IEC 61558-2-20

Edition 2.0 2010-06

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 des combinaisons de ces éléments – Partie 2-20: Règles particulières et essais pour les petites bobines d'inductance

IEC 61558-2-20:2010

Documents
Document Sharing Hub
Full document details: IEC 61558-2-20 2010

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2010 IEC, Geneva, Switzerland

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

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

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

About IEC publications

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

- Catalogue of IEC publications: www.iec.ch/searchpub
The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.
- IEC Just Published: www.iec.ch/online_news/justpub
Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.
- Electropedia: www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.
- Customer Service Centre: www.iec.ch/webstore/custserv
If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm
Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.
- Just Published CEI: www.iec.ch/online_news/justpub
Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.
- Electropedia: www.electropedia.org
Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.
- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

IEC 61558-2-20

Edition 2.0 2010-06

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 des combinaisons de ces éléments – Partie 2-20: Règles particulières et essais pour les petites bobines d'inductance

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX
Q

ICS 29.180

ISBN 978-2-88912-038-3

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

CONTENTS

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

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

This second edition cancels and replaces the first edition published in 2000. It constitutes a technical revision. The main changes consist of updating this part in accordance with IEC 61558-1:2005.

This part has the status of a group safety publication in accordance with IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*.

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

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

FDIS	Report on voting
96/356/FDIS	96/363/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

This part is intended to be used in conjunction with the latest edition of IEC 61558-1 and its amendments. It is based on the second edition (2005) of that standard.

This part supplements or modifies the corresponding clauses in IEC 61558-1, so as to convert that publication into the IEC standard: *Particular requirements and tests for small reactors.*

A list of all parts of the IEC 61558 series, 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 a particular subclause of Part 1 is not mentioned in this part, that subclause applies as far as is reasonable. Where this part states "addition", "modification" or "replacement", the relevant text of Part 1 is to be adapted accordingly.

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

Subclauses, notes, figures and tables additional to those in Part 1 are numbered starting from 101; supplementary annexes are entitled AA, BB, etc.

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

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

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months from the date of publication.

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

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**.**

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** or **reactor** covers **small reactors**.

This part 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 reactors**.

The **rated supply voltage** does not exceed 1 000 V a.c. or 1 500V ripple-free d.c., the **rated supply frequency** and the **internal operational frequencies** do not exceed 1 MHz.

The **rated power** does not exceed:

– 25 kVAR a.c. (25 kW d.c.) for single-phase **reactors,**
– 50 kVAR a.c. (50 kW d.c.) for poly-phase **reactors.**

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

This part is applicable to **dry-type reactors**. The windings may be encapsulated or non-encapsulated.

This part does not apply to:

– **reactors** covered by IEC 60289;
– ballast for tubular fluorescent covered by IEC 61347-2-8;
– ballast for discharge lamps (excluding tubular fluorescent lamps) covered by IEC 61347-2-9.

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

NOTE 3 Attention is drawn to the following:

- for **reactors** 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 **reactor** should also be considered;

AVA Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

- additional requirements in accordance with other appropriate standards and national rules may be applicable to **reactors** intended for use in special environments, such as tropical environment.

NOTE 4 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.

NOTE 5 **Reactors** incorporating **electronic circuits** and components are also covered by this standard.

NOTE 6 The protection against electric shock may be provided (or completed) by other parts or features of the equipment, such as the **body**.

NOTE 7 **Reactors** for particular applications will in the future be covered by complementary normative annexes.

NOTE 8 Future technological development of **reactors** may necessitate a need to increase the upper limit of the frequencies, until then this part may be used as a guidance document.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

3 Terms and definitions

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

Modification:

Where Part 1 is applicable, the word "**transformer**", if used, shall be replaced by "**reactor**".

Addition:

3.1.101
reactor
arrangement comprising one or more windings with an impedance depending on the frequency, working in accordance with the principle of self-induction whereby a magnetising current generates a magnetic field through a magnetically effective core or through air

NOTE **Reactors** with toroidal core are also included in this definition.

3.1.102
alternating current reactor
reactor in which the magnetising current generates an alternating magnetic field, changing its polarity depending on the frequency

3.1.103
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

3.1.104
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

Documents
Document Sharing Hub
Full document details: IEC 61558-2-20 2010

3.1.105
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 standard after the removal of the overload

3.1.105.1
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 standard after the removal of the overload and resetting or replacing of the protective device

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

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

3.1.105.2
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 standard after the removal of the overload

3.1.106
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 standard after the removal of the overload and resetting or replacing of the protective device

3.1.107
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

3.4 Circuits and windings

This subclause of Part 1 is not applicable.

3.5 Ratings

This subclause of Part 1 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

AVA Documents
Document Sharing Hub
Full document details: IEC 61558-2-20 2010

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

NOTE The specific operating conditions of d.c. **reactors** are determined by the d.c. component and the superimposed a.c. component.

3.5.103
rated resistance
d.c. **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 Part 1 is not applicable.

3.7 Insulation

This subclause of Part 1 is applicable.

