SLOVENSKI STANDARD
SIST EN 50549-10:2023

01-januar-2023

Nadomešča:
SIST EN 50438:2014
SIST EN 50438:2014/IS1:2015

Zahteve za vzporedno vezavo generatorskih postrojev z javnim nizkonapetostnim razdelilnim omrežjem - 10. del: Preskusi za oceno skladnosti generatorskih enot

Requirements for generating plants to be connected in parallel with distribution networks - Part 10: Tests for conformity assessment of generating units

Anforderungen für zum Parallelbetrieb mit einem Verteilnetz vorgesehene Erzeugungsanlagen - Teil 10: Tests für die Konformitätsbeurteilung von Erzeugungseinheiten

Exigences relatives aux centrales électriques destinées à être raccordées en parallèle à des réseaux de distribution - Partie 10: Essais d'évaluation de la conformité des unités de production

Ta slovenski standard je istoveten z: **EN 50549-10:2022**

ICS:

29.160.20	Generatorji	Generators
29.240.01	Omrežja za prenos in distribucijo električne energije na splošno	Power transmission and distribution networks in general

SIST EN 50549-10:2023 **en,fr**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50549-10

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English Version

Requirements for generating plants to be connected in parallel with distribution networks - Part 10: Tests for conformity assessment of generating units

Exigences relatives aux centrales électriques destinées à être raccordées en parallèle à des réseaux de distribution - Partie 10: Essais d'évaluation de la conformité des unités de production

Anforderungen für zum Parallelbetrieb mit einem Verteilnetz vorgesehene Erzeugungsanlagen - Teil 10: Prüfanforderungen für die Konformitätsbeurteilung von Erzeugungseinheiten

This European Standard was approved by CENELEC on 2022-08-09. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 50549-10:2022) has been prepared by CLC/TC 8X “System aspects of electrical energy supply”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-08-09
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2025-08-09

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

EN 50438:2013 has been superseded by EN 50549-1:2019. However, Annex D of EN 50438:2013 provided requirements on compliance type testing, which is out of the scope of EN 50549-1:2019 resulting in a gap regarding type testing. This document provides requirements for compliance type testing for generating units and closes this gap.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association.

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

1 Scope

The purpose of this document is to provide technical guidance for tests on generating units and interface protection to evaluate their electrical characteristics.

NOTE 1 Mechanical issues are taken into account as far as they influence the electrical characteristics.

The evaluation results are intended to be used to demonstrate conformity of generating units to technical requirements for grid connection. In this context the evaluation results can also be used as part of a certification programme.

NOTE 2 Besides the type test results of the generating unit all additional elements for connection to the grid (e.g. transformer, cabling, multiple units) are considered in the evaluation of the final installation of a generating plant.

The requirements to be evaluated are covered in the following standardization documents:

– EN 50549-1:2019: Requirements for generating plants to be connected in parallel with distribution networks - Part 1: connection to a LV distribution network - Generating plants up to and including Type B

– EN 50549-2:2019: Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network - Generating plants up to and including Type B

If grid connection requirements are dealt with in other documents or for other generating module types, where no specific testing procedure is provided, testing methods of this document can be used if applicable.

This document provides evaluation criteria for the conformity assessment of generating units with respect to the abovementioned standardization documents, based on type testing. However, some requirements are applicable on the generating plant level. The assessment of the conformity to these plant requirements are out of the scope of this document. Nevertheless, this document may be used to show the capabilities of a generating unit to be used in a plant.

As a consequence, it is possible that the conformity assessment of a generating unit does not cover all aspects of the above-mentioned standardization documents, typically when a requirement is evaluated on a plant level. Therefore, the conformity assessment report indicates clearly which clauses of this document are covered and which clauses are not covered.

This document recognizes the existence of specific technical test requirements within several member states that must be complied with.

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.

