IEC 61869-4

Edition 1.0 2013-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Instrument transformers –
Part 4: Additional requirements for combined transformers

Transformateurs de mesure –
Partie 4: Exigences supplémentaires concernant les transformateurs combinés

IEC 61869-4:2013

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSTRUMENT TRANSFORMERS –

Part 4: Additional requirements for combined transformers

FOREWORD

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This International Standard IEC 61869-4 has been prepared by IEC technical committee 38: Instrument transformers.

This standard replaces IEC 60044-3: Combined transformers.

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

FDIS	Report on voting
38/468/FDIS	38/472/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.

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This standard is Part 4 of IEC 61869, published under the general title *Instrument transformers*.

This Part 4 is to be read in conjunction with, and is based on, IEC 61869-1 *General Requirements* – first edition (2007), IEC 61869-2, *Additional requirements for current transformers* first edition (2012) and IEC 61869-3, *Additional requirements for inductive voltage transformers* first edition (2011) – however, the reader is encouraged to use the most recent edition of these documents.

This Part 4 follows the structure of IEC 61869-1, IEC 61869-2 and IEC 61869-3 and supplements or modifies its corresponding clauses.

When a particular subclause of Part 1, 2 or 3 is not mentioned in this Part 4, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1, 2 or 3 is to be adapted accordingly.

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

– clauses, subclauses, tables and figures that are numbered starting from 401 are additional to those in Part 1, 2 or 3;
– additional annexes are lettered 4A, 4B, 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 TC38 is available at the website: www.iec.ch

The contents of the corrigendum of August 2014 have been included in this copy.

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PRODUCT FAMILY STANDARDS		PRODUCT STANDARD	PRODUCTS	OLD STANDARD
61869-1 GENERAL REQUIREMENTS FOR INSTRUMENT TRANSFORMERS	**61869-6** ADDITIONAL GENERAL REQUIREMENT FOR LOW POWER 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
		61869-7	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 SENSORS	60044-7
		61869-12	ADDITIONAL REQUIREMENTS FOR COMBINED ELECTRONIC INSTRUMENT TRANSFORMER OR COMBINED STAND ALONE SENSORS	
		61869-13	STAND ALONE MERGING UNIT	
		61869-14	ADDITIONAL REQUIREMENTS FOR DC CURRENT TRANSFORMERS	
		61869-15	ADDITIONAL REQUIREMENTS FOR DC VOLTAGE TRANSFORMERS	

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

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INSTRUMENT TRANSFORMERS –

Part 4: Additional requirements for combined transformers

1 Scope

This part of IEC 61869 applies to newly-manufactured combined transformers for use with electrical measuring instruments and electrical protective devices at frequencies from 15 Hz to 100 Hz.

The requirements and tests of this standard, in addition to the requirements and tests of IEC 61869-1, IEC 61869-2 and IEC 61869-3 cover current and inductive voltage transformers that are necessary for combined instrument transformers.

2 Normative references

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

Addition:

IEC 60028, *International Standard of resistance for copper*

IEC 60038, *IEC standard voltages*

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

IEC 61869-2:2012, *Instrument Transformers – Part 2: Additional requirements for current transformers*

IEC 61869-3:2011, *Instrument Transformers – Part 3: Additional requirements for inductive voltage transformers*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given in IEC 61869-1:2007, IEC 61869-2:2012 and IEC 61869-3:2011, as well as the following apply.

3.1 General definitions

3.1.401
combined instrument transformer
instrument transformer consisting of a current and a voltage transformer in the same enclosure

3.1.402
error of voltage transformer
ε_V
ratio error of voltage transformer determined with disconnected current transformer

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3.1.403
phase displacement of voltage transformer
δ_v
phase displacement of voltage transformer determined with disconnected current transformer

3.1.404
voltage induced by rated continuous thermal current
U_v
the voltage induced by the rated continuous thermal current of the current transformer in the voltage transformer defined as a measure of the maximum variation of the voltage error

3.1.405
greatest variation of voltage error
$\Delta\varepsilon_v$
the greatest possible variation of the ratio error of the voltage transformer due to voltage induced by the rated continuous thermal current of the current transformer

3.1.406
greatest variation of phase displacement
$\Delta\delta_v$
the greatest possible variation of the phase displacement of the voltage transformer due to voltage induced by the rated continuous thermal current of the current transformer

3.1.407
absolute value of the variations of voltage error
ε'_v
sum of the absolute values of the ratio error of the voltage transformer and the greatest variation of the voltage error obtained at specified voltage

