SLOVENSKI STANDARD
oSIST prEN 50549-2:2017

01-julij-2017

Nadomešča:
SIST-TS CLC/TS 50549-2:2015

Zahteve za vzporedno vezavo generatorskih postrojev z javnim razdelilnim omrežjem - 2. del: Vezava s srednjenapetostnim razdelilnim omrežjem

Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network

Ta slovenski standard je istoveten z: **prEN 50549-2**

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

oSIST prEN 50549-2:2017 **en,fr**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50549-2

May 2017

ICS 29.160.20

Will supersede CLC/TS 50549-2:2015

English Version

Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network

To be completed

To be completed

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2017-08-18.

It has been drawn up by CLC/TC 8X.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CENELEC 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Project: 63321

Ref. No. prEN 50549-2 E

Contents

Page

47

48

European foreword

This document (prEN 50549-2:2017) has been prepared by CLC/TC 8X “System aspects of electrical energy supply”.

This document is currently submitted to the Enquiry.

The following dates are proposed:

• latest date by which the existence of this document has to be announced at national level	(doa)	dor + 6 months
• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

This document will supersede CLC/TS 50549-2:2015.

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

This European Standard relates to both European Network Codes and current technical market needs. Its purpose is to give detailed description of functions to be implemented in products.

This European Standard is also intended to serve as a technical reference for the definition of national requirements where European Network Codes requirements allow flexible implementation. The specified requirements are solely technical requirements; economic issues regarding, e.g. the bearing of cost are not in the scope of this document.

CLC/TC 8X plans future standardization work in order to ensure the compatibility of this European Standard (EN) with the evolution of the legal framework.

1 Scope

This European Standard specifies the technical requirements for the protection functions and the operational capabilities for generating plants, intended to operate in parallel with MV distribution networks.

For practical reasons, this European Standard refers to the relevant distribution system operator where settings have to be defined and/or provided, even when these settings are to be defined and/or provided by another actor e.g. TSO, Member state, regulatory authorities, according to national and European legal framework.

NOTE 1 This includes European network codes and their national implementation, as well as additional national regulations.

NOTE 2 Additional national requirements especially for the connection to the distribution network and the operation of the generating plant may apply.

The requirements of this European Standard apply to all generating plants, generating modules, electrical machinery and electronic equipment, irrespective of the kind of primary energy source and irrespective of the presence of loads in the producer's network that meet all of the following conditions:

- converting any primary energy source into AC electricity;
- connected to a MV distribution network
- generating modules capacity of Type B or smaller according to COMMISSION REGULATION (EU) 2016/631while considering national implementation for the decision regarding power limits between A and B types and B and C types;
- intended to operate in parallel with a distribution network.

If generating modules of different type are combined in one plant, different requirements apply for the different modules based on the type of each module.

NOTE 3 Generating plants connected to a LV distribution network fall into the scope of EN 50549–1.

Unless specified otherwise by the DSO, a generating with a maximum apparent power up to 100 kVA can, as alternative to the requirements of this European Standard, comply with EN 50549-1. A different threshold may be defined by the DSO.

This European Standard defines connection requirements for generating plants to be connected in parallel with distribution networks.

This European Standard recognizes the existence of National Standards, Network Codes, and specific technical requirements of the DSOs and these should be complied with.

Excluded from the scope are:

- the selection and evaluation of the point of connection;
- power system impact assessment;
- connection assessment;
- island operation of generating plants, both intentional and unintentional, where no part of the distribution network is involved;
- four-quadrant rectifier of drives feeding breaking energy back into the distribution network for limited duration with no internal source of primary energy;
- Uninterruptible power supply with duration of parallel operation limited to 100ms

NOTE 4 Parallel operation due to maintenance of uninterruptible power supply units is not considered.

- requirements for the safety of personnel as they are already adequately covered by existing European Standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 60044-2, Instrument transformers — Part 2: Inductive voltage transformers (IEC 60044-2)

EN 60044-7, Instrument transformers — Part 7: Electronic voltage transformers (IEC 60044-7)

EN 60255-127, Measuring relays and protection equipment — Part 127: Functional requirements for over/under voltage protection (IEC 60255-127)

EN 61000-4-30, Electromagnetic compatibility (EMC) — Part 4-30: Testing and measurement techniques — Power quality measurement methods (IEC 61000-4-30)

EN 61869-3, Instrument transformers — Part 3: Additional requirements for inductive voltage transformers (IEC 61869-3)

3 Terms and definitions

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

3.1 General

3.1.1
distribution network
electrical network, including closed distribution networks, for the distribution of electrical power from and to third parties connected to it, to and from a transmission or another distribution network, for which a DSO is responsible