EN 50549-1:2019, *Requirements for generating plants to be connected in parallel with distribution networks - Part 1: Connection to a LV distribution network - Generating plants up to and including Type B*

EN 50549-2:2019, *Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network - Generating plants up to and including Type B*

EN IEC 60034 (all parts), *Rotating electrical machines*

EN IEC 60034-4-1, *Rotating electrical machines - Part 4-1: Methods for determining electrically excited synchronous machine quantities from tests*

EN 50524, *Data sheet for photovoltaic inverters*

EN 60255-1, *Measuring relays and protection equipment - Part 1: Common requirements*

EN 60255-26, *Measuring relays and protection equipment - Part 26: Electromagnetic compatibility requirements*

EN 60255-27, *Measuring relays and protection equipment - Part 27: Product safety requirements*

EN 60255-127, *Measuring relays and protection equipment - Part 127: Functional requirements for over/under voltage protection*

EN IEC 60255-181:2019, *Measuring relays and protection equipment - Part 181: Functional requirements for frequency protection*

EN 60730-1:2016[1], *Automatic electrical controls - Part 1: General requirements*

EN 61000-3-2, *Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

EN 61000-3-3, *Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection*

EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements*

EN IEC 61000-3-11, *Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection*

EN 61000-3-12, *Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase*

EN 61000-4-7:2002,[2] *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

EN 61000-4-13:2002,[3] *Electromagnetic compatibility (EMC) - Part 4-13: Testing and measurement techniques - Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

EN 61869-2, *Instrument transformers - Part 2: Additional requirements for current transformers*

EN 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

EN 62116, *Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures*

EN 62109-2, *Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters*

EN IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control, and laboratory use*

EN IEC 61326 (all parts), *Electrical equipment for measurement, control and laboratory use - EMC requirements*

UL 1998:2013, *Standard for Software in Programmable Components*

[1] As amended by EN 60730-1:2016/A1:2019 and EN 60730-1:2016/A2:2022.
[2] As amended by EN 61000-4-7:2002/A1:2009.
[3] As amended by EN 61000-4-13:2002/A1:2009 and EN 61000-4-13:2002/A2:2016.

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50549-1:2019, EN 50549-2:2019 and the following apply. The terms and definitions given in this clause are structured in the same way as the terms and definitions of EN 50549-1:2019 and EN 50549-2:2019.

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

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp/

NOTE Terms and definitions are selected to achieve consistency with IEV (cf. www.electropedia.org) and CENELEC terminology, recognizing that terms in COMMISSION REGULATION (EU) 2016/631 can deviate.

3.1.1 General

3.1.1.1
relevant parties
stakeholders having role and responsibility in the different conformity procedures in place within different EU countries

EXAMPLE TSOs, DSOs, certifiers, measuring institutes, manufacturers, etc.

3.1.1.2
manufacturer
organisation, situated at a stated location or stated locations that carries out or controls such stages in the process of bringing a product to the market as manufacture, assessment, verification, handling and storage of a product

Note 1 to entry: A manufacturer has full responsibility for continued compliance of the product until delivery to the customer with the relevant requirements and undertakes all obligations in that connection.

[SOURCE: IECRE Definitions, modified – Limitation until delivery to the customer added.]

3.1.1.3
conformity
fulfilment of a requirement

[SOURCE: IEV 192-01-15]

3.1.1.4
conformity assessment
demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

Note 1 to entry: The subject field of conformity assessment includes activities defined elsewhere in ISO/IEC 17000, such as testing, inspection and certification, as well as the accreditation of conformity assessment bodies.

Note 2 to entry: The expression “object of conformity assessment” or “object” is used in ISO/IEC 17000 to encompass any particular material, product, installation, process, system, person or body to which conformity assessment is applied. A service is covered by the definition of a product (see Note 1 to IEV 902-02-03).

