SLOVENSKI STANDARD
oSIST prEN IEC 61869-15:2026

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Instrumentni transformatorji - 15. del: Dodatne zahteve za napetostne transformatorje za enosmerne aplikacije

Instrument transformers - Part 15: Additional requirements for voltage transformers for DC applications

Messwandler - Teil 15: Zusätzliche Anforderungen an Spannungswandler für Gleichstromanwendungen

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ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities

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38/868/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 61869-15 ED2**	
DATE OF CIRCULATION: **2026-10-30**	CLOSING DATE FOR VOTING: **2027-01-22**
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IEC TC 38 : INSTRUMENT TRANSFORMERS	
SECRETARIAT: Italy	SECRETARY: Mr Filippo Frugoni
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 13,TC 33,TC 57,SC 77A,TC 85,TC 95,TC 115	HORIZONTAL FUNCTION(S):
ASPECTS CONCERNED: Electricity transmission and distribution,Electromagnetic Compatibility	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Instrument transformers - Part 15: Additional requirements for voltage transformers for DC applications

PROPOSED STABILITY DATE: 2032

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CONTENTS

FOREWORD 5
INTRODUCTION 7
1 Scope 9
2 Normative references 9
3 Terms, definitions, symbols and abbreviated terms 9
3.1 Terms and definitions 9
3.2 Symbols and abbreviated terms 11
4 Normal and special environmental conditions 11
5 Ratings 14
5.1 General 14
5.2 Voltage ratings 14
5.2.1 Highest voltage for equipment (U_m) 14
5.2.2 Power system earthing 14
5.2.3 Standard values for rated primary voltage (U_{pr}) 14
5.2.4 Standard values for rated secondary voltage (U_{sr}) 14
5.2.5 Rated auxiliary power supply voltage (U_{ar}) 15
5.3 Current ratings 15
5.4 Dielectric ratings 15
5.4.1 General 15
5.4.2 Rated primary terminal insulation level 15
5.4.3 Other requirements for primary terminals insulation 16
5.4.4 Between-section insulation requirements 17
5.4.5 Insulation requirements for secondary terminals and low-voltage components 17
5.5 Rated frequency 17
5.6 Output ratings 17
5.6.1 Rated output for inductive instrument transformers and CVTs 17
5.6.2 Rated burden for LPITs 17
5.6.3 Standard values for the rated delay time for EITs (t_{dr}) 17
5.7 Accuracy requirements 17
5.7.1 General 17
5.7.2 Rated accuracy classes 17
5.7.3 Accuracy class extension for harmonics 19
5.7.4 Accuracy requirements for harmonics 19
5.7.5 Harmonic requirements for LPIT protection accuracy classes 19
5.7.6 Anti-aliasing filter for EIT using digital data processing 20
5.7.1501 Rated step response time 20
6 Design and construction 20
6.1 Requirements for liquids used in equipment 20
6.2 Requirements for gases used in equipment 20
6.3 Requirements for solid materials used in equipment 20
6.4 Requirements for temperature rise of parts and components 20
6.5 Requirements for earthing of equipment 20
6.6 Requirements for the external insulation 20

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oSIST prEN IEC 61869-15:2026

