltage** and loaded with the **rated output current** at unity power factor.*

*During this test, no interruption of the current shall occur. After the test, the temperatures of the **transformer** windings shall not exceed the values specified in 14.2, and the no-load input current shall not alter by a short-circuit placed between the turns of the windings of the **output circuit**.*

20.103 The operating means of control devices, if any, shall not be affixed to the **transformers** with the exception of **transformers** for toy railway applications.

NOTE In Denmark, the exception of 20.103 is not applicable.

21 Internal wiring

This clause of IEC 61558-1:2017 is applicable.

22 Supply connection and other external flexible cable~~s~~ or cords

This clause of IEC 61558-1:2017 is applicable, except as follows:

22.5

Modification:

Power supply cords of **transformers** complying with the requirements for degree of protection ~~code~~ IP4X or IP65 shall not be lighter than ordinary tough rubber sheathed cord (code designation 60245 IEC 53 of IEC 60245-1) or ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53 of IEC 60227-1).

Power supply cords of **transformers** with the degree of protection ~~code~~ of IP67 shall not be lighter than ordinary polychloroprene sheathed cord (code designation 60245 IEC 57 of IEC 60245-1).

22.6

Replacement:

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Appliance couplers are not allowed in the **input circuits** of **transformers**.

22.7

Modification:

For **transformers** having a mass greater than 500 g excluding the cable or cord, the cross-sectional area of the supply cable or cord shall be at least 1 mm².

22.9

Modification:

Power supply cords ~~may~~ can be connected to the **transformers** by **type Y** and **type Z attachments**. **Type X attachment** is not allowed.

23 Terminals for external conductors

This clause of IEC 61558-1:2017 is applicable.

24 Provisions for protective earthing

This clause of IEC 61558-1:2017 is not applicable.

25 Screws and connections

This clause of IEC 61558-1:2017 is applicable.

26 Creepage distances, clearances and distances through insulation

This clause of IEC 61558-1:2017 is applicable.

27 Resistance to heat~~, abnormal heat~~, fire and tracking

This clause of IEC 61558-1:2017 is applicable.

28 Resistance to rusting

This clause of IEC 61558-1:2017 is applicable.

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Annexes

The annexes of IEC 61558-1:2017 are applicable.

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Bibliography

The Bibliography of IEC 61558-1:2017 is applicable, except as follows:

Addition:

IEC 61558 (all parts), *Safety of transformers, reactors, power supply units and combinations thereof*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications*

IEC 61558-2-13, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

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

IEC 62115:2017, *Electric toys – Safety*

ISO/IEC Guide 50:2014, *Safety aspects – Guidelines for child safety in standards and other specifications*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

IEC Guide 117:2010, *Electrotechnical equipment – Temperatures of touchable hot surfaces*

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IEC 61558-2-7

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Safety of transformers, reactors, power supply units and combinations thereof – Part 2-7: Particular requirements and tests for transformers and power supply units for toys

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 2-7: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour jouets