3.1.408
absolute value of the variations of phase displacement of voltage transformer
δ'_v
sum of the absolute values of the phase displacement of the voltage transformer and the greatest variation of the phase displacement obtained at specified voltage

3.1.409
voltage induced at rated short-time thermal current
U_e
the voltage induced by the short-time thermal current of the current transformer in the voltage transformer and marked on the rating plate

3.1.410
error of current transformer
ε_i
ratio error of current transformer determined with unexcited voltage transformer

3.1.411
phase displacement of current transformer
δ_i
phase displacement of current transformer determined with unexcited voltage transformer

3.1.412
voltage generated in the current transformer by capacitive current
U_i
voltage generated in the current transformer by capacitive current due to applied voltage of the voltage transformer and defined as a measure of the maximum variation of the current error

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3.1.413
greatest variation of current error
$\Delta\varepsilon_i$
the greatest possible variation of the ratio error of the current transformer due to voltage generated in the current transformer by capacitive current

3.1.414
greatest variation of phase displacement
$\Delta\delta_i$
the greatest possible variation of the phase displacement of the current transformer due to voltage generated in the current transformer by capacitive current

3.1.415
absolute value of the variations of current error
ε'_i
sum of the absolute values of the ratio error of the current transformer and the greatest variation of the current error obtained at specified current

3.1.416
absolute value of the variations of phase displacement of current transformer
δ'_i
sum of the absolute values of the phase displacement of the current transformer and the greatest variation of the phase displacement obtained at specified current

3.7 Index of abbreviations and symbols

Replacement:

ε_v	error of voltage transformer
δ_v	phase displacement of the voltage transformer
U_v	voltage induced by the rated continuous thermal current
$\Delta\varepsilon_v$	the greatest variation of the voltage error
U_{sr}	rated secondary voltage
$\Delta\delta_v$	the greatest variation of the phase displacement of the voltage transformer
ε'_v	the absolute value of the variations of the voltage error
δ'_v	the absolute value of the variations of the phase displacement of voltage transformer
I_{th}	rated short-time thermal current
I_{cth}	rated continuous thermal current
U_e	the voltage induced at rated short-time thermal current
ε_i	error of current transformer
δ_i	phase displacement of the current transformer
U_i	voltage generated in the current transformer by capacitive current
$\Delta\varepsilon_i$	the greatest variation of the current error
$\Delta\delta_i$	the greatest variation of the phase displacement of the current transformer
ε'_i	the absolute value of the variations of the current error
δ'_i	the absolute value of the variations of the phase displacement of current transformer
I_{sr}	rated secondary current

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4 Normal and special service conditions

Clause 4 of IEC 61869-1:2007 is applicable.

5 Ratings

Clause 5 of IEC 61869-1:2007, Clause 5 of IEC 61869-2:2012 and Clause 5 of IEC 61869-3:2011 are applicable with the following modifications:

Additional subclause:

5.401 Additional requirements for measuring and protective combined transformer

5.401.1 General

The error limits for measuring combined transformers shall correspond to the requirements for measuring current transformers, indicated in 5.6.201 of IEC 61869-2:2012, and to the requirements for measuring voltage transformers indicated in 5.6.301 of IEC 61869-3:2011. The limits of error for protective combined transformers shall correspond to the requirements for protective current transformers indicated in 5.6.202 of IEC 61869-2:2012, and to the requirements for protective voltage transformers indicated in 5.6.302 of IEC 61869-3:2011.

5.401.2 Mutual influence

When operating the current transformer between 5 % of the rated current and the rated continuous thermal current, the voltage transformer shall not exceed the limits of voltage error and phase displacement corresponding to its class within the specified range of burden and between 80 % and 120 % of the rated voltage.

When operating the voltage transformer between 80 % of the rated voltage and the rated voltage multiplied by the rated voltage factor, the current transformer shall not exceed the limits of current error and phase displacement within the range of current corresponding to its class and within the specified range of burden.

See 7.2.6.401 and 7.2.6.402 and Annex 4A.