3.1.2
closed distribution network
a system which distributes electricity within a geographically confined, industrial, commercial or shared services site and does not (without prejudice to a small number of households located within the area served by the system and with employment or similar associations with the owner of the system) supply households customers. This Closed Distribution Network will either have its operations or the production process of the users of the system integrated for specific or technical reasons or distribute electricity primarily to the owner or operator of the Closed Distribution Network or their related undertakings

3.1.3
distribution system operator - DSO
natural or legal person responsible for the distribution of electrical power to the public and for operating, ensuring the maintenance of and, if necessary, developing the distribution network in a given area

Note 1 to entry: in this document applicable to distribution grids DSO is used for relevant system operator according Article 2 (13) of COMISSION REGULATION 2016/631

Note 2 to entry: In some countries, the distribution network operator (DNO) fulfils the role of the DSO.

3.1.4
transmission system operator - TSO
natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other power systems, and for ensuring the long-term ability of the power system to meet reasonable demands for the transmission of electricity

3.1.5
medium voltage (MV) distribution network
electric distribution network with a voltage whose nominal r.m.s. value is 1 kV < Un ≤ 36 kV

Note 1 to entry: Because of existing network structures, the upper boundary of MV can be different in some countries.

3.1.6
power system stability
the capability of a power system to regain a steady state, characterized by the synchronous operation of the generating plants after a disturbance

[SOURCE: IEV 603-03-01]

3.1.7
producer
natural or legal person who already has or is planning to connect an electricity generating plant to a distribution network

3.1.8
producer's network
electrical installations downstream from the point of connection owned/operated by the producer for internal distribution of electricity

3.1.9
downstream
direction in which the active power would flow if no generating units, connected to the distribution network, were running

3.1.10
point of connection - POC
reference point on the electric power system where the user's electrical facility is connected

Note 1 to entry: For the purpose of this standard, the electric power system is the distribution network.

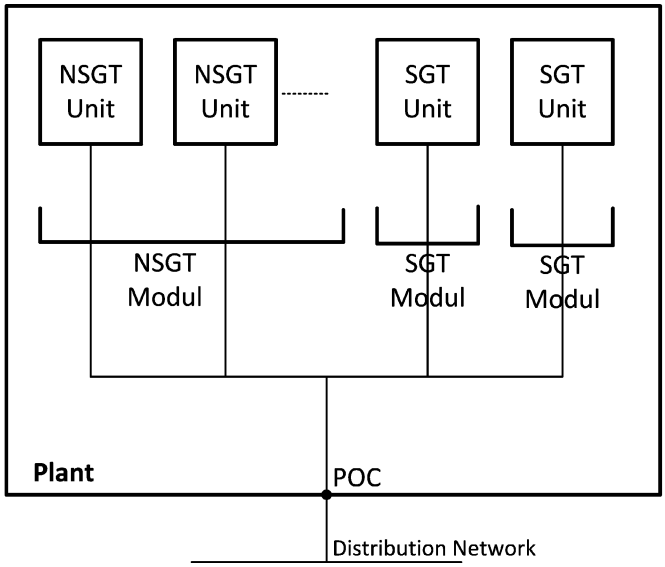
[SOURCE: IEV 617-04-01 modified]

3.1.11
operating in parallel with the distribution network
situation where the generating plant is connected to a distribution network and operating

3.1.12
temporary operation in parallel with the distribution network
conditions in which the generating plant is connected to a distribution network, during defined short periods, to maintain the continuity of the supply voltage and to facilitate testing

3.2 Plant, module and unit

3.2.1
generating module
either a generating unit of synchronous generating technology or the sum of all generating units of non-synchronous generating technology connected to a common point of connection including all elements needed to feed electric power to the distribution grid



NSGT: non-synchronous generating technology

SGT: synchronous generating technology

Figure 1 — Generating module at a common POC

3.2.2
generating plant
sum of generating modules connected at one point of connection, including auxiliaries and all connection equipment

Note 1 to entry: This definition is intended to be used for verification of compliance to the technical requirements of this standard. It may be different to the legal definition of a plant.

3.2.3
generating unit
smallest set of installations which can generate electrical energy running independently and which can feed this energy into a distribution network

Note 1 to entry: For example, a combined cycle gas turbine (CCGT) or an organic rankine cycle (ORC) after a combustion engine is considered as a single generating unit.

Note 2 to entry: If a generating unit is a combination of technologies leading to different requirements, this has to be settled case by case.

Note 3 to entry: A storage device operating in electricity generation mode and AC connected to the distribution network is considered to be a generating unit.