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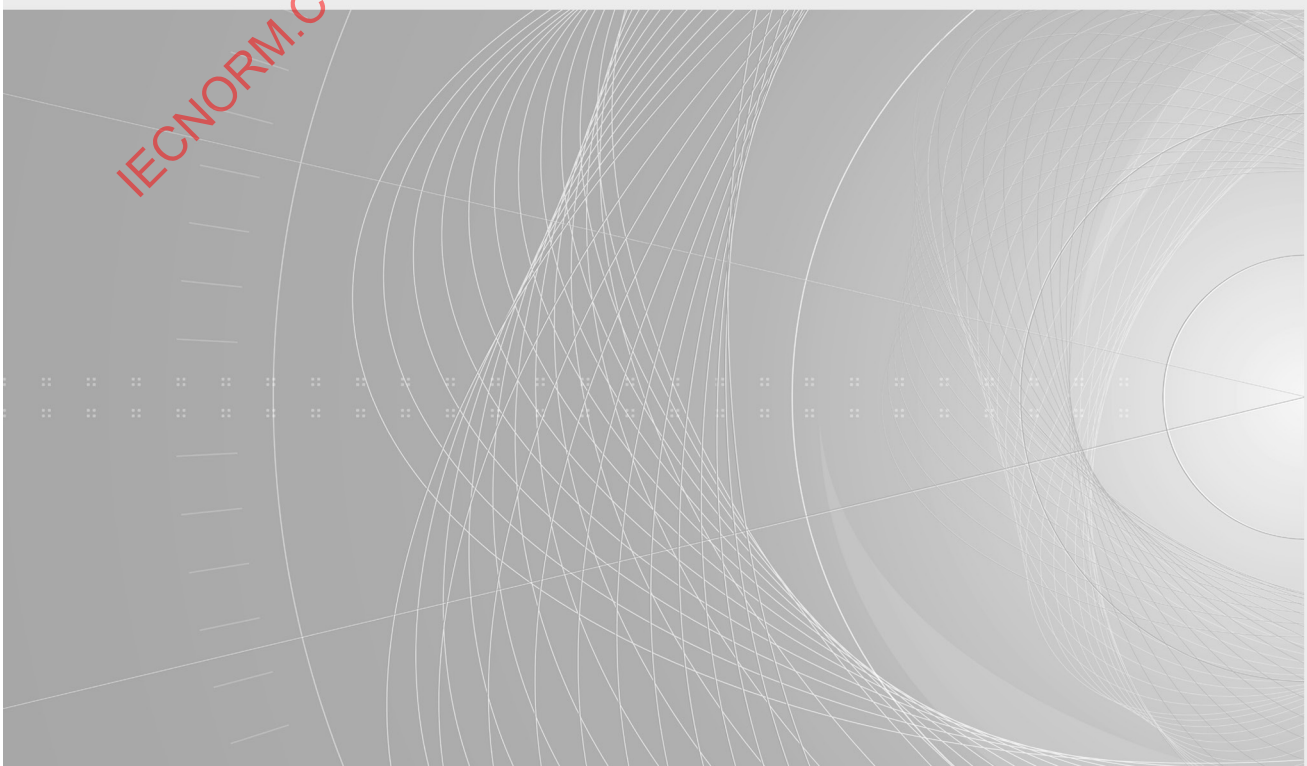

IEC 61558-2-7:2023-06(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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.

IEC 61558-2-7 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 2007. 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) new symbol for power supply unit with linearly regulated output voltage.

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

Draft	Report on voting
96/579/FDIS	96/581/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 International Standard 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/publications.

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

This International Standard 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 toys.*

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

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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, 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 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.

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

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

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **transformers for toys** and **power supply units** incorporating **transformers for toys**. **Transformers for toys** 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 toys and **power supply units** incorporating **transformers** for toys.

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

This document is applicable to **independent transformers** and **transformers for specific use**.

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.

The **rated supply voltage** does not exceed 250 V AC. The **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **rated output** does not exceed 200 VA and a **rated output current** does not exceed 10 A.

The **no-load output voltage** does not exceed 33 V AC or 46 V ripple-free DC, and the **rated output voltage** does not exceed 24 V AC or 33 V ripple-free DC.

In general, this document does not take into consideration children playing with the **transformers**.

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

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;

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- for transformers for toys intended to be used as a battery charger for use with children additional requirements can apply.

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

This clause of IEC 61558-1:2017 is applicable except as follows:

Addition:

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

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1:2003, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

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

IEC 61558-2-16, *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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61558-1:2017 apply, except as follows:

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

Addition:

3.1.101
transformer for toys
independent safety isolating transformer designed to supply toys not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V AC

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3.1.102
power supply unit for toys
power supply unit incorporating a **transformer for toys** not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V AC or 33 V ripple-free DC

4 General requirements

This clause of IEC 61558-1:2017 is applicable.

5 General notes on tests

This clause of IEC 61558-1:2017 is applicable.

6 Ratings

This clause of IEC 61558-1:2017 is applicable except as follows:

Addition:

6.101 The **rated output voltage** shall not exceed 24 V AC or 33 V ripple-free DC.

6.102 The **rated output** shall not exceed 200 VA.

6.103 The **rated supply frequency** shall not exceed 500 Hz.

6.104 There shall be only one **rated supply voltage** not exceeding 250 V AC.

6.105 The **rated output current** shall not exceed 10 A.

Compliance with the requirements of 6.101 to 6.105 is checked by inspection of the marking.

7 Classification

This clause of IEC 61558-1:2017 is applicable, except as follows:

7.1

Replacement:

According to their protection against electric shock:

– **class II transformers**.

