

SLOVENSKI STANDARD
SIST EN 50549-2:2019**01-april-2019****Nadomešča:****SIST-TS CLC/TS 50549-2:2015**

**Zahteve za vzporedno vezavo generatorskih postrojev z razdelilnim omrežjem - 2.
del: Vezava s srednjenapetostnim razdelilnim omrežjem do vključno tipa B**

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

Anforderungen für zum Parallelbetrieb mit einem Verteilnetz vorgesehene
Erzeugungsanlagen – Teil 2: Anschluss an das Mittelspannungsverteilstromnetz für
Erzeugungsanlagen bis einschließlich Typ B

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Exigences relatives aux centrales électriques destinées à être raccordées en parallèle à
des réseaux de distribution - Partie 2: Raccordement à un réseau de distribution MT -
Centrales électriques jusqu'au Type B inclus

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Requirements for generating plants to be connected in parallel
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distribution network - Generating plants up to and including Type
B

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das Mittelspannungsverteilstromnetz für Erzeugungsanlagen bis
einschließlich Typ B

This European Standard was approved by CENELEC on 2018-08-09. 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.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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EN 50549-2:2019 (E)**European foreword**

This document (EN 50549-2:2019) 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) 2019-08-01
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2022-02-01

This document supersedes CLC/TS 50549-2:2015.

This European Standard relates to both the RfG European Network Code 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 the RfG European Network Code 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.

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.

Introduction

1. Foreword

This Explanatory Note explains the rationale behind the content and structure of EN 50549-1 and EN 50549-2. Due to the unique relationship between COMMISSION REGULATION 2016/631 (RfG) and the EN 50549 Series, and based on the comments received at the enquiry stage of FprEN 50549-1 and FprEN 50549-2, TC8X WG03 decided to draft this explanatory note in order to provide national committees and the wider public with an understanding of these rationale

2. Increased Scope of EN 50549 in relation to RfG

In the tradition of EN 50438, TC8X WG03 intended, in writing of FprEN 50549, to include all capabilities of generating plants that are needed to operate these in parallel to distribution networks. This includes issues necessary for a stable distribution network management as well as the management of the interconnected system. As RfG is focused on the interconnected system, it is logical that, taking into account further needs for distribution network management, further aspects are included.

3. Introduction of “Responsible party”

During the national implementation process of COMMISSION REGULATION (EU) 2016/631, different types of responsible parties play a role in the refinement of the non-exhaustive requirements. In each member country, the National Regulatory Authority approves this national implementation. Depending on the national regulatory framework, this might result in a variety of documents: national laws, decrees or regulations, technical specifications, or requirements of transmission and distribution system operators. Therefore, as explained in the scope, EN 50549-1 and EN 50549-2 refer to the “responsible party” where requirements have to be defined by an actor other than the DSO. However when a generating plant is built and connected to the distribution network, typically the distribution system operator provides the plant developer all the technical requirements to be fulfilled.

4. Use of terms

Terms and definitions are selected to achieve consistency with EN 60050, IEC (cf. www.electropedia.org) and CENELEC terminology, recognizing that terms in COMMISSION REGULATION (EU) 2016/631 may deviate.

5. Additional requirements for distribution system management

The following requirements are stated in EN 50549 for distribution system management reasons, which might not be required in RfG or if required in RfG, are not required for type A. As Directive 714/2009 8(7) limits the scope of RfG to issues effecting the cross border trade of electricity, requirements included solely for the need of distribution system management are considered beyond the scope of RfG.

- Connection scheme and Coordination of switch gear,
- Voltage operating range,
- Reactive power capability and control modes,
- Voltage related active power reduction,
- Interface protection including the detection of island situations,
- Connection and reconnection to the grid,
- Generation curtailment,
- Remote information exchange,

6. Additional requirements for stability of the interconnected system

Additionally, requirements relevant for the stability of the interconnected systems are included in case of over voltage ride through (OVRT) as this is not dealt with in RfG. Due to the long duration of RfG development and the fast development of decentralised generation in Europe robustness to voltage swells is considered to be of high importance, but apparently could not be included into RfG.

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As electrical energy storage system (EESS), are excluded from the scope of RfG, but are included in the scope of the EN 50549 Series, EN 50549 also includes the further requirement of active power frequency response to under frequency (LFSM-U) to electrical energy storage systems. This requirement is considered of great importance in view of the expected fast increase of electrical energy storage for the next years and is considered not to affect the cost of electrical energy storage systems if considered during their design.