6.6.1 Pollution 20
6.6.2 Altitude 21
6.7 Mechanical requirements 21
6.8 Multiple chopped impulse on primary terminals 21
6.9 Internal arc fault protection requirements 21
6.10 Degrees of protection by enclosures 21
6.11 Electromagnetic compatibility (EMC) 21
6.11.1 General 21
6.11.2 Requirement for immunity 21
6.11.3 Requirement for emission 21
6.11.4 Requirement for transmitted overvoltage (TOV) 21
6.11.5 Requirement for radio interference voltage (RIV) 22
6.11.1501 Impact of electric field at rated frequency from other phases 22
6.12 Corrosion 22
6.13 Markings 22
6.13.1 General 22
6.13.2 Terminal markings 22
6.13.3 Rating plate markings 23
6.13.1501 Rating plate markings for cables 25
6.14 Requirements for LPIT secondary terminal connection 25
6.15 EIT secondary signal noise 25
6.16 Fire hazard 25
6.17 Pressure withstand of gas-filled enclosures 25
6.18 Failure detection of EIT 25
6.19 Operability 25
6.20 Reliability and dependability of electronic part of EIT 26
6.21 Vibration requirements 26
6.22 Storage climatic conditions withstand capability 26
7 Tests 26
7.1 General 26
7.1.1 Classification of tests 26
7.1.2 List of tests 26
7.1.3 Sequence of tests 27
7.1.4 Testing conditions 29
7.2 Type tests 29
7.2.1 General 29
7.2.2 Temperature rise test 29
7.2.3 Impulse voltage withstand test on primary terminals 29
7.2.4 Wet test for outdoor type transformers 30
7.2.5 Electromagnetic compatibility (EMC) tests 31
7.2.6 Test for accuracy 31
7.2.7 Verification of the degree of protection by enclosures 33
7.2.8 Enclosure tightness test at ambient temperature 33
7.2.9 Proof test for the gas-filled enclosure 33
7.2.10 Mechanical tests 33
7.2.11 Voltage withstand test of low-voltage components and secondary terminals 33
7.2.12 Storage climate environmental tests 34
7.2.13 Vibration test 35

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oSIST prEN IEC 61869-15:2026

7.2.14 Durability of markings 35
7.2.15 Tests for accuracy for harmonics 35
7.2.16 Test for anti-aliasing 35
7.2.1501 Polarity reversal test with partial discharge measurement 35
7.2.1502 Measurement of the step response time 36
7.2.1503 Test for impact of electric field at rated frequency 37
7.3 Routine tests 39
7.3.1 Power-frequency voltage withstand tests on primary terminals 39
7.3.2 Partial discharge measurement 40
7.3.3 Power-frequency voltage withstand tests between sections 40
7.3.4 Power-frequency voltage withstand tests on secondary terminals 40
7.3.5 Power-frequency voltage withstand test for low-voltage components 40
7.3.6 Test for accuracy 40
7.3.7 Verification of markings 41
7.3.8 Enclosure tightness test at ambient temperature 41
7.3.9 Pressure test for the gas-filled enclosure 41
7.3.10 Measurement of capacitance and dielectric dissipation factor 41
7.3.1501 DC applied voltage withstand test 41
7.3.1502 Resistance measurement 42
7.4 Special tests 42
7.4.1 Multiple chopped impulse test on primary terminals 42
7.4.2 Transmitted overvoltage test 42
7.4.3 Internal arc fault test 42
7.4.4 Enclosure tightness test at low and high temperatures 42
7.4.5 Insulation resistance measurement on secondary terminals 42
7.4.6 Corrosion test 42
7.4.7 Fire hazard test 42
7.4.8 Thermo-mechanical endurance test 42
7.4.9 Vibration and shock tests 43
7.4.10 Tests for accuracy versus harmonics 43
7.4.11 Seismic qualification 43
7.4.1501 Pollution tests 43
7.4.1502 Accuracy stability stress test 44
7.5 Commissioning tests 44
7.6 Sample tests 44
8 Rules for transport, storage, erection, operation and maintenance 44
9 Safety 44
10 Influence of products on the natural environment 44
Annex A (normative) Identification of test specimen 45
Annex B (informative) Recommendation for contents of failure report 46
Annex C (informative) Fire hazard 47
Annex D (informative) Sample test 48
Annex E (informative) Technique used in temperature rise test of transformers to determine the thermal time constant by an experimental estimation. 49
Annex F (informative) Guidance for the extension of validity of type test or special tests of instrument transformers 50
Annex G (informative) Guidance for the calculation of equivalent diameter in case of irregular shape of insulating part 51

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oSIST prEN IEC 61869-15:2026

