

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Instrument transformers –  
Part 1: General requirements

ITih STANDARD PREVIEW  
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Transformateurs de mesure –  
Partie 1: Exigences générales

[IEC 61869-1:2007](#)

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**INSTRUMENT TRANSFORMERS –****Part 1: General requirements**

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International Standard IEC 61869-1 has been prepared by IEC technical committee 38: Instrument transformers.

TC 38 decided to restructure the whole set of stand-alone Standards in the IEC 60044 series and transform it into a new set of standards composed of general requirements documents and specific requirements documents.

This Standard is the first issue of this new series and can be regarded as a Product Family standard. It contains the general requirements for instrument transformers and shall be read in conjunction with the relevant specific requirements standard for the instrument transformer concerned.



An overview of the planned set of standards is given below:

PRODUCT FAMILY STANDARDS	PRODUCT STANDARD	PRODUCTS	OLD STANDARD	
61869-1 GENERAL REQUIREMENTS FOR INSTRUMENT TRANSFORMERS	61869-2	CURRENT TRANSFORMERS	60044-1	
	61869-3	INDUCTIVE VOLTAGE TRANSFORMERS	60044-2	
	61869-4	COMBINED TRANSFORMERS	60044-3	
	61869-5	CAPACITIVE VOLTAGE TRANSFORMERS	60044-5	
	61869-6	CURRENT TRANSFORMERS FOR TRANSIENT PERFORMANCE	60044-6	
	61869-9 ADDITIONAL REQUIREMENTS AND DIGITAL INTERFACE FOR ELECTRONIC INSTRUMENT TRANSFORMERS	61869-7	ELECTRONIC VOLTAGE TRANSFORMERS	60044-7
		61869-8	ELECTRONIC CURRENT TRANSFORMERS	60044-8
		61869-10	LOW-POWER STAND- ALONE CURRENT SENSORS	

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This Standard covers all general requirements formerly found in the stand-alone standards of the IEC 60044 series. Additionally, it introduces some technical innovations:

- requirements for gas-insulated instrument transformers
- additional special tests
- requirements for internal arc fault protection
- requirements for degrees of protection by enclosure
- requirements for resistance to corrosion
- requirements for safety and environmental concerns

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

FDIS	Report on voting
38/360/FDIS	38/364/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.

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

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# INSTRUMENT TRANSFORMERS –

## Part 1: General requirements

### 1 Scope

This International Standard is applicable to newly manufactured instrument transformers with analogue or digital output for use with electrical measuring instruments or electrical protective devices having rated frequencies from 15 Hz to 100 Hz.

This standard is a product family standard and covers general requirements only. For each kind of instrument transformer the product standard is composed by this standard and the relevant specific standard.

### 2 Normative references

The following referenced documents are essential 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 60060-1: *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-11: *Basic environmental testing procedures – Part 2: Tests – Test Ka: Salt mist*

IEC 60068-2-17: *Basic environmental testing procedures – Part 2: Tests – Test Q: Sealing*

IEC 60068-2-75: *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests.*

IEC 60071-1: *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60085: *Electrical insulation – Thermal classification*

IEC 60270: *High-voltage test techniques – Partial discharge measurements*

IEC 60296: *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60376: *Specification of technical grade sulfur hexafluoride (SF<sub>6</sub>) for use in electrical equipment*

IEC 60417: *Graphical symbols for use on equipment*

IEC 60455 (all parts): *Resin based reactive compounds used for electrical insulation*

IEC 60480: *Guidelines for the checking and treatment of sulphur hexafluoride (SF<sub>6</sub>) taken from electrical equipment and specification for its re-use*

IEC 60529: *Degrees of protection provided by enclosures (IP code)*

IEC 60567: *Oil-filled electrical equipment – Sampling of gases and of oil for analysis of free and dissolved gases – Guidance*

IEC 60694: *Common specifications for high-voltage switchgear and controlgear standards*

IEC 60695-1-1: *Fire hazard testing – Part 1-1: Guidance for assessing the fire hazard of electrotechnical products - General guidelines*

IEC 60695-1-30: *Fire hazard testing – Part 1-30: Guidance for assessing the fire hazard of electrotechnical products – Use of preselection testing procedures*

IEC 60695-7-1: *Fire hazard testing – Part 7-1: Toxicity of fire effluent - General guidance*

IEC 60721-3-3: *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use of weatherprotected locations*

IEC 60721-3-4: *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weatherprotected locations*

IEC 60815, *Guide for the selection of insulators in respect of polluted conditions*

IEC 60867: *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 61462: *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods and acceptance criteria and design recommendations*

IEC 61634: *High-voltage switchgear and controlgear – Use and handling of sulphur hexafluoride (SF<sub>6</sub>) in high-voltage switchgear and controlgear*

IEC 62155: *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*

IEC 62262: *Degree of protection IK code*

IEC 62271-2: *High-voltage switchgear and controlgear – Part 2: Seismic qualification for rated voltages of 72,5 kV and above.*

IEC 62271-203: *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

CISPR 18-2: *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits*

IEC Guide 109: *Environmental aspects – Inclusion in electrotechnical product standards*

ISO 3231: *Paints and varnishes – Determination of resistance to humid atmospheres containing sulphur dioxide*

### **3 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

### 3.1 General definitions

#### 3.1.1

##### **instrument transformer**

transformer intended to transmit an information signal to measuring instruments, meters and protective or control devices or similar apparatus

[IEV 321-01-01, modified]