7.2

Replacement:

According to short-circuit protection or protection against abnormal conditions:

- **inherently short-circuit proof transformers;**
- **non-inherently short-circuit-proof transformers;**
- **fail-safe transformers.**

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7.4

Replacement:

According to their mobility:

- **portable transformers;**
- **stationary transformers.**

7.5

Replacement:

According to their duty type:

- **continuous operation.**

7.8

Replacement:

According to their transient overvoltage condition:

- **overvoltage category II.**

8 Marking and other information

This clause of IEC 61558-1:2017 is applicable, except as follows:

8.1

h)

Replacement of the content up to the first semi-colon by the following:

relevant graphical symbols shown in Table 101 that indicate the kind of **transformer**.

m)

Replacement:

transformers suitable for outdoor use shall be marked with the appropriate degree of protection (IP code);

8.11

Addition:

The symbol for linear **power supply units** shall be used in conjunction with the symbol indicating the kind of **transformer**.

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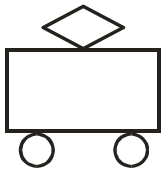
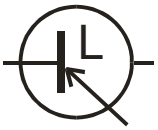
Table 101 – Symbols indicating the kind of transformer

Symbol or graphical symbol	Explanation or title	Identification
	**Safety isolating tranformers for toys** **(Inherently short-circuit proof transformers, non-inherently short-circuit proof transformers or fail-safe transformers)** To indicate a **fail-safe** function, the letter F may be used adjacent of the graphical symbol.	IEC 60417-5219:2006-12
	**Power supply unit, linear**	IEC 60417-6210:2013-10

Addition:

8.101

The instructions for use shall include the following statement or equivalent:

Instructions to parents: ”Transformers and power supply units for toys are not intended to be used as toys, and the use of these products by children shall be under the full supervision of parents.”

8.102

The instructions for use of transformers using power supply cords with the degree of protection IP65 shall include the following statement or equivalent:

Instructions to parents: ”This transformer or power supply unit for toys is not intended for permanent outdoor usage and for instance rain conditions shall be avoided.”

9 Protection against electric shock

This clause of IEC 61558-1:2017 is applicable except as follows:

9.2.2 Accessibility to hazardous-live-parts

Modification:

The standard test finger of Figure 4 is replaced by the small test finger of Figure 101.

Addition:

It shall not be possible to gain access to **live parts** of the **input circuit** or to the metal parts separated from live parts by **basic insulation** only, even after removal of the covers that can be removed with the aid of a tool.

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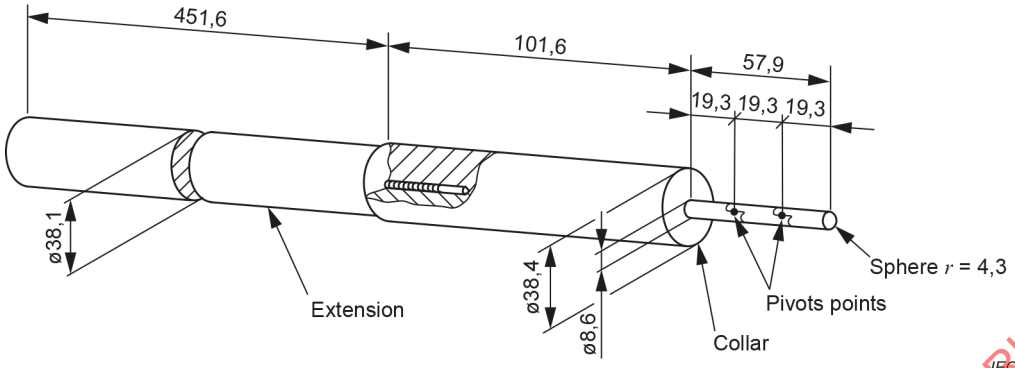
Dimensions in millimetres



where

Material is metal

Tolerances on dimensions are ±0,125 mm

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0° to 10° tolerance

Figure 101 – Small test finger

10 Change of input voltage setting

This clause of IEC 61558-1:2017 is applicable, except as follows:

Replacement:

Transformers shall have only one **rated supply voltage** or one **rated supply voltage range**.

Compliance is checked by inspection.

11 Output voltage and output current under load

This clause of IEC 61558-1:2017 is applicable except as follows:

11.1

Modification:

When the **transformer** is connected to the **rated supply voltage**, at the **rated supply frequency** and loaded with an impedance resulting in the **rated output** at the **rated output voltage** and, for an AC rated power factor, the **output voltage** shall not differ from the rated value by more than 10 % for AC or 15 % for DC.