6 Design and construction

Clause 6 of IEC 61869-1:2007, Clause 6 of IEC 61869-2:2012 and Clause 6 of IEC 61869-3:2011 are applicable with the following modifications:

6.4 Requirements for temperature rise of parts and components

6.4.1 General

Subclause 6.4.1 of IEC 61869-2:2012 is applicable with the following modifications:

Addition:

The temperature rise of a combined instrument transformer shall not exceed the appropriate values of 6.4 of IEC 61869-1:2007, if a voltage as indicated in 7.2.2 of IEC 61869-3:2011, is applied to it and the current transformer is carrying a primary current equal to the rated continuous thermal current. The current transformer is connected to a unity power factor burden corresponding to the rated output and with the voltage transformer being loaded at rated burden, or at the highest rated burden if there are several rated burdens, and at a power factor between 0,8 lagging and unity. The additional tolerance of 10 K proposed in some

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cases for the voltage transformers (see clause 7.2.2 of IEC 61869-3:2011) is also applicable for the current transformers of the combined instrument transformers.

6.13 Markings

Additional subclauses:

6.13.401 Terminal markings

The terminals of the current and voltage transformer parts of combined instrument transformers shall be marked in the same way as for individual transformers as specified in 6.13.201 of IEC 61869-2:2012 and 6.13.301 of IEC 61869-3:2011.

6.13.402 Rating plate marking

6.13.402.1 General rules

The specifications for the current transformer according to 6.13.202 of IEC 61869-2:2012 and the voltage transformer according to 6.13.302 of IEC 61869-3:2011 shall be marked separately on the rating plate.

6.13.402.2 Marking of the rating plate of a combined transformer

The voltage transformer shall carry on the rating plate the value of the voltage U_e induced by the r.m.s. value of the rated short-time thermal current flowing through the current transformer, when the primary winding of the voltage transformer is short-circuited. The induced voltage is measured at the terminals of the secondary winding of the voltage transformer loaded with 15 VA or the rated burden.

NOTE Instead of the voltage U_e induced by the r.m.s. value of the rated short-time thermal current, the rating plate can carry the indication of the proportion of the induced voltage to the current flowing through the current transformer in millivolts per kiloampere.

7 Tests

Clause 7 of IEC 61869-1:2007, Clause 7 of IEC 61869-2:2012 and Clause 7 of IEC 61869-3:2011 are applicable with the following modifications:

7.1 General

7.1.2 List of tests

Replacement of Table 10:

Table 10 – List of tests

Tests	Subclause
Type tests	**7.2**
Temperature-rise test	7.2.2
Impulse voltage withstand test on primary terminals	7.2.3
Wet test for outdoor type transformers	7.2.4
Electromagnetic Compatibility tests	7.2.5
Tests for accuracy	7.2.6
Verification of the degree of protection by enclosures	7.2.7
Enclosure tightness test at ambient temperature	7.2.8
Pressure test for the enclosure	7.2.9

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Tests	Subclause
Short-time current tests	7.2.201
Short-circuit withstand capability test	7.2.301
Routine tests	**7.3**
Power-frequency voltage withstand tests on primary terminals	7.3.1
Partial discharge measurement	7.3.2
Power-frequency voltage withstand tests between sections	7.3.3
Power-frequency voltage withstand tests on secondary terminals	7.3.4
Tests for accuracy	7.3.5
Verification of markings	7.3.6
Enclosure tightness test at ambient temperature	7.3.7
Pressure test for the enclosure	7.3.8
Determination of the secondary winding resistance	7.3.201
Determination of the secondary loop time constant	7.3.202
Rated knee point e.m.f. and maximum exciting current	7.3.203
Inter-turn overvoltage test	7.3.204
Special tests	**7.4**
Chopped impulse voltage withstand test on primary terminals	7.4.1
Multiple chopped impulse test on primary terminals	7.4.2
Measurement of capacitance and dielectric dissipation factor	7.4.3
Transmitted overvoltage test	7.4.4
Mechanical tests	7.4.5
Internal arc fault test	7.4.6
Enclosure tightness test at low and high temperatures	7.4.7
Gas dew point test	7.4.8
Corrosion test	7.4.9
Fire hazard test	7.4.10
Sample tests	**7.5**
Determination of the remanence factor	7.5.1
Determination of the instrument security factor (FS) of measuring current transformers	7.5.2

7.2 Type tests

7.2.2 Temperature-rise test

Replacement of the first sentence by the following:

A test shall be made in order to prove compliance with 6.4.1.

Addition:

When there is more than one secondary winding, the tests shall be made with the appropriate rated burden connected to each secondary winding unless otherwise agreed between manufacturer and user. For the test, the transformer shall be mounted in a manner representative of the mounting in service. The prescribed current and voltage are applied simultaneously to the combined instrument transformer. For this purpose, it is necessary that the primary winding and the secondary winding of the transformer generating the high current

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