#### 3.1.2

##### **enclosure**

housing affording the type and degree of protection suitable for the intended application

[IEV 826-12-20]

#### 3.1.3

##### **primary terminals**

terminals to which the voltage or current to be transformed is applied

#### 3.1.4

##### **secondary terminals**

terminals which transmit an information signal to measuring instruments, meters and protective or control devices or similar apparatus

#### 3.1.5

##### **secondary circuit**

the external circuit receiving the information signals supplied by the secondary terminals of an instrument transformer

[IEV 321-01-08, modified]

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#### 3.1.6

##### **section**

electrically conductive part of an instrument transformer insulated from other similar parts and equipped with terminals

### 3.2 Definitions related to dielectric ratings

#### 3.2.1

##### **highest voltage of a system ( $U_{sys}$ )**

highest value of the phase-to-phase operating voltage (r.m.s. value) which occurs under normal operating conditions at any time and at any point in the system

[IEV 601-01-23, modified]

#### 3.2.2

##### **highest voltage for equipment ( $U_m$ )**

the highest r.m.s. value of phase-to-phase voltage for which the equipment is designed in respect of its insulation as well as other characteristics which relate to this voltage in the relevant equipment standards

[IEV 604-03-01 ]

#### 3.2.3

##### **rated insulation level**

combination of voltage values which characterizes the insulation of a transformer with regard to its capability to withstand dielectric stresses

### 3.2.4

#### **isolated neutral system**

system where the neutral point is not intentionally connected to earth, except for high impedance connections for protection or measurement purposes

[IEV 601-02-24]

### 3.2.5

#### **resonant earthed system (a system earthed through an arc-suppression coil)**

system in which one or more neutral points are connected to earth through reactances which approximately compensate the capacitive component of a single-phase-to-earth fault current

[IEV 601-02-27]

NOTE With resonant earthing of a system, the residual current in the fault is limited to such an extent that an arcing fault in air is self-extinguishing.

### 3.2.6

#### **earth fault factor**

at a given location of a three-phase system, and for a given system configuration, the ratio of the highest r.m.s. phase-to-earth power frequency voltage on a healthy phase during a fault to earth affecting one or more phases at any point on the system to the r.m.s. value of phase-to-earth power frequency voltage which would be obtained at the given location in the absence of any such fault

[IEV 604-03-06]

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### 3.2.7

#### **earthed neutral system**

system in which the neutral is connected to earth either solidly or through a resistance or reactance of sufficiently low value to reduce transient oscillations and to give a current sufficient for selective earth fault protection.

- a) A three-phase system with effectively earthed neutral at a given location is a system characterized by an earth fault factor at this point which does not exceed 1,4.

NOTE This condition is obtained approximately when, for all system configurations, the ratio of zero-sequence reactance to the positive-sequence reactance is less than 3 and the ratio of zero-sequence resistance to positive sequence reactance is less than one.

- b) A three-phase system with non-effectively earthed neutral at a given location is a system characterized by an earth fault factor at this point that may exceed 1,4.

### 3.2.8

#### **solidly earthed neutral system**

system whose neutral point(s) is(are) earthed directly

[IEV 601-02-25]

### 3.2.9

#### **impedance earthed neutral system**

system whose neutral point(s) is(are) earthed through impedances to limit earth fault currents

[IEV 601-02-26]

### 3.2.10

#### **exposed installation**

installation in which the apparatus is subject to overvoltages of atmospheric origin

NOTE Such installations are usually connected to overhead transmission lines either directly or through a short length of cable.

### 3.2.11

#### **non-exposed installation**

installation in which the apparatus is not subject to overvoltages of atmospheric origin

NOTE Such installations are usually connected to underground cable networks.

### 3.3 Definitions related to current ratings

See specific requirements standard.

### 3.4 Definitions related to accuracy

#### 3.4.1

##### **actual transformation ratio ( $k$ )**

ratio of the actual primary voltage or current to the actual secondary voltage or current

#### 3.4.2

##### **rated transformation ratio ( $k_r$ )**

ratio of the rated primary voltage or current to the rated secondary voltage or current

#### 3.4.3

##### **ratio error ( $\epsilon$ )**

the error which an instrument transformer introduces into the measurement and which arises from the fact that the actual transformation ratio is not equal to the rated transformation ratio

#### 3.4.4

##### **phase displacement ( $\Delta\phi$ )** (standards.iteh.ai)

difference in phase between the primary voltage or current and the secondary voltage or current phasors, the direction of the phasors being so chosen that the angle is zero for an ideal transformer.

The phase displacement is said to be positive when the secondary voltage or current phasors leads the primary voltage or current phasors. It is usually expressed in minutes or centiradians.

NOTE 1 This definition is strictly correct for sinusoidal voltages or currents only.

NOTE 2 Electronic instrument transformers may introduce a delay time due to a digital data transmission and by digital signal processing.

[IEV 321-01-23, modified]

#### 3.4.5

##### **accuracy class**

a designation assigned to an instrument transformer, the ratio error and phase displacement of which remain within specified limits under prescribed conditions of use

[IEV 321-01-24, modified]

#### 3.4.6

##### **burden**

admittance (or impedance) of the secondary circuit expressed in siemens (or ohms) and power factor

NOTE The burden is usually expressed as the apparent power in volt-amperes absorbed at a specified power-factor and at the rated secondary voltage or current.

#### 3.4.7

##### **rated burden**

value of the burden on which the accuracy requirements of this specification are based.