This requirement is applicable to all the **output windings** and their tappings.

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12 No-load output voltage

This clause of IEC 61558-1:2017 is applicable, except as follows:

Addition:

12.101 The **no-load output voltage** shall not exceed 33 V AC or 46 V ripple-free DC. For toy transformers, this output voltage limitation applies even when **output windings** not intended for interconnection are connected in series.

12.102 The difference between the **no-load output voltage** and the output voltage under load shall not be excessive.

The ratio between the **no-load output voltage** measured in Clause 12 and the **output voltage** under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed 10 % for AC or 15 % for DC.

The ratio is determined by Formula (1):

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100(\%) \quad (1)$$

where

$U_{\text{no-load}}$ is the no-load output voltage, expressed in V;

U_{load} is the output voltage under load, expressed in V.

*Compliance with the requirements of 12.101 and 12.102 is checked by measuring the **no-load output voltage** at the **ambient temperature** when the **transformer** is connected to **the rated supply voltage** at the **rated supply frequency**.*

13 Short-circuit voltage

This clause of IEC 61558-1:2017 is not applicable.

14 Heating

This clause of IEC 61558-1:2017 is applicable, except as follows:

Modification:

Replace the requirements for external **enclosures** of Table 2 of **stationary transformers** by the following:

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Table 2 – Values of maximum temperatures in normal use

Parts	Temperature °C
External **enclosures** (which can be touched with the small test finger of Figure 101), handles and the like, if made of	
– metal;	58
– other material.	71
External **enclosures** (which cannot be touched with the small test finger of Figure 101).	85

15 Short circuit and overload protection

This clause of IEC 61558-1:2017 is applicable, except as follows:

15.1.1 Short circuit and overload test method

Addition:

Transformers shall be of either **short-circuit-proof** or **fail-safe** construction. **Short-circuit-proof transformers** shall withstand overloads that can occur during normal use. They shall not incorporate fuses.

If the short-circuit output current exceeds 20 A, a non-self-resetting overload protective device shall be incorporated.

Non-self-resetting overload protective devices, if any, shall be incorporated in the **input circuit**.

Replace the requirements for external **enclosures** of Table 5 by the following:

Table 5 – Maximum values of temperatures under short-circuit or overload conditions

Parts	Maximum temperature °C
External **enclosures** (which can be touched with the small test finger of Figure 101), if made of	
– metal;	58
– other material.	71

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Addition:

15.3.101 *The **transformer** having a short-circuit output current exceeding 20 A shall be connected to the **rated supply voltage** in the cold condition (i.e., as received and in the normal room ambient), and each **output circuit** or winding shall be short-circuited, one at a time, while the other windings or **output circuits** are open-circuited.*

*Only the **output circuits** with a short-circuit current exceeding 20 A shall be short-circuited in the case of more than one output current.*

The overload protective device shall operate within 1 s.

15.5.2 *Modification of the first dash as follows:*

– *the temperature of any part of the* ***enclosure*** *of the* ***fail-safe transformer*** *that can be touched with the small test finger of Figure 101 shall not exceed*

- *58 °C if made of metal;*
- *71 °C if made of other material.*

16 Mechanical strength

This clause of IEC 61558-1:2017 is applicable, except as follows:

16.1 General

Replacement of the second paragraph as follows:

Compliance is checked by the test of 16.2 for ***stationary transformers*** *and by the tests of 16.2, 16.3, 16.4, and 16.101, as appropriate, for* ***portable transformers****.*

