

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Instrument transformers –
Part 2: Additional requirements for current transformers**

**Transformateurs de mesure –
Partie 2: Exigences supplémentaires concernant les transformateurs de courant**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2012 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 Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
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.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

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 de la 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.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Instrument transformers –
Part 2: Additional requirements for current transformers**

**Transformateurs de mesure –
Partie 2: Exigences supplémentaires concernant les transformateurs de courant**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XB**
CODE PRIX

ICS 17.220.20

ISBN 978-2-83220-293-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	8
3.1 General definitions	8
3.3 Definitions related to current ratings	9
3.4 Definitions related to accuracy	10
3.7 Index of abbreviations	13
5 Ratings.....	20
5.3 Rated insulation levels.....	20
5.3.2 Rated primary terminal insulation level	20
5.3.5 Insulation requirements for secondary terminals.....	20
5.3.201 Inter-turn insulation requirements	20
5.5 Rated output.....	20
5.5.201 Rated output values	20
5.5.202 Rated resistive burden values	20
5.6 Rated accuracy class.....	21
5.6.201 Measuring current transformers.....	21
5.6.202 Protective current transformers	22
5.6.203 Class assignments for selectable-ratio current transformers	26
5.201 Standard values for rated primary current.....	26
5.202 Standard values for rated secondary current.....	27
5.203 Standard values for rated continuous thermal current	27
5.204 Short-time current ratings	27
5.204.1 Rated short-time thermal current (I_{th})	27
5.204.2 Rated dynamic current (I_{dyn})	27
6 Design and construction	27
6.4 Requirements for temperature rise of parts and components	27
6.4.1 General	27
6.13 Markings	27
6.13.201 Terminal markings.....	27
6.13.202 Rating plate markings.....	28
7 Tests.....	30
7.1 General	30
7.1.2 Lists of tests	30
7.2 Type tests.....	31
7.2.2 Temperature-rise test	31
7.2.3 Impulse voltage withstand test on primary terminals	33
7.2.6 Tests for accuracy.....	33
7.2.201 Short-time current tests	35
7.3 Routine tests	36
7.3.1 Power-frequency voltage withstand tests on primary terminals	36
7.3.5 Tests for accuracy.....	36
7.3.201 Determination of the secondary winding resistance (R_{ct}).....	38
7.3.202 Determination of the secondary loop time constant (T_s)	38

7.3.203	Test for rated knee point e.m.f. (E_k) and exciting current at E_k	39
7.3.204	Inter-turn overvoltage test	39
7.4	Special tests	40
7.4.3	Measurement of capacitance and dielectric dissipation factor	40
7.4.6	Internal arc fault test	40
7.5	Sample tests.....	41
7.5.1	Determination of the remanence factor	41
7.5.2	Determination of the instrument security factor (FS) of measuring current transformers.....	41
Annex 2A (normative)	Protective current transformers classes P, PR.....	42
Annex 2B (normative)	Protective current transformer classes for transient performance	47
Annex 2C (normative)	Proof of low-leakage reactance type	63
Annex 2D (informative)	Technique used in temperature rise test of oil-immersed transformers to determine the thermal constant by an experimental estimation	64
Annex 2E (informative)	Alternative measurement of the ratio error (ε).....	66
Annex 2F (normative)	Determination of the turns ratio error.....	68
Figure 201	– Duty cycles	15
Figure 202	– Primary time constant T_p	16
Figure 203	– Secondary linked flux for different fault inception angles γ	17
Figure 2A.1	– Vector Diagram.....	42
Figure 2A.2	– Error triangle.....	43
Figure 2A.3	– Typical current waveforms	44
Figure 2A.4	– Basic circuit for 1:1 current transformer	44
Figure 2A.5	– Basic circuit for current transformer with any ratio.....	45
Figure 2A.6	– Alternative test circuit	45
Figure 2B.1	– Short-circuit current for two different fault inception angles	48
Figure 2B.2	– $\psi_{\max}(t)$ as the curve of the highest flux values, considering all relevant fault inception angles γ	48
Figure 2B.3	– Relevant time ranges for calculation of transient factor	49
Figure 2B.4	– Determination of K_{tf} in time range 1 at 50 Hz for $T_s = 1,8$ s	50
Figure 2B.5	– Determination of K_{tf} in time range 1 at 60 Hz for $T_s = 1,5$ s	50
Figure 2B.6	– Determination of K_{tf} in time range 1 at 16,7 Hz for $T_s = 5.5$ s	50
Figure 2B.7	– Limiting the magnetic flux by considering core saturation.....	52
Figure 2B.8	– Basic circuit	53
Figure 2B.9	– Determination of remanence factor by hysteresis loop	55
Figure 2B.10	– Circuit for d.c. method.....	56
Figure 2B.11	– Time-amplitude and flux-current diagrams	56
Figure 2B.12	– Recordings with shifted flux base line	57
Figure 2B.13	– Circuit for capacitor discharge method	58
Figure 2B.14	– Typical records for capacitor discharge method	59
Figure 2B.15	– Measurement of error currents	60
Figure 2D.1	– Graphical extrapolation to ultimate temperature rise	65
Figure 2E.1	– Simplified equivalent circuit of the current transformer	66

Table 201 – Limits of ratio error and phase displacement for measuring current transformers (classes 0,1 to 1).....	21
Table 202 – Limits of ratio error and phase displacement for measuring current transformers (classes 0,2S and 0,5S)	22
Table 203 – Limits of ratio error for measuring current transformers (classes 3 and 5).....	22
Table 204 – Characterisation of protective classes	23
Table 205 – Error limits for protective current transformers class P and PR	23
Table 206 – Error limits for TPX, TPY and TPZ current transformers.....	25
Table 207 – Specification Methods for TPX, TPY and TPZ current transformers	26
Table 208 – Marking of terminals	28
Table 10 – List of tests	31

Currently in preview, click buy full version.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSTRUMENT TRANSFORMERS –

Part 2: Additional requirements for current 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 far 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.