[SOURCE: IEV 902-01-01]

3.1.1.5
conformity evaluation
systematic examination of the extent to which a product, process or service fulfils specified requirements

[SOURCE: IEV 151-16-14]

3.1.2 Plant, module and unit

3.1.2.1
type test
conformity test made on one or more items representative of the production

[SOURCE: IEV 151-16-16]

3.1.2.2
measuring equipment
assembly of measuring instruments intended for specified measurement purposes

[SOURCE: IEC 311-03-05]

3.1.2.3
test equipment
all equipment that is added to a test setup for the purpose of testing and measuring during the test

Note 1 to entry: This includes among others specific impedances, FRT-container, measurement equipment, grid-simulator as applicable.

3.1.2.4
test set-up
electrical system where the test is carried out

Note to entry 1: This includes, among others, grid-characteristics at POC, transformers, cables, test equipment as applicable.

3.1.2.5
generating unit under test
GUT
generating unit subjected to tests

3.1.2.6
equipment under test
EUT
equipment (products, devices, components and systems) subjected to tests

3.1.2.7
component
constituent part of a device which cannot be physically divided into smaller parts without losing its particular function

[SOURCE: IEV 151-11-21]

3.1.2.8
primary energy converter
system that converts any form of primary energy into either electrical or mechanical energy as part of the conversion to AC electricity

EXAMPLE PV generator; fuel driven engines; gas, steam or water turbines; aerodynamic system of a wind turbine.

3.1.2.9
on-load tap-changer
load-tap-changer (US)
OLTC
device for changing the tapping connections of a winding, suitable for operation while the transformer is energized or on load

[SOURCE: IEV 421-11-01, modified – An abbreviation was added.]

3.1.2.10
software
assembly of programs, procedures, rules, documentation and data, pertaining to the operation of an information processing device or system

EXAMPLE Firmware, operating system, application software.

Note 1 to entry: Software is an intellectual creation that is independent of the medium upon which it is recorded.

Note 2 to entry: Software requires hardware to execute programs, and to store and transmit data.

[SOURCE: IEV 171-01-21]

3.1.3 Power

3.1.3.1
nominal power
P_n
nominal value of a generating unit's active power, which is stated by the manufacturer

3.1.3.2
nominal current
I_n
nominal value of generating unit, either as stated by the manufacturer or which shall be calculated from nominal active power P_n and nominal voltage U_n according to

$$I_n = \frac{P_n}{\sqrt{3}U_n}$$

[SOURCE: IEC 61400-27, ed. 1.0 (2015-02) 3.1.6, modified – Applicable for generating units, manufacturer statement added.]

3.1.3.3
minimum regulating level
minimum active power, as specified by the manufacturer, down to which the generating unit can control active power

Note 1 to entry: In special cases, generating units of non-synchronous generating technology also have a minimum technical power.

Note 2 to entry: The minimum regulating level of a power generating plant is to be determined in a suitable manner based on the minimum regulating levels of the power generating units.

[SOURCE: COMMISSION REGULATION 2016/631 Article 2 (24) modified – RfG definition adopted to the formal terminology structure in CLC standards and two notes have been added.]

3.1.3.4
maximum reactive power
$Q_{max\ over}$
<overexcited> maximum continuous overexcited reactive power, measured in a 10 min average, which a generating unit or the sum of all the generating units in a generating plant can exchange as specified in the connection agreement or as agreed between the DSO and the generating plant operator

Note 1 to entry: In some configurations Q_{max} is not available for all active power operating points.

3.1.3.5
maximum reactive power
$Q_{max\ under}$
<underexcited> maximum continuous underexcited reactive power, measured in a 10 min average, which a generating unit or the sum of all the generating units in a generating plant can exchange as specified in the connection agreement or as agreed between the DSO and the generating plant operator

Note 1 to entry: In some configurations Q_{max} is not available for all active power operating points.

3.1.4 Voltage

3.1.4.1
rate of change of frequency
ROCOF
change of frequency by a given amount per unit of time

Note 1 to entry: A ROCOF relay measures the characteristic quantity and triggers if a given amount of this quantity per unit of time has changed.