Dimensions in millimetres

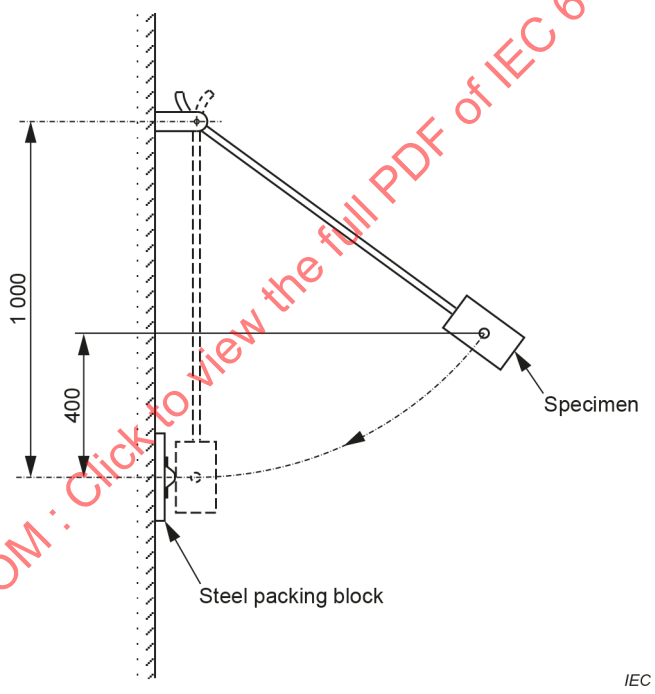

Figure 102 – Arrangement for impact test for transformers (see 16.101)

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Addition:

16.101 *In addition,* ***transformers*** *are subjected to the following test:*

The ***transformer*** *is dropped against a steel bar mounted on a solid wall of brick, stone, concrete or the like, as shown in Figure 102.*

The bar is of 40 mm × 40 mm × 5 mm right-angle section with the corner rounded to a radius of 5 mm. It is mounted in contact with the wall, or, if necessary, in contact with a steel packing block which is in contact with the wall.

*The **transformer** is suspended by its flexible cable or cord so that it rests against the corner of the bar, the point of suspension being 1 m above the bar. It is then drawn away from the bar in a plane perpendicular to the wall until it has risen through a height of 400 mm.*

*The **transformer** is allowed to fall against the bar. For **transformers** shaped as a cube or parallelogram, one blow is applied to each of the six sides of the **transformer**; for **transformers** shaped differently, one blow is applied to each similarly exposed side.*

*The steel packing block is only necessary if the shape of the **transformer** is such that, without it, the **transformer** does not hit the bar.*

*In addition, the **transformer** is allowed to fall freely from a height of 400 mm onto a steel plate, at least 5 mm thick, placed on a flat concrete base.*

*The number of falls is 10 times with the **transformer** cable mounted as in normal use, and the orientation of the **transformer** is different for each fall.*

*After the test, the **transformer** shall show no damage within the meaning of this document. In particular, live parts shall not become accessible.*

17 Protection against harmful ingress of dust, solid objects and moisture

This clause of IEC 61558-1:2017 is applicable.

18 Insulation resistance, dielectric strength and leakage current

This clause of IEC 61558-1:2017 is applicable, except as follows:

Addition:

18.101 The **touch current** shall in no operating condition exceed the values of Table 15.

NOTE Certain **transformer** types can have high initial **touch current** when first switched on, which does not decrease rapidly in a low-load condition.

19 Construction

This clause of IEC 61558-1:2017 is applicable, except as follows:

19.1 General construction

Replacement:

The **input** and **output circuits** shall be electrically separated from each other and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other metal parts, except by deliberate action.

Compliance is checked by inspection and measurements, taking Clause 18 and Clause 26 into consideration.

19.1.101 The **insulation** between the **input** and **output winding(s)** shall consist of **double** or **reinforced insulation**. In addition, the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body** shall consist of **double** or **reinforced insulation**.

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19.1.102 For **transformers** with **intermediate conductive parts** (for example, the iron core), not connected to the **body** and located between the **input** and **output windings**, the **insulation** between the **intermediate conductive part** and the **input windings** or between the **intermediate conductive part** and the **output windings** shall consist of at least **basic insulation**.

NOTE An **intermediate conductive part,** not separated from the **input** or **output windings** or the **body** by at least **basic insulation**, is considered to be connected to the relevant part(s).

In addition, the **insulation** between the **input** and **output windings**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**; the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**.

Addition:

19.101 **Transformers** shall comply with the requirements for degree of protection IP4X or higher with the exception of output terminals.

Transformers for outdoor use shall have a degree of protection of IP65 / IP67 or higher.

Compliance is checked by the tests of Clause 17.

19.102 There shall be no connections between the **output circuit** and the protective earth.

19.103 There shall be no connections between the **output circuit** and the **body**.

Compliance is checked by inspection.

19.104 The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier and it shall be of insulating material and be permanently fixed to the **transformer**.

*Compliance is checked by inspection and by measurement disregarding **intermediate conductive parts**.*

19.105 **Transformers** shall be class II.

19.106 **Transformers** shall not be fixed to or incorporated in toys.

Compliance is checked by inspection.