7. Details on the operation of the LFSM-O

During the enquiry stage, some comments reported that certain details in the chapter regarding the operation of the LFSM-O (e.g. intentional delay, operation with deactivation threshold) were violating the RfG. These topics have been further evaluated consulting the European Stakeholder Committee (ESC-GC) and TC8X WG03 could not conclude in the same way. The fact that these operations are not foreseen in the RfG is considered not sufficient to state any violation. Therefore these details are kept with additional information on their use.

8. Implementation of UVRT and LFSM-U to avoid legal conflict with RfG

Under Voltage Ride Through (UVRT) requirements are defined in RfG for modules type B, type C and type D. There is no mentioning of this topic for type A modules.

Nevertheless UVRT is seen as an important requirement in some member states even for small generation modules like type A.

From a legal point of view there are two contradicting opinions on whether it is allowed or forbidden to require UVRT for type A modules.

- Opinion 1: It can be required because the topic is not dealt with for type A modules.
- Option 2: It cannot be required because the topic UVRT is dealt within the RfG. Not mentioning UVRT for type A in RfG therefore means that it cannot be required for type A modules.

As long as there is no clarification on this legal issue Cenelec does not have the possibility to require UVRT for type A modules. This is the reason why in EN 50549-1 and 50549-2 the UVRT functionalities for type A generating plants are not defined as requirements (shall) but as a recommendation (should).

This same explanation can be applied to the requirements regarding Limited Frequency Sensitive Mode - Underfrequency (LFSM-U). In RfG, this LFSM-U is solely defined for type C and type D modules. In EN 50549, LFSM-U is defined as a recommendation (should) for generating modules of type A and type B. The sole exception is electrical energy storage systems having a requirement (shall) but these systems are not within the scope of the RfG.

9. Annex H - Relationship between this European standard and the COMMISSION REGULATION (EU) 2016/631.

Manufacturers of generating units and plants shall comply with all relevant EU Directives and Regulations. For the specific function of connecting the generating plant with the electric system the reference regulation is COMMISSION REGULATION (EU) 2016/631 (NC RfG).

Since the EN 50549-1 and -2 are covering all technical requirements for type A and type B generating units, modules and plants, it is considered helpful to provide the information which clause of the standard supports which article of the RfG in a structured informative annex within the standard.

For other EU Directives and Regulations (e.g. LVD, MD or GAR) it is a formal task given to CCMC to include such an informative Annex ZZ based on a standardization request from the EU. It is finally reviewed by the new approach consultant (NAC) for the relevant Directive or Regulation, prior to the listing of the standard in the official journal of the EU (OJEU) providing then “presumption of conformity”. This means that if a product is compliant with the standard, the Directive or Regulations is fulfilled too.

CLC TC 8X is fully aware, that this official procedure is not included in the RfG. Therefore CLC TC 8X WG3 drafted Annex H. In Annex H the relationship between the clauses and the articles is shown. It is considered, that generating plants compliant with the clauses of the standards are also compliant with the articles in the RfG. Of course, this does not provide “presumption of conformity” as a listed standard in the OJEU would provide. Nevertheless it will be helpful for the industry when performing the conformity assessment against RfG.

1 Scope

This document 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 document refers to the responsible party where requirements have to be defined by an actor other than the DSO, e.g. TSO, member state, regulatory authorities according to the legal framework. Typically the DSO will inform the producer about these requirements.

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

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

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

NOTE 4 Electrical energy storage systems (EESS) in meeting the conditions above are included

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

EXAMPLE: If a generating plant consists of multiple generating modules (see 3.2.1), according to COMMISSION REGULATION (EU) 2016/631 the situation might occur, that some generating modules are of type A and some are of type B.

Unless specified otherwise by the DSO and the responsible party, generating plants with a maximum apparent power up to 150 kVA can, as alternative to the requirements of this document, comply with EN 50549-1. A different threshold may be defined by the DSO and the responsible party.

This document recognizes the existence of specific technical requirements (e.g. grid codes) of the DSO or another responsible party within a member state and these must be complied with.

Excluded from the scope are:

- the selection and evaluation of the point of connection;
- power system impact assessment e.g. assessment of effects on power quality, local voltage increase, impact on line protections operation;
- connection assessment, the set of technical verifications made as part of the planning of the connection;
- 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 100 ms;

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NOTE 5 Parallel operation due to maintenance of uninterruptible power supply units is not seen as part of normal UPS operation and therefore not considered in this EN.

