IEC 61558-2-4

Edition 2.0 2009-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et produits analogues pour des tensions d'alimentation jusqu'à 1 100 V – Partie 2-4: Règles particulières et essais pour les transformateurs de séparation des circuits et les blocs d'alimentation incorporant des transformateurs de séparation des circuits

IEC 61558-2-4:2009

Documents
Document Sharing Hub
Full document details: IEC 61558-2-4 2009

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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 61558-2-4 2009

IEC 61558-2-4

Edition 2.0 2009-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers

Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et produits analogues pour des tensions d'alimentation jusqu'à 1 100 V – Partie 2-4: Règles particulières et essais pour les transformateurs de séparation des circuits et les blocs d'alimentation incorporant des transformateurs de séparation des circuits

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX N

ICS 29.180

ISBN 978-2-88910-540-3

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

Documents
Document Sharing Hub

Full document details: IEC 61558-2-4 2009

CONTENTS

FOREWORD ... 3
1 Scope ... 5
2 Normative references ... 6
3 Terms and definitions ... 6
4 General requirements ... 6
5 General notes on tests ... 6
6 Ratings ... 6
7 Classification ... 7
8 Marking and other information ... 7
9 Protection against electric shock ... 7
10 Change of input voltage setting ... 7
11 Output voltage and output current under load ... 7
12 No-load output voltage ... 8
13 Short-circuit voltage ... 8
14 Heating ... 9
15 Short-circuit and overload protection ... 9
16 Mechanical strength ... 9
17 Protection against harmful ingress of dust, solid objects and moisture ... 9
18 Insulation resistance, dielectric strength and leakage current ... 9
19 Construction ... 9
20 Components ... 11
21 Internal wiring ... 11
22 Supply connection and other external flexible cable or cords ... 11
23 Terminals for external conductors ... 11
24 Provisions for protective earthing ... 11
25 Screws and connections ... 12
26 Creepage distances, clearances and distances through insulation ... 12
27 Resistance to heat, fire and tracking ... 12
28 Resistance to rusting ... 12
Annexes ... 13
Annex C Creepage distances (cr), clearances (cl) and distances through insulation (dti) Material group II (400 ≤CTI <600) ... 13
Annex D Creepage distances (cr), clearances (cl) and distances through insulation (dti) Material group I (CTI ≥600) ... 13
Annex R Explanations of the application of 4.2 of IEC 60664-1:2007 (see IEC 61558-1 Subclause 26.2) ... 13
Bibliography ... 14

Table 101 – Output voltage difference ... 8

Documents
Document Sharing Hub
Full document details: IEC 61558-2-4 2009

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND SIMILAR PRODUCTS FOR SUPPLY VOLTAGES UP TO 1 100 V –

Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may Participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also Participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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 61558-2-4 has been prepared by IEC technical committee 96: Transformers, reactors, power supply units and similar products for low voltages up to 1 100 V.

This second edition cancels and replaces the first edition published in 1997. It constitutes a technical revision. The main changes consist of updating this part in accordance with Part 1 (2005), and increasing the supply voltages up to 1 100 V to be in line with the standards of TC 14.

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*.

AVA Documents
Document Sharing Hub

Full document details: IEC 61558-2-4 2009

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

FDIS	Report on voting
96/316/FDIS	96/321/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 isolating transformers and power supply units incorporating isolating transformers.*

A list of all parts of the IEC 61558 series can be found on the IEC website under the title: *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V*.

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 maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- 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 61558-2-4 2009

SAFETY OF TRANSFORMERS, REACTORS, POWER SUPPLY UNITS AND SIMILAR PRODUCTS FOR SUPPLY VOLTAGES UP TO 1 100 V –

Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers

1 Scope

Replacement:

This part of IEC 61558 deals with the safety of **isolating transformers** for general applications and **power supply units** incorporating **isolating transformers** for general applications. **Transformers** incorporating **electronic circuits** are also covered by this standard.

NOTE 1 Safety includes electrical, thermal and mechanical aspects.

Unless otherwise specified, from here onward, the term **transformer** covers **isolating transformers** for general applications and **power supply units** incorporating **isolating transformers** for general applications.

NOTE 2 For **power supply units** (linear) this part is applicable. For **switch mode power supply units,** IEC 61558-2-16 is applicable together with this part.

This part is applicable to **stationary** or **portable**, single-phase or polyphase, air-cooled (natural or forced) **independent** or **associated dry- type transformers.** The windings may be encapsulated or non-encapsulated.

The **rated supply voltage** does not exceed 1 100 V a.c., and the **rated supply frequency** and the **internal operating frequencies** do not exceed 500 Hz.

The **rated output** does not exceed:

– 25 kVA for single-phase **transformers;**
– 40 kVA for polyphase **transformers.**

This part is applicable to **transformers** without limitation of the **rated output** subject to an agreement between the purchaser and the manufacturer.

NOTE 3 **Transformers** intended to supply distribution networks are not included in the scope.

The **no-load output voltage** or the **rated output voltage** does exceed 50 V a.c. or 120 V ripple-free d.c., and where applicable, does not exceed 500 V a.c. or 708 V ripple-free d.c.

The **no-load output voltage** and the **rated output voltage** may be up to 1 000 V a.c. or 1 415 V ripple-free d.c. for special applications.

This part is not applicable to external circuits and their components intended to be connected to the input terminals and output terminals of the **transformers**.

Transformers covered by this part are used in applications where **double or reinforced insulation** between circuits is required by the installation rules or by the end product standard.