19.107 **Transformers** with AC terminals in the **output circuit** shall be designed such that when

– the **output circuits** of two or more **transformers** are connected together, and
– the **input circuit** of at least one of the **transformers** is connected to the mains supply, and
– the **input circuit** of at least one of the **transformers** is not connected to the mains supply,

the voltage across the bare pins of the plug of the **transformers** not connected to the mains supply shall not exceed 33 V AC.

*Compliance is checked by measurement of the voltage between the pins of the plug when the **output circuit** is supplied by the **rated output voltage(s)**.*

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20 Components

This clause of IEC 61558-1:2017 is applicable, except as follows:

20.5

Addition:

Transformers shall not be provided with switches connected to the flexible supply cables or cords.

20.6

Addition:

Socket-outlets in the **output circuit** of the **transformers** and plugs accepted by those socket-outlets shall not be interchangeable with plugs and socket outlets listed in IEC TR 60083. This requirement is not applicable to socket-outlets with corresponding plugs which are too large to be introduced into the mains socket outlets or that are too small so they can only be loosely inserted and do not stay firmly in place in the socket outlet aperture while in contact with the supply mains.

Socket-outlets for connectors such as jack types, USB types, RCA phono types with a diameter or diagonal measurement between 3,75 mm and 5,25 mm and length greater than 7 mm are considered to fail this requirement.

Compliance is checked by inspection.

20.8.1

Modification:

For **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices, the number of cycles of operation is increased from 300 to 1 000.

Addition:

20.101 It shall be possible to reset the **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices without removing their covers.

*Compliance is checked by short-circuiting the output terminals and connecting the **transformer** to the **rated supply voltage** until the device operates. If more than one set of output terminals are provided, each set shall be tested separately.*

*It shall not be possible to maintain the **thermal cut-out** or the overload protective device in the "ON" position by operating the resetting means.*

After removal of the short circuit, it shall be possible to put the overload protective device in the "ON" position without removing any covers. If necessary, after cooling.

20.102 Control devices, if any, shall be in the **output circuit** and shall operate reliably.

Compliance is checked by inspection and by the following test:

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*The control is operated 5 000 times. Each time from one extreme end of the range to the other at a uniform rate of approximately 30 cycles per minute with the **transformer** connected to the **rated supply voltage** and loaded with the **rated output current** at unity power factor.*

*During this test, no interruption of the current shall occur. After the test, the temperatures of the **transformer** windings shall not exceed the values specified in 14.2, and the no-load input current shall not alter by a short-circuit placed between the turns of the windings of the **output circuit**.*

20.103 The operating means of control devices, if any, shall not be affixed to the **transformers** with the exception of **transformers** for toy railway applications.

NOTE In Denmark, the exception of 20.103 is not applicable.

21 Internal wiring

This clause of IEC 61558-1:2017 is applicable.

22 Supply connection and other external flexible cable or cords

This clause of IEC 61558-1:2017 is applicable, except as follows:

22.5

Modification:

Power supply cords of **transformers** complying with the requirements for degree of protection IP4X or IP65 shall not be lighter than ordinary tough rubber sheathed cord (code designation 60245 IEC 53 of IEC 60245-1) or ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53 of IEC 60227-1).

Power supply cords of **transformers** with the degree of protection of IP67 shall not be lighter than ordinary polychloroprene sheathed cord (code designation 60245 IEC 57 of IEC 60245-1).

22.6

Replacement:

Appliance couplers are not allowed in the **input circuits** of **transformers**.

22.7

Modification:

For **transformers** having a mass greater than 500 g excluding the cable or cord, the cross-sectional area of the supply cable or cord shall be at least 1 mm².

22.9

Modification:

Power supply cords can be connected to the **transformers** by **type Y** and **type Z attachments**. **Type X attachment** is not allowed.

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23 Terminals for external conductors

This clause of IEC 61558-1:2017 is applicable.

24 Provisions for protective earthing

This clause of IEC 61558-1:2017 is not applicable.

25 Screws and connections

This clause of IEC 61558-1:2017 is applicable.

26 Creepage distances, clearances and distances through insulation

This clause of IEC 61558-1:2017 is applicable.

27 Resistance to heat, fire and tracking

This clause of IEC 61558-1:2017 is applicable.

28 Resistance to rusting

This clause of IEC 61558-1:2017 is applicable.

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Annexes

The annexes of IEC 61558-1:2017 are applicable.