3.1.4.2
phase
instantaneous phase
ϑ

argument of the cosine function in the representation of a sinusoidal quantity

Note 1 to entry: The term “instantaneous phase” is only used when the independent variable is time.

Note 2 to entry: For the quantity a(t) = $\hat{A}\cos\left(\omega t + \vartheta_0\right)$, the phase is $\omega t + \vartheta_0$.

[SOURCE: IEV 103-07-04]

3.1.4.3
phase jump
abrupt change in the phase of the voltage of an AC electrical network

3.1.5 Circuit theory

3.1.5.1
root-mean-square value
RMS value
quadratic mean
quantity representing the quantities in a finite set or in an interval,

1. for n quantities $x_1, x_2 \ldots x_n$, by the positive square root of the mean value of their squares

$$X_q = \left(\frac{1}{n} \left(x_1^2 + x_2^2 + \ldots + x_n^2 \right) \right)^{1/2}$$

2. for a quantity x depending on a variable t, by the positive square root of the mean value of the square of the quantity taken over a given interval $\left(t_0, t_0 + T\right)$ of a variable:

$$X_q = \left(\frac{1}{T} \int_{t_0}^{t_0+T} \left(x\left(t\right) \right)^2 dt \right)^{1/2}$$

Note 1 to entry: The root-mean-square value of a periodic quantity is usually taken over an integration interval the range of which is the period multiplied by a natural number.

Note 2 to entry: The root-mean-square value of a quantity is denoted by adding the subscript q to the symbol of the quantity.

Note 3 to entry: The abbreviation RMS was formerly denoted as r.m.s. or rms, but these notations are now deprecated.

[SOURCE: IEV 103-02-02]

3.1.6 Protection

3.1.6.1
characteristic quantity
electric quantity, or one of its parameters, the name of which characterizes a measuring relay or protection equipment and the values of which are the subject of accuracy requirements

[SOURCE: IEV 447-07-01]

3.1.6.2
setting value of the characteristic quantity
threshold value of the characteristic quantity at which a measuring relay or protection equipment is required to operate under specified conditions

[SOURCE: IEV 447-07-02]

3.1.6.3
reset value
value of the characteristic quantity at which a measuring relay or protection equipment resets

[SOURCE: IEV 447-02-12]

3.1.7 Control

3.1.7.1
steady state
state of a system at which all state and output variables remain constant in time while all input variables are constant

Note 1 to entry: A state under periodic conditions is often considered as a steady-state.

[SOURCE: IEV 351-45-10, modified, irrelevant note deleted, note of IEV 103-05-01 added]

3.1.7.2
accuracy
degree to which a measurement, calculation, performed function etc. is exact or correct

3.1.7.3
required accuracy
A_r
accuracy required by an assessment criterion

EXAMPLE EN 50549-1:2019 requires a voltage measurement accuracy of 1 % U_n.

3.1.8 Power quality

3.1.8.1
switching current factor
k_i
ratio of the highest current occurring during a switching operation (e.g. starting or connecting current or the highest breaking current under normal operating conditions) to the rated current I_r of the generating unit

Note 1 to entry: For this purpose, the current is to be considered as an RMS value over one period.

Note 2 to entry: If controlled power operation is possible, only the electromechanical switching operation (inrush of inductances and capacities) is observed.

3.1.8.2
flicker coefficient for continuous operation
$c(\psi_k)$
normalized measure of the flicker emission during continuous operation of the generating unit

$$c\left(\Psi_k\right) = P_{st,fic} \times \frac{S_{k,fic}}{S_n}$$

where

$P_{st,fic}$ is the short-term flicker severity from the wind turbine on the fictitious grid;
S_n is the nominal apparent power of the generating unit;
$S_{k,fic}$ is the short-circuit apparent power of the fictitious grid

[SOURCE: EN IEC 61400-21-1 modified – Definition applied to generating units.]