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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 2-20: Particular requirements and tests for small reactors

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et combinaisons de ces éléments – Partie 2-20: Exigences particulières et essais pour les petites bobines d'inductance



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

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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IEC 61558-2-20 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and combinations thereof. It is an International Standard.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

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

a) Adjustment of structure and references in accordance with IEC 61558-1:2017.
b) Additional Annex AA with references for characteristic parameter measurements.
c) Additional Annex BB for associated reactors with frequencies above 500 Hz.
d) Additional Annex CC for partial discharge.

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

Draft	Report on voting
96/556/FDIS	96/564/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 small reactors.*

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.

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.

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

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

1 Scope

Replacement

This part of IEC 61558 deals with the safety of **small reactors** for general applications. **Small reactors** 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** or **reactor** covers **small reactors**.

This document is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) general purpose **reactors** including alternating current, premagnetised and current compensated **independent** or **associated dry-type reactors.** The windings can be encapsulated or non-encapsulated.

The **rated supply voltage** does not exceed 1 000 V AC or 1 500 V ripple-free DC, the **rated supply frequency** and the **internal operating frequencies** do not exceed 100 MHz.

This document can be used for **reactors** with a fundamental frequency above 500 Hz (see Annex BB).

The **rated power** does not exceed:

– 25 kVAR AC (25 kW DC) for single-phase **reactors**,
– 50 kVAR AC (50 kW DC) for poly-phase **reactors**.

This document is applicable to **reactors** without limitation of the **rated power** subject to an agreement between the purchaser and the manufacturer.

This document does not apply to:

– **reactors** covered by IEC 60076-6 for rated voltages above 1 000 V;
– ballast for tubular fluorescent covered by IEC 61347-2-8;
– ballast for discharge lamps (excluding tubular fluorescent lamps) covered by IEC 61347-2-9.
– fixed inductors for electromagnetic interference suppression covered by IEC 60938 series

NOTE 2 For **reactors** filled with liquid dielectric or pulverised material such as sand, additional requirements are under consideration.

NOTE 3 Normally, **reactors** are intended to be associated with equipment for functional requirements of the equipment or requirements by the installation rules or by other appliance specifications. The protection against electric shock may be provided or completed by other parts or features of the equipment, such as the **body**.

NOTE 4 **Reactors** for particular applications will in the future be covered by complementary normative annexes.

Attention is drawn to the following if necessary:

– for **reactors** 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 **reactors**;
– additional requirements in accordance with other appropriate standards and national rules may be applicable to **reactors** intended for use in special environments.

Future technological development of **reactors** may necessitate a need to increase the upper limit of the frequencies. Until then, this document may 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 60076-6:2007, *Power transformers – Part 6: Reactors*

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

IEC 61558-2-16:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 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.

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

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

Modification

Where IEC 61558-1:2017 is applicable, the word "**transformer**", if used, shall be replaced by "**reactor**".

3.1 Transformers

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

Addition

3.1.101
alternating current reactor
reactor in which the magnetising current generates an alternating magnetic field, changing its polarity depending on the frequency

3.1.102
premagnetised reactor
reactor in which the magnetising direct current generates a magnetic field of only one polarity, while a superimposed alternating current alters the direct magnetic field depending on its strength and the frequency

3.1.103
current compensated reactor
reactor with at least two windings on a common core, where the magnetising currents are in opposite directions in order to reduce the magnetic flux

Replacement

3.1.9
overload proof reactor
reactor in which the temperature does not exceed the specified limits when the **reactor** is overloaded and continues to meet all requirements of this document after the removal of the overload

3.1.9.1
non-inherently overload proof reactor
overload proof reactor equipped with a protective device which opens the circuit, or reduces the current in the circuit when the **reactor** is overloaded, and which continues to meet all requirements of this document after the removal of the overload and resetting or replacing of the protective device

Note 1 to entry: Examples of protective devices are fuses, **overload releases**, thermal fuses, **thermal links**, **thermal cut-outs,** PTC resistors, and automatic circuit-breakers.

Note 2 to entry: In case of protection by a device which cannot be replaced nor re-set, the wording "continues to meet all requirements of this document after removal of the overload" does not imply that the **reactor** continues to operate.

3.1.9.2
inherently overload proof reactor
overload proof reactor not equipped with a device to protect the **reactor** and in which the temperature in the case of overload, by construction, does not exceed the specified limits and which continues to operate and meet all the requirements of this document after the removal of the overload

3.1.10
non-overload proof reactor
reactor which is intended to be protected against excessive temperature by means of a protective device not provided with the **reactor** and which continues to meet all the requirements of this document after the removal of the overload and resetting or replacing of the protective device

3.1.11
fail-safe reactor
reactor which, after abnormal use, permanently fails to function by an interruption of the failing circuit but presents no danger to the user or surroundings

3.5 Ratings

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

Replacement

3.5.4
rated current
rated current, assigned to the **reactor** by the manufacturer including harmonics, if any, which influence the heating of the **reactor**

Addition

3.5.101
rated power
sum of the products of the **rated voltage drop** and the **rated current** at the **rated frequency** for the different windings

3.5.102
rated inductance
inductance of the **reactor** designed by the manufacturer for the specified operating condition of the **reactor**

Note 1 to entry: The specific operating conditions of DC **reactors** are determined by the DC component and the superimposed AC component.

3.5.103
rated resistance
DC **resistance** of a winding of a **reactor** designed by the manufacturer for the specified operating conditions of the **reactor**

3.5.104
rated voltage drop
voltage across a winding of the **reactor** at the **rated current** and the **rated frequency** assigned by the manufacturer

3.6 No-load values

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

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.