- requirements for the safety of personnel as they are already adequately covered by existing European Standards.
- the connection of a generating unit, module or plant into a DC network

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 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.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://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 may deviate.

3.1 General**3.1.1****distribution network**

AC 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

Note 1 to entry: A distribution network does not include the producer's network

3.1.2**closed distribution network**

system which distributes electricity within an industrial, commercial or shared services site, that is geographically confined, and does not supply households customers (without excluding the option of a small number of households served by the system that have an employment or similar associations with the owner of the system)

Note 1 to entry: A closed distribution network will either be used to integrate the production processes of the network users for specific or technical reasons or distribute electricity primarily to the operator of the closed distribution network or his related undertakings

[SOURCE: Directive 2009/72/EC, article 28, modified]

3.1.3**distribution system operator****DSO**

natural or legal person responsible for the distribution of electrical power to final customers and for operating, ensuring the maintenance of and, if necessary, developing the distribution network in a given area

Note 1 to entry: As this document is applicable to distribution grids, DSO is used for relevant system operator according to article 2 (13) of COMMISSION 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**

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**responsible party**

party, that according to the legal framework is responsible to define requirements or parameters according to COMMISSION REGULATION 2016/631 e.g. TSO, member state, regulatory authority

3.1.6**low voltage (LV) distribution network**

electric distribution network with a voltage whose nominal r.m.s. value is $U_n \leq 1$ kV

3.1.7**medium voltage (MV) distribution network**

electric distribution network with a voltage whose nominal r.m.s. value is $1 \text{ kV} < U_n \leq 36$ kV

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

3.1.8**power system stability**

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

[SOURCE: IEC 603-03-01]

3.1.9**producer**

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

EN 50549-2:2019 (E)**3.1.10****producer's network**

AC electrical installations downstream from the point of connection operated by the producer for internal distribution of electricity

Note 1 to entry: When the internal distribution network is identical to an electrical network of a customer having his own generating plant, where one or more generating units are connected to this internal distribution network behind a point of connection, then this network may be also referred as prosumer's network

3.1.11**downstream**

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

3.1.12**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: IEC 617-04-01 modified]

3.1.13**operating in parallel with the distribution network**

situation where the generating plant is connected to a distribution network and operating

3.1.14**temporary operation in parallel with the distribution network**

conditions in which the generating plant is connected during defined short periods to a distribution network to maintain the continuity of the supply and to facilitate testing

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3.1.15**nominal value**

value of a quantity used to designate and identify a component, device, equipment, or system

Note to entry: The nominal value is generally a rounded value.

[SOURCE: IEC 151-16-09]

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

Note 1 to entry: In some documents this can mean a power-generating module

Note 2 to entry: Generating modules in the context of this document can be of type A or type B according to the definition of COMMISSION REGULATION 2016/631, article 5