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Bibliography

The Bibliography of IEC 61558-1:2017 is applicable, except as follows:

Addition:

IEC 61558 (all parts), *Safety of transformers, reactors, power supply units and combinations thereof*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications*

IEC 61558-2-13, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-13: Particular requirements and tests for auto-transformers and power supply units incorporating auto-transformers for general applications*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

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

IEC 62115:2017, *Electric toys – Safety*

ISO/IEC Guide 50:2014, *Safety aspects – Guidelines for child safety in standards and other specifications*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

IEC Guide 117:2010, *Electrotechnical equipment – Temperatures of touchable hot surfaces*

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SOMMAIRE

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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

Partie 2-7: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour jouets

AVANT-PROPOS

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L'IEC 61558-2-7 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 2007. 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.

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

Projet	Rapport de vote
96/579/FDIS	96/581/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 cette Norme internationale est l'anglais.

Ce 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/publications.

Il a le statut de publication groupée de sécurité conformément au Guide 104 de l'IEC.

La présente Norme internationale doit être utilisée 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 jouets.*

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 ce 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

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INTRODUCTION

Le CE 96 de l'IEC a une fonction groupée de sécurité, conformément au Guide 104 de l'IEC relatif aux transformateurs autres que ceux destinés à alimenter les réseaux de distribution, notamment les transformateurs et les blocs d'alimentation destinés à permettre l'application de mesures de protection contre les chocs électriques, comme cela est défini par le CE 64, mais en incluant également dans certains cas la limitation de la tension et de la fonction de sécurité horizontale pour la TBTS, conformément à l'IEC 60364-4-41.

La fonction groupée de sécurité (GSF, *Group Safety Function*) est utilisée en raison 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 secondaire assignée.

Un autotransformateur conforme à l'IEC 61558-2-13 peut par exemple être conçu avec un circuit TBTS séparé, conformément aux exigences particulières de l'IEC 61558-2-6 liées aux exigences générales de l'IEC 61558-1.

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

Partie 2-7: Exigences particulières et essais pour les transformateurs et blocs d'alimentation pour jouets

1 Domaine d'application

Remplacement:

La présente partie de l'IEC 61558 traite de la sécurité des **transformateurs pour jouets** et des **blocs d'alimentation** qui incorporent des **transformateurs pour jouets**. Les **transformateurs pour jouets** 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 jouets** et les **blocs d'alimentation** qui incorporent des **transformateurs pour jouets**.

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

Le présent document s'applique aux **transformateurs indépendants** et aux **transformateurs pour usage spécifique**.

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 en contradiction, c'est la plus sévère qui prévaut.

La **tension primaire assignée** ne dépasse pas 250 V en courant alternatif. La **fréquence primaire assignée** et les **fréquences de fonctionnement interne** ne dépassent pas 500 Hz.

La **puissance assignée** ne dépasse pas 200 VA et un **courant secondaire assigné** ne dépasse pas 10 A.

La **tension secondaire à vide** ne dépasse pas 33 V en courant alternatif ou 46 V en courant continu lissé, et la **tension secondaire assignée** ne dépasse pas 24 V en courant alternatif ou 33 V en courant continu lissé.

En général, le présent document ne prend pas en considération l'emploi des **transformateurs** comme jouet par des enfants.

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

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;

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- mesures qui visent à protéger l'**enveloppe** et les composants à l'intérieur de l'enveloppe contre les influences externes, telles que les champignons, la vermine, les termites, le rayonnement solaire 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;
- exigences supplémentaires qui peuvent s'appliquer aux **transformateurs pour jouets** destinés à être utilisés comme chargeur de batterie par des enfants.

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 centrée sur les recommandations de sécurité est essentiellement destinée à être utilisée en tant que norme de sécurité des produits pour les produits mentionnés 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 analogues à ceux mentionnés 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'étude 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.