Annex H (informative) Test circuits 52
Annex I (normative) Seismic qualification of instrument transformers 53
Annex 15A (normative) Composite AC/DC voltages 54
15A.1 Composite AC/DC voltage descriptions 54
15A.2 Example 1 – without 3PWM 55
15A.3 Example 2 – with 3PWM 55
15A.4 Conclusion 57
Annex 15B (informative) Voltage definitions 58
Bibliography 59

Figure 1501 – Example of LCC scheme 13
Figure 1502 – Typical scheme for VSC – symmetrical monopole 14
Figure 1503 – Typical scheme for VSC – asymmetrical monopole or bipole 14
Figure 1504 – Accuracy limits of a DC VT 19
Figure 1505 – RC divider with low-voltage part outside the main housing 34
Figure 1506 – Connection for voltage withstand test of the external low voltage part of a DC VT 35
Figure 1507 – Polarity reversal test profile 36
Figure 1508– Measurement of the step response time 38
Figure 1509– Test setup for LPVT used in air-insulated substations 39
Figure 15A.1 – Example of an asymmetrical VSC converter 55
Figure 15A.2 – Maximum peak voltage without 3PWM 56
Figure 15A.3 – Both individual voltage curves with 3PWM 57
Figure 15A.4 – Superimposed voltage curve with 3PWM, based on Figure 15A.3 58
Figure 15B.1 – Voltage overview and definitions 59

Table 1501 – Voltage on DC VT´s for LCC application 13
Table 1502 – Voltage on DC VT´s for VSC application 14
Table 4 – Partial discharge test voltages and permissible levels 17
Table 1503 – Limits of ratio error for DC VT (classes from 0,1 to 3) 19
Table 1504 – Limits of ratio error for AC component of superposed AC and DC voltages 20
Table 14– Maximum static withstand loads 22
Table 1505 – Markings of terminals 24
Table 1506 – Rating plate marking for common rating plate 25
Table 1507 – Rating plate marking for each secondary converter 26
Table 1508 – Rating plate marking for auxiliary power supply 26
Table 20 – List of tests 27
Table 22 – Required routine tests 29
Table 1509 – Test setup distances 39

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INSTRUMENT TRANSFORMERS –

Part 15: Additional requirements for voltage transformers for DC applications

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IEC 61869-15 has been prepared by IEC technical committee 38: Instrument transformers. It is an international standard.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

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

FDIS	Report on voting
38/XX/FDIS	38/XX/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

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This Part 15 is to be used in conjunction with, and is based on, IEC 61869-1:2023, *General requirements*, – however the reader is encouraged to use the most recent editions.

This Part 15 follows the structure of IEC 61869-1:2023 and supplements or modifies the corresponding clauses.

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 1501 are additional to those in Part 1;
- additional annexes are lettered 15A, 15B, etc.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
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INTRODUCTION

General

This document applies to voltage transformers (VT) intended to be used in DC applications with at least one of the following functions:

measure DC voltage (with significant harmonics);

withstand DC voltage.

This document is the first revision of the standard IEC 61869-15, defining additional requirements for voltage transformers for DC applications.

The main modifications of this revision are listed below:

- General
  - adaption of the new structure and requirements of IEC 61869-1:2023, general requirements for instrument transformers.
  - transfer of the definitions to the TC 38 Glossary IEC 61869-99
  - definitions related to composite AC and DC currents
  - introduction of VT1 for VSC applications
- Ratings
  - voltage ratings for composite AC and DC voltages including 3PWM
  - rated delay time definition for point to point connections
  - definition of accuracy requirements for AC voltage measurement
  - definition of accuracy requirements for harmonics
  - revised step response times
- Design and construction
  - rating plate markings revised
- Tests
  - Revised list of tests
  - Table added indicating routine tests to be performed after a Type test
- Type tests
  - composite AC and DC voltage: definition to perform tests separately in two tests
  - voltage withstand test for low voltage terminals improved
  - step response time evaluation brought in line with definition in TC 38 Glossary IEC 61869-99
  - test for impact of external field for DC VT measuring AC components added
- Routine tests
  - partial discharge measurement during DC applied voltage withstand test replaced by verification of partial discharge level during repeated AC applied withstand test with partial discharge measurement
  - composite AC and DC voltage: definition to perform tests separately in two tests
- Special tests