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

Replacement:

6.1 The **rated supply voltage** shall not exceed 1 000 V a.c or 1 500 V ripple-free d.c..

6.2 The **rated power** shall not exceed 25 kVAR a.c. (25 kW d.c.) for single-phase **reactors** and 50 kVAR a.c. (50 kW d.c.) for poly-phase **reactors,** except for **reactors** subject to an agreement between the purchaser and the manufacturer.

6.3 The **rated supply frequency** and the **internal operational frequencies** does not exceed 100 MHz.

6.4 The values of **rated inductance** and **rated resistance** shall be given at the rated ambient temperature, under no load conditions, and the tolerance shall be declared by the manufacturer.

Compliance with the requirements of 6.1 to 6.4 is checked by inspection of the marking.

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

7 Classification

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

7.1 *Replacement:*

According to their protection against electric shock:

– class I **reactors**;
– class II **reactors**;
– class III **reactors**.

NOTE **Incorporated reactors** are not classified; their degree of protection against electric shock is determined by the way in which the **reactors** are incorporated.

7.2 *Replacement:*

According to the protection against abnormal use:

– **inherently overload proof reactors;**
– **non-inherently overload proof reactors;**
– **non overload proof reactors;**
– **fail-safe reactors.**

8 Marking and other information

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

8.1 *Replacement:*

Reactors shall be marked with the following parameters:

a) **rated supply voltage** in volts (V);
b) **rated supply frequency** (ies) in Hertz (Hz):
c) **rated voltage drop** in volts (V) only for a.c. reactors;
d) **rated power** in VAR or kVAR for a.c., in watts (W) or kilowatts (kW) for d.c.;
e) **rated current** and harmonics, if any, in amperes (A) or milliamperes (mA);
f) symbol or abbreviation DC for nature of direct current, if applicable;
g) symbol or abbreviation AC for nature of alternating current, if applicable;
h) **rated inductance** of the winding(s) in henries (H) or millihenries (mH) for **reactors** followed by the appropriate tolerance;

NOTE 1 Only one of the values c), d) or h) needs to be marked, as the others can be calculated from the given values.

i) the **reactor** shall be marked with one of the graphical symbol shown in 8.11;
j) **rated resistance** of the winding(s) in ohms (Ω) or milliohms (mΩ) followed by the appropriate tolerance;

NOTE 2 The marking j) may be given in the literature instead of being marked.

k) model or type references;
l) name or trademark of the manufacturer or responsible supplier;

Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010

m) indication of the protection index IP, if other than IP00;

n) rated maximum ambient temperature t_a, if other than 25 °C;

NOTE 3 It is recommended that the values of t_a are given in steps of 5 °C for $t_a \leq 50$ °C and in steps of 10 °C for $t_a > 50$ °C.

o) **rated minimum ambient temperature** t_{amin}, if lower than +10 °C and if a temperature sensitive device is used;

NOTE 4 It is recommended that the values of t_{amin} are given in steps of 5 °C.

p) duty cycle, if any, unless the operating time is limited by the construction of the **reactor** or corresponds to the operating conditions. The marking of **short-time duty cycle** or **intermittent duty cycle** shall correspond to normal use. The operating time for **reactors** with short-time duty shall be expressed in seconds (s) or minutes (min); the operating time and the resting time of **reactors** with **intermittent duty cycle** shall be expressed in seconds (s) or minutes (min), separated by an oblique stroke;

q) switching frequency (ies) of the supplying frequency inverter;

r) **reactors** to be used with forced air cooling where the fan is not a part of the **reactor** shall be marked with "AF" followed by the air speed, expressed in m/s;

s) symbol for **class II** construction, for **class II reactors** only;

t) symbol for **class III** construction, for **class III reactors** only.

NOTE 5 Additional markings are allowed provide they do not give rise to misunderstanding.

8.4 *Replacement:*

Reactors with tapped or multiple windings shall be clearly marked in accordance with 8.1.

8.5 *Replacement:*

Reactors which are declared to be **overload proof reactors** and comply with the requirements for such **reactors** shall be marked with the symbol for **overload proof reactors**.

Non-inherently overload proof reactors with incorporated fuses and **non overload proof reactors** designed to be protected by fuses shall, in addition, be marked with the **rated current** in amperes or milliamperes of the protecting fuse-link, followed or preceded by the symbol for the time current characteristics of the fuse in accordance with the relevant standard, if applicable.

Non-inherently overload proof reactors with incorporated replaceable protective devices other than fuses and **non overload proof reactor** designed to be protected with protective devices other than fuses shall, in addition, be marked with the manufacturer's model or type reference of the device, and/or ratings of the device.

NOTE **Overload proof reactors** with non-replaceable devices need no additional marking regarding the protective device.

The marking shall be sufficient to ensure correct replacement of the protective device.

When replaceable protective devices other than fuses are used, appropriate information about their replacement shall be provided in an instruction sheet or the equivalent accompanying the **reactor**.

Reactors declared to be **fail-safe reactors** and comply with the requirements for such **reactors** shall be marked with the symbol for **fail-safe reactors**.

AVA Documents
Document Sharing Hub

Full document details: IEC 61558-2-20 2010