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2 Références normatives

L'article de l'IEC 61558-1:2017 s'applique, avec l'exception suivante:

Addition:

IEC TR 60083, *Prises de courant pour usages domestiques et analogues normalisées par les pays membres de l'IEC*

IEC 60227-1:2007, *Conducteurs et câbles isolés au polychlorure de vinyle, de tension nominale au plus égale à 450/750 V – Partie 1: Exigences générales*

IEC 60245-1:2003, *Conducteurs et câbles isolés au caoutchouc – Tension assignée au plus égale à 450/750 V – Partie 1: Exigences générales*

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, *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*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 61558-1:2017 s'appliquent, avec les exceptions suivantes:

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse https://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

Addition:

3.1.101
transformateur pour jouets
transformateur de sécurité indépendant destiné à l'alimentation de jouets, non fixé à ni incorporé dans un jouet, et dont la **tension secondaire assignée** ne dépasse pas 24 V en courant alternatif

3.1.102
bloc d'alimentation pour jouets
bloc d'alimentation qui incorpore un **transformateur pour jouets**, non fixé à ni incorporé dans un jouet, et dont la **tension secondaire assignée** ne dépasse pas 24 V en courant alternatif ou 33 V en courant continu lissé

4 Exigences générales

L'article de l'IEC 61558-1:2017 s'applique.

5 Généralités sur les essais

L'article de l'IEC 61558-1:2017 s'applique.

6 Caractéristiques assignées

L'article de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

Addition:

6.101 La **tension secondaire assignée** ne doit pas dépasser 24 V en courant alternatif ou 33 V en courant continu lissé.

6.102 La **puissance assignée** ne doit pas dépasser 200 VA.

6.103 La **fréquence primaire assignée** ne doit pas dépasser 500 Hz.

6.104 Il ne doit y avoir qu'une seule **tension primaire assignée** qui ne dépasse pas 250 V en courant alternatif.

6.105 Le **courant secondaire assigné** ne doit pas dépasser 10 A.

La conformité aux exigences énoncées du 6.101 au 6.105 est vérifiée par examen du marquage.

7 Classification

L'article de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

7.1

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Remplacement:

D'après leur protection contre les chocs électriques:

- **transformateurs de classe II**.

7.2

Remplacement:

D'après la protection contre les courts-circuits ou la protection contre une utilisation anormale:

- **transformateurs résistants aux courts-circuits par construction;**
- **transformateurs résistants aux courts-circuits par dispositif incorporé;**
- **transformateurs non dangereux en cas de défaillance.**

7.4

Remplacement:

D'après leur mobilité:

- **transformateurs mobiles;**
- **transformateur installé à poste fixe.**

7.5

Remplacement:

D'après leur type de service:

- **service permanent.**

7.8

Remplacement:

D'après leur condition de surtension transitoire:

- **catégorie de surtension II**.

8 Marquage et indications

L'article de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

8.1

h)

Remplacement du contenu jusqu'au premier point-virgule par le texte suivant:

les symboles graphiques correspondants représentés dans le Tableau 101, qui indiquent le type de **transformateur**.

m)

Remplacement:

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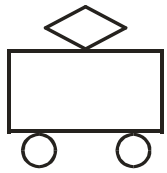
les **transformateurs** qui sont utilisables à l'extérieur doivent être marqués du degré de protection approprié (code IP);

8.11

Addition:

Le symbole des **blocs d'alimentation** linéaires doit être utilisé conjointement avec le symbole qui indique le type de **transformateur**.

Tableau 101 – Symboles qui indiquent le type de transformateur

Symbole ou symbole graphique	Explication ou titre	Identification
	**Transformateurs de sécurité pour jouets** **(Transformateurs résistants aux courts-circuits par construction, transformateurs résistants aux courts-circuits par dispositif incorporé** ou **transformateurs non dangereux en cas de défaillance**) La lettre F peut être utilisée à côté du symbole graphique pour indiquer une fonction **non dangereuse en cas de défaillance**.	IEC 60417-5219 (2006-12)
	**Bloc d'alimentation linéaire**	IEC 60417-6210 (2013-10)

Addition:

8.101

Les instructions d'utilisation doivent inclure l'indication suivante ou une indication équivalente:

Instructions destinées aux parents: "Les transformateurs et blocs d'alimentation pour jouets ne sont pas destinés à être utilisés comme jouets, et l'utilisation de ces produits par des enfants doit se faire sous la stricte surveillance des parents."

8.102

Les instructions d'utilisation des transformateurs qui utilisent des câbles d'alimentation dont le degré de protection est IP65 doivent inclure l'indication suivante ou une indication équivalente:

Instructions destinées aux parents: "Ce transformateur ou bloc d'alimentation pour jouets n'est pas destiné à un usage permanent à l'extérieur, et l'exposition à la pluie doit par exemple être évitée."

9 Protection contre les chocs électriques

L'article de l'IEC 61558-1:2017 s'applique, avec les exceptions suivantes:

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