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- measurement of capacitance and dielectric dissipation factor eliminated, because test is already routine test.
- even wetting DC voltage test eliminated, wet test performance, insulator performance under wet condition is covered during type tests under 7.2.4.
- accuracy test on the composite signal is eliminated, it is covered during type tests under 7.2.15.
- subclause 7.4.1501.2 renamed to Wet DC voltage test
- subclause 7.4.1502 deleted
- subclause 7.4.1503, now 7.4.1502 renamed to Accuracy stability stress test

i) new annexes:

- Annex A (normative): Identification of test specimen;
- Annex B (informative): Recommendation for contents of failure reports;
- Annex C (informative) Fire hazard;
- Annex D (informative): Sample test;
- Annex E (informative): Technique used in temperature rise test of transformers to determine the thermal time constant by an experimental estimation;
- Annex F (informative): guidance for the extension of validity of type tests and special tests;
- Annex G (informative): Guidance for the calculation of equivalent diameter in case of irregular shape of insulating part;
- Annex H (informative): Test circuits
- Annex I (normative): seismic qualification of instrument transformers;
- Annex 15B (normative): Composite AC/DC voltages

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The actual technology used for DC VT's are resistive voltage dividers (with or without additional capacitance). However, other technologies could be used in the future (for example, optical voltage sensors).

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This document includes some specific requirements applicable to resistive and mixed resistive-capacitive voltage dividers, but it can also be applied to other technologies, like optical measurement systems.

Depending on the position of the voltage transformer on the DC system, different kinds of applications exist, which are briefly described in 4.1501, together with the approximate voltage wave shape.

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INSTRUMENT TRANSFORMERS –

Part 15: Additional requirements for voltage transformers for DC applications

1 Scope

This part of IEC 61869 provides all requirements specific to voltage transformers to be used in DC applications (DC VTs), whatever the technology used. The output signal can be analogue or digital. When it is analogue, it is available as low voltage representing the primary voltage.

It is applicable to newly manufactured voltage transformers used for measuring, protection and/or control applications in power systems with a rated voltage above 1,5 kV DC.

The general configuration of a single-pole low-power instrument transformer is described in Figure 1 of IEC 61869-1:2023.

DC CT for railway applications are not part of this standard and are covered by IEC TC9.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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Clause 2 of IEC 61869-1:2023 applies, with the following additions and modifications:

IEC 60071-11:2022, *Insulation coordination - Part 11: Definitions, principles and rules for HVDC systems*

IEC 60270:2025, *High voltage test techniques – Partial discharge measurements*

IEC TS 60815-4:2016, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 4: Insulators for DC systems*

IEC TS 61245:2015, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on DC systems*

IEC 61869-1:2023, *Instrument transformers – Part 1: General requirements*

IEC 61869-9:2016, *Instrument transformers – Part 9: Digital interface for instrument transformers*

IEC 61869-99:2022, *Instrument transformers – Part 99: Glossary*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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- IEC Electropedia: available at http://www.electropedia.org/;
- ISO Online browsing platform: available at http://www.iso.org/obp.

For the purposes of this document, the terms and definitions given in IEC 61869-99 and the following apply.

3.1.1501
Absolute error
ε_A
error (expressed in V) that a voltage transformer introduces into the measurement, and which arises from the fact that the actual transformation ratio is not equal to the rated transformation ratio

Note 1 to entry: The absolute error is defined by the following formula:

$$\varepsilon_A = K_r \cdot U_s - U_p$$

where

K_r is the rated transformation ratio;

U_p is the DC value of the actual primary voltage in steady state;

U_s is the DC value of the output voltage.