3.2.4
synchronously coupled generating technology
technology where a generating unit is based on a synchronous machine which is directly coupled

3.2.5
non-synchronous generating technology
technology where a generating unit is connected non-synchronously to a distribution grid

Note 1 to entry: Examples are: induction machines and converter based technologies.

3.2.6
cogeneration -combined heat and power (CHP)
combined generation of electricity and heat by an energy conversion system and the concurrent use of the electric and thermal energy from the conversion system

3.3 Power

3.3.1
design active power - P_D
maximum AC active power output at an active factor of 0,9 or the active factor specified by the DSO for a certain generating plant or generating technology

3.3.2
maximum active power - P_{max}
maximum continuous active power which a power-generating plant can produce, less any demand associated solely with facilitating the operation of that power-generating plant and not fed into the network as specified in the connection agreement or as agreed between the DSO and the power-generating facility owner

Note 1 to entry: This maximum power is defined by a measurement with 10 min averaging.

3.3.3
rated current
maximum continuous AC output current which a generating unit or generating plant is designed to achieve under normal operating conditions

[SOURCE: IEV 415-04-03, modified]

3.3.4
maximum apparent power - S_{max}
maximum AC apparent power output that the generating unit or the sum of all the generating units in a generating plant is designed to achieve under normal operating conditions

Note 1 to entry: This maximum power is defined by a measurement with 10 min averaging.

3.3.5
momentary active power - P_M
actual AC active power output at a certain instant

3.3.6
primary energy source
non-electric energy source supplying an electric generating unit

Note 1 to entry: Examples of primary energy sources include natural gas, wind and solar energy. These sources can be utilized, e.g. by gas turbines, wind turbines and photovoltaic cells.

3.3.7
available active power - P_A
maximum AC active power available from the prime mover subject to the availability and magnitude of the primary energy source at the relevant time

Note 1 to entry: The maximum active power considers all constraints regarding e.g. the primary energy source or the availability of a heat sink for CHP.

3.4 Voltage

3.4.1
nominal voltage - U_n
voltage by which a supply network is designated or identified and to which certain operating characteristics are referred

3.4.2
nominal frequency - f_n
frequency used to designate and identify equipment or a power system

Note 1 to entry: For the purpose of this standard, the nominal frequency f_n is 50 Hz.

[SOURCE: IEV 151-16-09, modified]

3.4.3
declared supply voltage - U_C
supply voltage U_C agreed by the power system operator and the network user

Note 1 to entry: Generally declared supply voltage U_C is the nominal voltage U_N but it may be different according to the agreement between the DSO and the network user.

[SOURCE: EN 50160]

3.4.4
reference voltage
value specified as the base on which residual voltage, thresholds and other values are expressed in per unit or percentage terms

Note 1 to entry: For the purpose of this standard, the reference voltage is the nominal voltage or the declared voltage of the distribution network.

[SOURCE: EN 50160:2010, 3.18, modified]

3.4.5
voltage change
variation of the r.m.s. value of a voltage between two consecutive levels sustained for definite but unspecified durations

[SOURCE: IEV 161-08-01, modified]

3.4.6
voltage variation
increase or decrease of r.m.s. voltage normally due to load variations in load and/or generation

[SOURCE: EN 50160:2010, 3.34, modified]

3.5 Circuit theory

3.5.1
active factor
for a two-terminal element or a two-terminal circuit under sinusoidal conditions, ratio of the active power to the apparent power

Note 1 to entry: In a three phase system, this is referring to the positive sequence component of the fundamental.

Note 2 to entry: The active factor is equal to the cosine of the displacement angle.

[SOURCE: IEV 131-11-49, modified]

3.5.2
displacement angle - φ
under sinusoidal conditions, phase difference between the voltage applied to a linear two-terminal element or two-terminal circuit and the electric current in the element or circuit

Note 1 to entry: In a three phase system, this is referring to the positive sequence component of the fundamental.

Note 2 to entry: The cosine of the displacement angle is the active factor.

[SOURCE IEV 131-11-48 modified]

3.5.3
power factor
under periodic conditions, ratio of the absolute value of the active power P to the apparent power S:

$$\lambda = \frac{|P|}{S}$$

Note 1 to entry: Under sinusoidal conditions, the power factor is the absolute value of the active factor.

[SOURCE: IEV 131-11-46]

3.5.4
fundamental components of a three-phase system
3.5.4.1
phasor
representation of a sinusoidal integral quantity by a complex quantity whose argument is equal to the initial phase and whose modulus is equal to the root-mean-square value

Note 1 to entry: For a quantity a(t) = A √2 cos(ωt +Θ$_0$) the phasor is A exp Jθ$_0$.