This International Standard IEC 61869-2 Ed.1.0 has been prepared by committee 38: Instrument transformers.

This first edition of IEC 61869-2 cancels and replaces the first edition of IEC 60044-1, published in 1996, and its Amendment 1 (2000) and Amendment 2 (2002), and the first edition of IEC 60044-6, published in 1992. Additionally it introduces technical innovations in the standardization and adaptation of the requirements for current transformers for transient performance.

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

FDIS	Report on voting
38/435/FDIS	38/437/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.

A list of all the parts in the IEC 61869 series, published under the general title *Instrument transformers*, can be found on the IEC website.

This Part 2 is to be used in conjunction with, and is based on, IEC 61869-1:2007, *General Requirements* – however the reader is encouraged to use its most recent edition.

This Part 2 follows the structure of IEC 61869-1:2007 and supplements or modifies its corresponding clauses.

When a particular clause/subclause of Part 1 is not mentioned in this Part 2, that clause/subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

For additional clauses, subclauses, figures, tables, annexes or notes, the following numbering system is used:

- clauses, subclauses, tables, figures and notes that are numbered starting from 201 are additional to those in Part 1;
- additional annexes are lettered 2A, 2B, etc.

An overview of the planned set of standards at the date of publication of this document is given below. The updated list of standards issued by IEC TC 8 is available at the website: www.iec.ch.

PRODUCT FAMILY STANDARDS	PRODUCT STANDARD	PRODUCTS	OLD STANDARD
61869-1:2007 GENERAL REQUIREMENTS FOR INSTRUMENT TRANSFORMERS	61869-2	ADDITIONAL REQUIREMENTS FOR CURRENT TRANSFORMERS	60044-1 60044-6
	61869-3	ADDITIONAL REQUIREMENTS FOR INDUCTIVE VOLTAGE TRANSFORMERS	60044-2
	61869-4	ADDITIONAL REQUIREMENTS FOR COMBINED TRANSFORMERS	60044-3
	61869-5	ADDITIONAL REQUIREMENTS FOR CAPACITIVE VOLTAGE TRANSFORMERS	60044-5
	61869-6	ADDITIONAL GENERAL REQUIREMENT FOR ELECTRONIC INSTRUMENT TRANSFORMERS AND LOW POWER STAND ALONE SENSORS	60044-7
	61869-7	ADDITIONAL REQUIREMENTS FOR ELECTRONIC VOLTAGE TRANSFORMERS	60044-7
	61869-8	ADDITIONAL REQUIREMENTS FOR ELECTRONIC CURRENT TRANSFORMERS	60044-8
	61869-9	DIGITAL INTERFACE FOR INSTRUMENT TRANSFORMERS	
	61869-10	ADDITIONAL REQUIREMENTS FOR LOW-POWER STAND-ALONE CURRENT SENSORS	
	61869-11	ADDITIONAL REQUIREMENTS FOR LOW POWER STAND ALONE VOLTAGE SENSOR	60044-7
	61869-12	ADDITIONAL REQUIREMENTS FOR COMBINED ELECTRONIC INSTRUMENT TRANSFORMER OR COMBINED STAND ALONE SENSORS	
	61869-13	STAND ALONE MERGING UNIT	

Since the publication of IEC 60044-6 (*Requirements for protective current transformers for transient performance*) in 1992, the area of application of this kind of current transformers has been extended. As a consequence, the theoretical background for the dimensioning according to the electrical requirements has become much more complex. In order to keep this standard as user-friendly as possible, the explanation of the background information will be transferred to the Technical Report IEC 61869-100 TR, which is now in preparation.

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.

INSTRUMENT TRANSFORMERS –

Part 2: Additional requirements for Current Transformers

1 Scope

This part of IEC 61869 is applicable to newly manufactured inductive current transformers for use with electrical measuring instruments and/or electrical protective devices having rated frequencies from 15 Hz to 100 Hz.

2 Normative references

Clause 2 of IEC 61869-1:2007 is applicable with the following additions:

IEC 61869-1:2007, *Instrument Transformers – Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 61869-1:2007 apply with the following additions:

3.1 General definitions

3.1.201

current transformer

instrument transformer in which the secondary current, under normal conditions of use, is substantially proportional to the primary current and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections

[SOURCE: IEC 60050-321:1986, 321-02-01]

3.1.202

measuring current transformer

current transformer intended to transmit an information signal to measuring instruments and meters

[SOURCE: IEC 60050-321:1986, 321-02-18]

3.1.203

protective current transformer

a current transformer intended to transmit an information signal to protective and control devices

[SOURCE: IEC 60050-321: 1986, 321-02-19)

3.1.204

class P protective current transformer

protective current transformer without remanent flux limit, for which the saturation behaviour in the case of a symmetrical short-circuit is specified

3.1.205

class PR protective current transformer

protective current transformer with remanent flux limit, for which the saturation behaviour in the case of a symmetrical short-circuit is specified