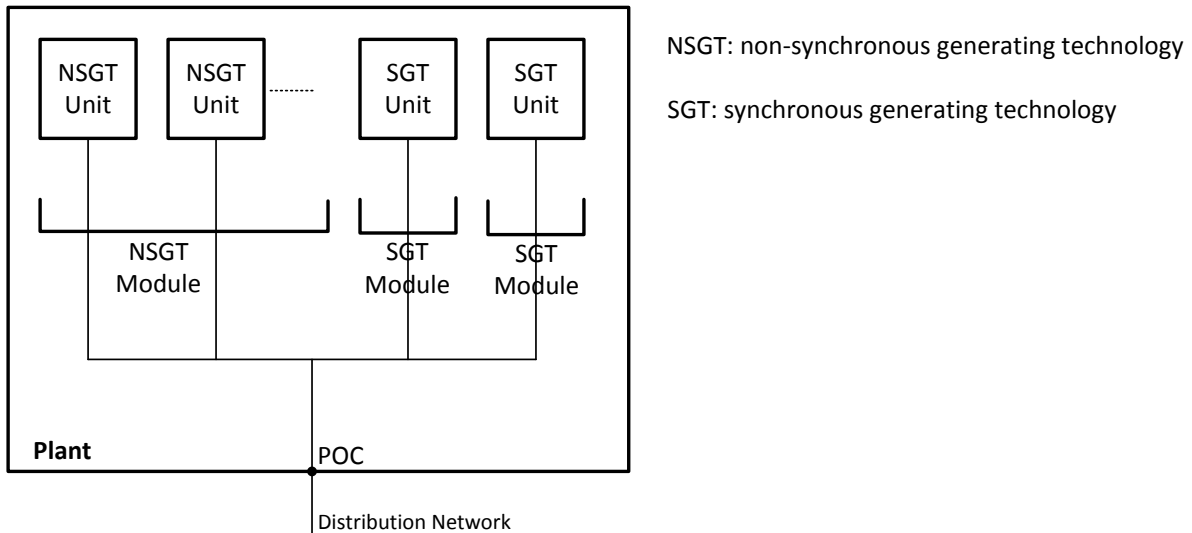


Figure 1 — Generating module at a common POC

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: In some documents this can mean a power-generating plant

Note 2 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: In some documents this can mean a power-generating unit

Note 2 to entry: For example, a combined cycle gas turbine (CCGT) consisting of a gas turbine and a steam turbine or an installation of an internal combustion engine (ICE) followed by an organic rankine cycle (ORC) machine are considered both as a single generating unit.

Note 3 to entry: If a generating unit is a combination of technologies leading to different requirements, this has to be resolved case by case.

Note 4 to entry: A electrical energy storage EES operating in electricity generation mode and AC connected to the distribution network is considered to be a generating unit.

3.2.4

void

3.2.5

void

3.2.6

synchronous generating technology

technology where a generating unit is based on a synchronous machine which is directly coupled to an electric power system

EN 50549-2:2019 (E)**3.2.7****non-synchronous generating technology**

technology where a generating unit is connected non-synchronously to an electric power system

EXAMPLE induction machine (non-synchronously connected in COMMISSION REGULATION 2016/631), converter based technology (connected through power electronics in COMMISSION REGULATION 2016/631)

3.2.8**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

3.2.9**electrical energy storage system****EES system****EES**

grid-integrated installation with defined electrical boundaries, comprising of at least one EES, whose purpose is to extract electrical energy from an electric power system, store this energy internally in some manner and inject electrical energy into an electrical power system and which includes civil engineering works, energy conversion equipment and related ancillary equipment.

Note 1 to entry: The EES system is controlled and coordinated to provide services to the electric power system operators or to the electric power system users.

Note 2 to entry: In some cases, an EES system may require an additional energy source during its discharge, providing more energy to the electric power system than the energy it stored.

[SOURCE: IEC 62933-1 ED1]

3.2.10**electrical energy storage****EES**

installation able to absorb electrical energy, to store it for a certain amount of time and to release electrical energy during which energy conversion processes may be included

EXAMPLE A device that absorbs AC electrical energy to produce hydrogen by electrolysis, stores the hydrogen, and uses that gas to produce AC electrical energy is an EES.

Note 1 to entry: EES may be used also to indicate the activity of an apparatus described in the definition during performing its own functionality.

[SOURCE: IEC 62933-1 ED1]

3.3 Power**3.3.1****active power****P**

under periodic conditions, mean value, taken over one period T , of the instantaneous power p

$$P = \frac{1}{T} \int_0^T p dt$$

Note 1 to entry: Under sinusoidal conditions, the active power is the real part of the complex power S , thus $P = \text{Re } S$.

Note 2 to entry: The coherent SI unit for active power is watt, W.

[SOURCE: IEC 131-11-42]

3.3.2**design active power** **P_D**

maximum AC active power output at an active factor of 0,95 or the active factor specified by the DSO or the responsible party for a certain generating plant or generating technology

3.3.3**maximum active power** **P_{max}**

maximum continuous active power, measured in a 10 min average, which a generating unit or the sum of all the generating units in a generating plant can produce, minus any loads associated solely with facilitating the operation of that generating plant and not fed into the network as specified in the connection agreement or as agreed between the DSO and the generating plant operator

3.3.5**momentary active power** **P_M**

actual AC active power output at a certain instant

3.3.6**available active power** **P_A**

maximum AC active power available from the primary energy source after power conversion subject to the availability and magnitude of that primary energy source at the relevant time

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

3.3.7**rated current**

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

3.3.8**maximum apparent power** **S_{max}**

maximum AC apparent power output, measured in a 10 min average, that the generating unit or the sum of all the generating units in a generating plant is designed to achieve under normal operating conditions

3.3.9**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.

3.4 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