Note 2 to entry: The similar representation with the modulus equal to the amplitude is called “amplitude phasor”.

Note 3 to entry: A phasor can also be represented graphically.

[SOURCE: IEV 131-11-26, modified]

3.5.4.2
positive sequence component of the fundamental
for a three-phase system with phases L1, L2 and L3, the symmetrical sinusoidal three-phase set of voltages or currents having frequency equal to the fundamental frequency and which is defined by the following complex mathematical expression:

$$\underline{X}_1 = \frac{1}{3}\left(\underline{X}_{L1} + \underline{a}\,\underline{X}_{L2} + \underline{a}^2\,\underline{X}_{L3}\right)$$

where $\underline{a} = e^{j2\pi/3}$ is the 120 degree operator, and X_{L1}, X_{L2} and X_{L3} are the complex expressions of the fundamental frequency phase quantities concerned, that is, current or voltage phasors

Note 1 to entry: In a balanced harmonic-free system, only positive sequence component of the fundamental exists. For example, if phase voltage phasors are symmetrical $\underline{U}_{L1} = Ue^{j\theta}$, $\underline{U}_{L2} = Ue^{j(\theta+4\pi/3)}$ and $\underline{U}_{L3} = Ue^{j(\theta+2\pi/3)}$ then $\underline{U}_1 = (Ue^{j\theta} + e^{j2\pi/3}\,Ue^{j(\theta+4\pi/3)} + e^{j4\pi/3}\,Ue^{j(\theta+2\pi/3)})/3 = (Ue^{j\theta} + Ue^{j\theta} + Ue^{j\theta})/3 = Ue^{j\theta}$

[SOURCE: IEV 448-11-27]

3.5.4.3
negative sequence component of the fundamental
for a three-phase system with phases L1, L2 and L3, the symmetrical sinusoidal three-phase set of voltages or currents having frequency equal to the fundamental frequency and which is defined by the following complex mathematical expression:

$$\underline{X}_2 = \frac{1}{3}\left(\underline{X}_{L1} + \underline{a}^2\,\underline{X}_{L2} + \underline{a}\,\underline{X}_{L3}\right)$$

where $\underline{a} = e^{j2\pi/3}$ is the 120 degree operator, and X_{L1}, X_{L2} and X_{L3} are the complex expressions of the fundamental frequency phase quantities concerned, that is, current or voltage phasors

Note 1 to entry: Negative sequence voltage or current components may be significant only when the voltages or currents, respectively, are unbalanced. For example, if phase voltage phasors are symmetrical $\underline{U}_{L1} = Ue^{j\theta}$, $\underline{U}_{L2} = Ue^{j(\theta+4\pi/3)}$ and $\underline{U}_{L3} = Ue^{j(\theta+2\pi/3)}$ then the negative sequence component $\underline{U}_2 = (Ue^{j\theta} + e^{j4\pi/3}\,Ue^{j(\theta+4\pi/3)} + e^{j2\pi/3}\,Ue^{j(\theta+2\pi/3)})/3 = Ue^{j\theta}\,(1 + e^{j2\pi/3} + e^{j4\pi/3})/3 = 0$.

[SOURCE: IEV 448-11-28]

3.5.4.4
zero sequence component of the fundamental
for a three-phase system with phases L1, L2 and L3, the in-phase sinusoidal voltage or current component having the fundamental frequency and equal amplitude in each of the phases and which is defined by the following complex mathematical expression:

$$\underline{X}_0 = \frac{1}{3}\left(\underline{X}_{L1} + \underline{X}_{L2} + \underline{X}_{L3}\right)$$

where X_{L1}, X_{L2} and X_{L3} are the complex expressions of the fundamental frequency phase quantities concerned, that is, current or voltage phasors

[SOURCE: IEV 448-11-29]

3.6 Protection

3.6.1
protection system
an arrangement of one or more protection equipments, and other devices intended to perform one or more specified protection functions

Note 1 to entry: A protection system includes one or more protection equipments, instrument transformer(s), wiring, tripping circuit(s), auxiliary supply(s) and, where provided, communication system(s). Depending upon the principle(s) of the protection system, it may include one end or all ends of the protected section and, possibly, automatic reclosing equipment.

Note 2 to entry: The circuit-breaker(s) are excluded.

[SOURCE: IEV 448-11-03]

3.6.2
protection relay
measuring relay which detects faults or other abnormal conditions in a power system or of a power equipment

Note 1 to entry: A protection relay is a component part of a protection system.

Note 2 to entry: An interface protection relay is a protection relay acting on the interface switch.

[SOURCE: IEV 447-01-14]