IEC 61557-13

Edition 1.0 2011-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 13: Hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems

Sécurité électrique dans les réseaux de distribution basse tension de 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection – Partie 13: Pinces et capteurs de courant portatifs et manipulés à la main pour la mesure des courants de fuite dans les réseaux de distribution électriques

IEC 61557-13:2011

Documents
Document Sharing Hub
Full document details: IEC 61557-13 2011

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 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 61557-13 2011

IEC 61557-13

Edition 1.0 2011-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 13: Hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems

Sécurité électrique dans les réseaux de distribution basse tension de 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection – Partie 13: Pinces et capteurs de courant portatifs et manipulés à la main pour la mesure des courants de fuite dans les réseaux de distribution électriques

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX R

ICS 17.220.20; 29.080.01; 29.240.01

ISBN 978-2-88912-571-5

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

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
4 Requirements 9
4.1 General 9
4.2 Operating classes 9
4.2.1 General 9
4.2.2 Operating class 1 9
4.2.3 Operating class 2 9
4.2.4 Operating class 3 9
4.3 Measuring range / percentage operating uncertainty of reading 9
4.3.1 General 9
4.3.2 Measuring range of an operating class 1 current sensor 10
4.3.3 Measuring range of an operating class 2 current sensor 10
4.3.4 Measuring range of an operating class 3 current sensor 10
4.4 Reference conditions 12
4.5 Minimum rated operating conditions 13
4.6 Mechanical requirements 15
4.7 Pollution degree 15
4.8 Measurement category 15
4.9 Electromagnetic compatibility (EMC) 15
5 Marking and operating instructions 15
5.1 Marking 15
5.2 Operating instructions 16
6 Tests 16
6.1 Type tests 16
6.1.1 Electrical safety 16
6.1.2 Variations 16
6.1.3 Percentage operating uncertainty 17
6.1.4 Marking and operating instructions 17
6.2 Routine tests 17
6.2.1 Intrinsic uncertainty 17
6.2.2 Marking and operating instructions 17
Annex A (informative) Examples of measurement applications 18
Bibliography 19

Figure 1 – Percentage operating uncertainty in relation to operating class and external magnetic field for measuring ranges less than or equal to 10 mA 11
Figure 2 – Percentage operating uncertainty in relation to operating classes and external magnetic field and measuring ranges greater than10 mA 12
Figure 3 – Reference position for two straight conductors (for differential method) 13
Figure 4 – Example of operating positions for differential method 15
Figure 5 – Example for an applicable pictogram for operating class 1 16

AVA Documents
Document Sharing Hub
Full document details: IEC 61557-13 2011

Figure A.1 – Example for measurement of protective conductor current – Direct method 18
Figure A.2 – Example for measurement of leakage current including protective conductor current – Differential method 18

Table 1 – Relation of external field and operating class 10
Table 2 – Calculation of percentage operating uncertainty 14

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V a.c. AND 1 500 V d.c. – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

Part 13:Hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems

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 61557-13 has been prepared by IEC technical committee TC85: Measuring equipment for electrical and electromagnetic quantities.

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

FDIS	Report on voting
85/387/FDIS	85/391/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.

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

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

This part is to be used in conjunction with IEC 61557-1:2007.

A list of all parts of the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing,measuring or monitoring of protective measures,* can be found on the IEC website.

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.

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

INTRODUCTION

During periodical inspections of electrical installations, it is increasingly difficult to carry out measurements of insulation resistances with devices according to IEC 61557-2 when the installations cannot be switched off for long periods and when there are sensitive appliances connected. Therefore, the measurement of leakage currents can provide additional information about the safe or unsafe situation of an installation.

Furthermore, the user has the opportunity to place current clamps and sensors on different points of the distribution system for troubleshooting nuisance tripping of RCDs, alarms of RCMs and other problems caused by low frequency leakage currents.

Unfortunately, the presence of high external magnetic fields has a big impact on the performance of commonly used current clamps and sensors. High uncertainty and non-repeatability of readings can lead to unsafe interpretations.

This standard defines performance classes for current clamps and sensors in relationship to ranges of high external magnetic fields and gives guidance to the user to choose the appropriate measuring device for a given situation.

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V a.c. AND 1 500 V d.c. – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

Part 13:Hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems

1 Scope

This part of IEC 61557 defines special performance requirements for hand-held and hand-manipulated current clamps and sensors for measurement of leakage currents in electrical distribution systems up to 1 000 V a.c. and 1 500 V d.c., taking into account the influence of high external low-frequency magnetic fields and other influencing quantities. This standard does not apply to current clamps or sensors which are used in combination with devices for insulation fault location according to IEC 61557-9, unless it is specified by the manufacturer.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*

IEC 61010-2-030, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits*

IEC 61010-2-032:2002, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-032: Particular requirements for hand-held and hand-manipulated current sensors for electrical test and measurement*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61326-2-2, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*

IEC 61557-1:2007, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 61557-1 and the following definitions apply.