AVA Documents
Document Sharing Hub

Full document details: IEC 61558-2-4 2009

NOTE 4 Attention is drawn to the following:

- for **transformers** 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** should also be considered;
- additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers** intended for use in special environments.

NOTE 5 Future technological development of **transformers** 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.

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

This clause of Part 1 is applicable.

Addition:

6.101 The **rated output voltage** shall exceed 50 V a.c. or 120 V ripple-free d.c. but not exceed;

– 250 V a.c. for single-phase **portable transformers**;
– 400 V a.c. for polyphase **portable transformers**, and
– 500 V a.c. or 708 V ripple-free d.c. for other **transformers**. In this case, the **rated output voltage** may be up to 1 000 V a.c. or 1 415 V ripple-free d.c. to be in accordance with the national wiring rules or for a special purpose. This output voltage limitation apply even when output windings, not intended for interconnection, are connected in series.

6.102 The **rated output** shall not exceed:

– 25 kVA for single-phase **transformers;**
– 40 kVA for polyphase **transformers;**

Documents
Document Sharing Hub
Full document details: IEC 61558-2-4 2009

Transformers without limitation of the rated output shall be subject to agreement between the purchaser and the manufacturer.

6.103 The **rated supply frequency** and the **internal operating frequencies** shall not exceed 500 Hz.

6.104 The **rated supply voltage** shall not exceed 1 100 V a.c.

Compliance with the requirements of 6.101 to 6.104 is checked by inspection of the marking.

7 Classification

This clause of Part 1 is applicable.

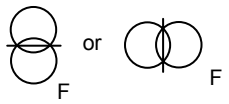
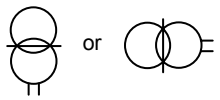
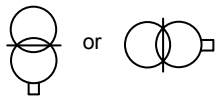
8 Marking and other information

This clause of Part 1 is applicable except as follows:

8.1 h) *Replacement*:

Replace the first sentence by the following: relevant graphical symbols shown in 8.11 indicating the kind of **transformer**;

8.11 *Addition:*

Symbol or Graphical symbol	Explanation or title	Identification
	**Fail-safe isolating transformer**	60417-5221
	**Non-short-circuit-proof isolating transformer**	60417-5944
	**Short-circuit-proof isolating transformer** (inherently or non-inherently)	60417-5945

9 Protection against electric shock

This clause of Part 1 is applicable.

10 Change of input voltage setting

This clause of Part 1 is applicable.

11 Output voltage and output current under load

This clause of Part 1 is applicable.

Documents
Document Sharing Hub

Full document details: IEC 61558-2-4 2009

12 No-load output voltage

This clause of Part 1 is applicable except as follows:

Addition:

The **no-load output voltage** is measured when the **transformer** is connected to the **rated supply voltage** at the **rated supply frequency** at ambient temperature defined by Part 1.

12.101 The **no-load output voltage** shall exceed 50 V a.c. or 120 V ripple-free d.c. but not exceed:

– 300 V a.c. for single-phase **portable transformers**;
– 500 V a.c. for polyphase **portable transformers**, and
– 500 V a.c. or 708 V ripple-free d.c. for other **transformers**. In this case, the **no-load output voltage** may be up to 1 000 V a.c. or 1 415 V ripple-free d.c. to be in accordance with the national wiring rules or for special purpose.

For **independent 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 is expressed as a percentage of the latter voltage calculated according to the following formula:

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

where $U_{\text{no-load}}$ is the no-load output voltage and U_{load} is the output voltage under load.

*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**.*

The difference shall not exceed the values shown in Table 101.

Table 101 – Output voltage difference

Type of transformer Rated output VA	Difference between no-load output voltage and output voltage under load %
Up to and including 63	20
Over 63 up to and including 250	15
Over 250 up to and including 630	10
Over 630	5

13 Short-circuit voltage

This clause of Part 1 is applicable.

Documents
Document Sharing Hub
Full document details: IEC 61558-2-4 2009

14 Heating

This clause of Part 1 is applicable.

15 Short-circuit and overload protection

This clause of Part 1 is applicable.

16 Mechanical strength

This clause of Part 1 is applicable.

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

This clause of Part 1 is applicable.

18 Insulation resistance, dielectric strength and leakage current

This clause of Part 1 is applicable.

19 Construction

This clause of Part 1 is applicable except as follows:

Replace 19.1 by the following:

19.1 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 **conductive parts**, except by deliberate action.

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

19.1.1 The insulation between **input** and **output winding(s)** shall consist of **double** or **reinforced insulation** (rated for the **working voltage**) unless the requirements in 19.1.3 are complied with:

In addition, the following applies:

– for **class I transformers** not intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** connected to earth shall consist of at least **basic insulation** rated for the **input voltage**. The insulation between the **output windings** and the **body** connected to earth, shall consist of at least **basic insulation** (rated for the **output voltage**);

– for **class I transformers** intended for connection to the mains supply by means of a plug, the insulation between the **input windings** and the **body** shall consist of at least **basic insulation**, and the insulation between the **output windings** and the **body** shall consist of at least **supplementary insulation** (both basic and supplementary insulations rated for the **working voltage**);

– for **class II transformers**, the insulation between the **input windings** and the **body** shall consist of **double** or **reinforced insulation** (rated for the **input voltage**). The insulation between the **output windings** and the **body**, shall consist of **double** or **reinforced insulation** (rated for the **output voltage**).

AVA Documents
Document Sharing Hub

Full document details: IEC 61558-2-4 2009