3.1.1502
AC grid power frequency
f_{rAC}

Rated frequency of the AC grid to which the HVDC station is connected

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3.2 Symbols and abbreviated terms

The table in 3.2 of IEC 61869-1:2023 is replaced by the following one:

DC VT	voltage transformer for DC application
F	mechanical load
f_{rAC}	rated AC grid power frequency
I_{amax}	maximum supply current
I_{ar}	rated supply current
IT	instrument transformer
K	actual transformation ratio
K_r	rated transformation ratio
lc	electrical cable length of the transmitting system
R_{br}	rated burden
R_1	rated primary resistance
R_2	rated secondary resistance
t_d	delay time
t_{dr}	rated delay time
T_{set}	settling time
T_{sr}	step response time
T_t	dead time
U_{ar}	auxiliary power supply voltage
U_h	voltage harmonic of frequency f_h
U_{hAmax}	voltage harmonic with the highest amplitude
U_{DC}	DC system voltage
U_{DCmax}	highest DC voltage for a system
U_m	highest voltage for equipment
U_{pr}	rated primary voltage
U_{sr}	rated secondary voltage
ε	ratio error
ε_A	absolute error
3PWM	Pulse width modulation with third harmonic, also known as third harmonic injection (THI)

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4 Normal and special environmental conditions

Clause 4 of IEC 61869-1:2023 applies with the following addition.

4.1501 Operational environment and configurations of DC CT in Converter-based systems

4.1501.1 Line-commutated converters (LCC)

Line-commutated converters (LCC) are based on thyristor converters. They are characterized by a single direction of current flow, and a voltage polarity reversal possibility. Significant voltage and current harmonics exist up to frequencies of about 3 kHz to 4 kHz.

The position of the DC VTs on the DC system is illustrated in Figure 1501.

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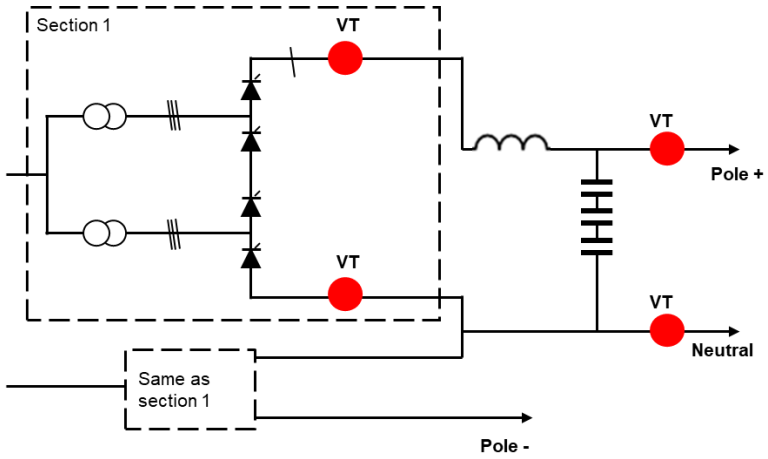
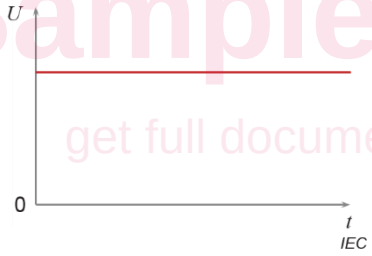


Figure 1501 – Example of LCC scheme

Table 1501 gives an overview of the voltage waveshape as well as the main characteristics of the VT.

Table 1501 – Voltage on DC VT´s for LCC application

Voltage	Characteristics
	DC application High-accuracy measurement Harmonics measurement Metering, control and protection purpose

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4.1501.2 Voltage-source converters (VSC)

Voltage-source converters (VSC) are based on transistor converters. They are characterized by a bi-directional current flow and a single voltage polarity. Voltage and current harmonics exist up to frequencies of about 20 kHz.

Two variants of VSC schemes exist: symmetrical monopoles (using one single converter) and asymmetrical monopole or bipole (with one converter for each polarity).

Both schemes are shown in Figure 1502 and Figure 1503.

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