AVA Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

3.1
hand-held and hand-manipulated current clamps and sensors
portable or hand-held device for measurement, display or for indication of types of leakage currents in distribution systems without interruption of these circuits including defined attached equipment

NOTE In the following text, only the expression "current sensors" is used.

3.2
fixing device
device to fix the position of a conductor in relation to the current sensors

3.3
measurement category
coordination of maximum transients to the working voltage according to IEC 61010-2-030

3.4
variation E_{11}
variation due to external low frequency magnetic fields

3.5
variation E_{12}
variation due to load current during measurement using the differential method (see Annex A, Figure A.2)

3.6
variation E_{13}
variation due to touch current caused by common mode voltage during hand-manipulation

3.7
variation E_{14}
variation due to frequency

3.8
variation E_{15}
repeatability of the measurement readings due to at least 10 open / close cycles

3.9
operating class
performance class defining the influence of external low frequency magnetic fields on the current sensors (see 4.2)

3.10
leakage current
current driven by active conductors of a distribution system and/or loads to earth and/or protective conductors

[IEC 60050-195:1998, 195-05-15, modified]

3.11
load current
current flowing through the line conductor/s

3.12
rated burden
the value of the burden on which the accuracy requirements of a specification are based

[IEC 60050-321:1986, 321-01-26]

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

4 Requirements

4.1 General

The following requirements as well as those given in IEC 61557-1 shall apply.

Current sensors according to this standard shall comply with IEC 61010-2-032.

Current sensors according to this standard shall have the ability to measure leakage currents from 1 mA to 10 A a.c. and/or d.c. as a minimum and shall be designed for a load current of at least 60 A. Multiple ranges are allowed.

The resolution shall be 0,1 mA a.c. and/or d.c or better.

The indicated current values shall be r.m.s. values.

The frequency range of the current sensors shall include the range beginning at 40 Hz up to the third harmonic of the rated mains frequency at the minimum.

NOTE 1 For railway applications a frequency range beginning at 15 Hz is recommended.

NOTE 2 For industrial applications a frequency range up to 1 kHz is recommended.

NOTE 3 For testing the leakage current of appliances a measuring range starting at 0,1 mA with a resolution of 0,01 mA is recommended.

4.2 Operating classes

4.2.1 General

According to their sensitivity for low frequency magnetic fields according to IEC 61000-4-8 within the range of 15 Hz up to 400 Hz, current sensors are classified into 3 operating classes.

4.2.2 Operating class 1

Current sensors of operating class 1 shall be applicable to operate within external low frequency magnetic fields according to 4.2.1 up to a field strength of 100 A/m. The upper limit of field strength shall be marked on the pictogram according to 5.1.

4.2.3 Operating class 2

Current sensors of operating class 2 shall be applicable to operate within external low-frequency magnetic fields according to 4.2.1 up to a field strength of 30 A/m. The upper limit of field strength shall be marked on the pictogram according to 5.1.

4.2.4 Operating class 3

Current sensors of operating class 3 shall be applicable to operate within external low frequency magnetic fields according to 4.2.1 up to a field strength of 10 A/m. The upper limit of field strength shall be marked on the pictogram according to 5.1.

4.3 Measuring range / percentage operating uncertainty of reading

4.3.1 General

Percentage operating uncertainty of current sensors of operating class 1, operating class 2 and operating class 3 shall be determined according to the equation of Table 2 within the operating conditions of 4.4. The relation between operating class and external magnetic field is shown in Figure 1, Figure 2 and Table 1.

Documents
Document Sharing Hub

Full document details: IEC 61557-13 2011

The fiducial value is the measured value of the leakage current.

4.3.2 Measuring range of an operating class 1 current sensor

The measuring range of an operating class 1 current sensor is the range of indicated values between stated lower and upper measurements for which the percentage operating uncertainty of reading is:

– less than 15 % for values less than or equal to 10 mA, and is less than 10 % for values greater than 10 mA for external low frequency magnetic fields of up to 10 A/m;

  and

– less than 20 % for values less than or equal to 10 mA and is less than 12.5 % for values greater than 10 mA for external low frequency magnetic fields of up to 30 A/m;

  and

– less than 30 % for values less than or equal to 10 mA, and is less than 15 % for values greater than10 mA for external low frequency magnetic fields of up to 100 A/m.

4.3.3 Measuring range of an operating class 2 current sensor

The measuring range of an operating class 2 current sensor is the range of indicated values between stated lower and upper measurements for which the percentage operating uncertainty of reading is:

– less than 15 % for values less than or equal to 10 mA and is less than 10 % for values greater than10 mA for external low frequency magnetic fields of up to 10 A/m;

  and

– less than 20 % for values less than or equal to 10 mA and is less than 12,5 % for values greater than 10 mA for external low frequency magnetic fields of up to 30 A/m.

4.3.4 Measuring range of an operating class 3 current sensor

The measuring range of an operating class 3 instrument is the range of indicated values between stated lower and upper measurements for which the percentage operating uncertainty of reading is:

– less than 15 % for values less than or equal to 10 mA and is less than 10 % for values greater than10 mA for external low frequency magnetic fields of up to 10 A/m.

Table 1 – Relation of external field and operating class

External field strength	10 A/m	30A/m	100A/m
Percentage operating uncertainty of reading ≤10 mA	15%	20%	30%
Percentage operating uncertainty of reading >10 mA	10%	12,5 %	15%
Operating class 1 current sensor	✔	✔	✔
Operating class 2 current sensor	✔	✔	-
Operating class 3 current sensor	✔	-	-

Documents
Document Sharing Hub
Full document details: IEC 61557-13 2011

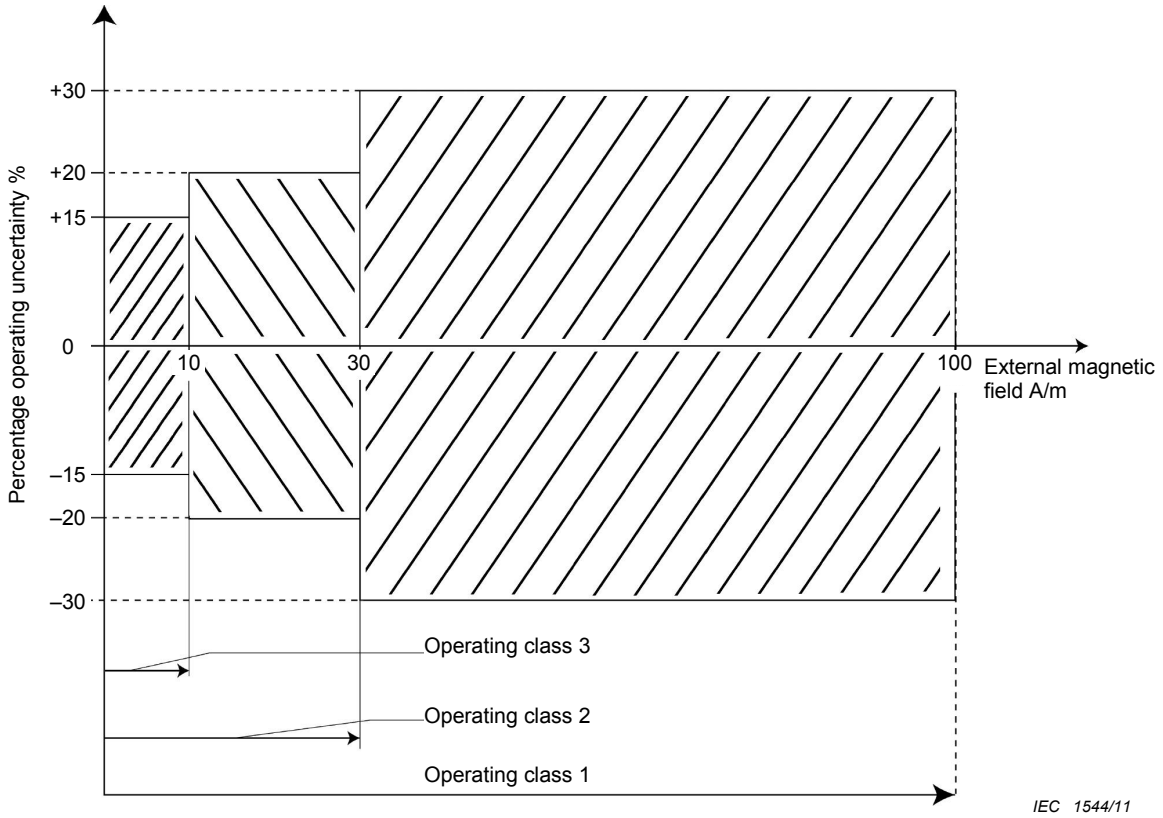

Figure 1 – Percentage operating uncertainty in relation to operating class and external magnetic field for measuring ranges less than or equal to 10 mA

Documents
Document Sharing Hub
Full document details: IEC 61557-13 2011