



Irish Standard
I.S. EN 50549-1:2019&A1:2023

Version 1.02

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

I.S. EN 50549-1:2019&A1:2023 V1.02

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

NSAI/... xxx: A National adoption of a Technical Regulation (TR), Technical Specification (TS), CEN and/or CENELEC Workshop Agreement (CWA).

I.S. EN 50549-1:2019&A1:2023 V1.02 was published under the authority of the NSAI and came into effect on: 2023-10-29

ICS number(s): 29.160.20

NSAI
1 Swift Square
Northwood, Santry
Dublin 9
D09 A0E4
+353 1 807 3800
standards@nsai.ie
[NSAI.ie](https://www.nsa.ie)

Sales
+353 1 857 6730
[Standards.ie](https://www.standards.ie)

Údarás um Chaighdeán Náisiúnta na hÉireann

National Foreword

I.S. EN 50549-1:2019&A1:2023 V1.02 is the version of the NSAI adopted European document 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*, including any Corrections, Amendments etc. to EN 50549-1:2019.

This normative document by CEN/CENELEC the elaboration of which includes a public enquiry, followed by a Formal Vote of CEN/CENELEC national members and final ratification. This European Standard is published as an identical national standard and every conflicting national standard will be withdrawn. The content of a European Standard does not conflict with the content of any other EN (and HD for CENELEC).

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

For relationships with other publications refer to the NSAI web store.

Conformance with this document does not of its self confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

I.S. EN 50549-1:2019&A1:2023 V1.02

This page intentionally left blank

EUROPEAN STANDARD

EN 50549-1:2019/A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2023

ICS 29.160.20

English Version

**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**

Exigences relatives aux centrales électriques destinées à
être raccordées en parallèle à des réseaux de distribution -
Partie 1: Raccordement à un réseau de distribution BT -
Centrales électriques jusqu'au Type B inclus

Anforderungen für zum Parallelbetrieb mit einem Verteilnetz
vorgesehene Erzeugungsanlagen - Teil 1: Anschluss an
das Niederspannungsverteilstromnetz - Erzeugungsanlagen bis
einschließlich Typ B

This amendment A1 modifies the European Standard EN 50549-1:2019; it was approved by CENELEC on 2023-09-21. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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.



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

Contents

Page

European foreword.....	3
1 Modification to Introduction	4
2 Modification to Clause 2, “Normative references”	4
3 Modification to Clause 3, “Terms and definitions”	4
4 Modification to Clause 4, “Requirements on generating plants”	6
5 Modification to Annex C, “Parameter Table”	10
6 Modification to Annex D, “List of national requirements applicable for generating plants”	11
7 Modification to Annex F, “Examples of protection strategies”	11

European foreword

This document EN 50549-1:2019/A1:2023 has been prepared by TC 8X “System aspects of electrical energy supply”.

The following dates are fixed:

- latest date by which this document has to be (dop) 2024-09-21
implemented at national level by publication of
an identical national standard or by
endorsement
- latest date by which the national standards (dow) 2026-09-21
conflicting with this document have to be
withdrawn

This document amends EN 50549-1:2019.

This amendment includes the following significant technical changes:

- Introduction of a phase jump immunity requirement.
- Harmonizing the ROCOF immunity requirement for synchronous and non-synchronous generating technology.
- Modifying FRT for type A from recommendation to requirement.
- Providing additional detail for EESS in case of overfrequency.

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.

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.

EUROPEAN STANDARD

EN 50549-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2019

ICS 29.160.20

Supersedes CLC/TS 50549-1:2015, EN 50438:2013, EN 50438:2013/IS1:2015

English Version

**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**

Exigences relatives aux centrales électriques destinées à
être raccordées en parallèle à des réseaux de distribution -
Partie 1: Raccordement à un réseau de distribution BT -
Centrales électriques jusqu'au Type B inclus

Anforderungen für zum Parallelbetrieb mit einem Verteilnetz
vorgesehene Erzeugungsanlagen - Teil 1: Anschluss an
das Niederspannungsverteilstromnetz 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.

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.



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

Contents	Page
European foreword	4
Introduction.....	5
1 Scope.....	8
2 Normative references	9
3 Terms and definitions	9
3.1 General	9
3.2 Plant, module and unit.....	11
3.3 Power.....	14
3.4 Voltage.....	15
3.5 Circuit theory.....	16
3.6 Protection.....	18
3.7 Control	22
4 Requirements on generating plants	23
4.1 General	23
4.2 Connection scheme	24
4.3 Choice of switchgear	24
4.3.1 General	24
4.3.2 Interface switch	24
4.4 Normal operating range	25
4.4.1 General	25
4.4.2 Operating frequency range	25
4.4.3 Minimal requirement for active power delivery at underfrequency	26
4.4.4 Continuous operating voltage range	27
4.5 Immunity to disturbances.....	27
4.5.1 General	27
4.5.2 Rate of change of frequency (ROCOF) immunity	27
4.5.3 Under-voltage ride through (UVRT)	28
4.5.4 Over-voltage ride through (OVRT)	29
4.6 Active response to frequency deviation	30
4.6.1 Power response to overfrequency.....	30
4.6.2 Power response to underfrequency.....	33
4.7 Power response to voltage changes	36
4.7.1 General	36
4.7.2 Voltage support by reactive power	36
4.7.3 Voltage related active power reduction	41
4.7.4 Short circuit current requirements on generating plants	41
4.8 EMC and power quality	42
4.9 Interface protection	43
4.9.1 General	43
4.9.2 Void.....	44
4.9.3 Requirements on voltage and frequency protection.....	45
4.9.4 Means to detect island situation	47

4.9.5	Digital input to the interface protection	48
4.10	Connection and starting to generate electrical power.....	48
4.10.1	General	48
4.10.2	Automatic reconnection after tripping.....	48
4.10.3	Starting to generate electrical power	48
4.10.4	Synchronization	49
4.11	Ceasing and reduction of active power on set point	49
4.11.1	Ceasing active power	49
4.11.2	Reduction of active power on set point	49
4.12	Remote information exchange	49
4.13	Requirements regarding single fault tolerance of interface protection system and interface switch	50
Annex A (informative)	Interconnection guidance	51
A.1	General	51
A.2	Network integration	51
A.3	Clusters of single-phase generating units	52
Annex B (informative)	Void	53
Annex C (informative)	Parameter Table	54
Annex D (informative)	List of national requirements applicable for generating plants	59
Annex E (informative)	Loss of Mains and overall power system security	61
Annex F (informative)	Examples of protection strategies	62
F.1	Introduction	62
F.1.1	General	62
F.1.2	Generalities	62
F.1.3	Detection of unwanted islands	62
F.1.4	Problems with uncontrolled islanding in MV networks	63
F.1.4.1	Safety	63
F.1.4.2	Grid parameters	63
F.1.4.3	Reclosing operations	63
F.1.4.4	Protection of islands against overcurrents	63
F.1.4.5	Protection against phase to earth faults	63
F.2	Example strategy 1	64
F.3	Example strategy 2	67
Annex G (normative)	Abbreviations	69
Annex H (informative)	Relationship between this European standard and the COMMISSION REGULATION (EU) 2016/631	70
Bibliography	71

European foreword

This document (EN 50549-1:2019) 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 (dop) 2019-08-01
implemented at national level by publication
of an identical national standard or by
endorsement
- latest date by which the national standards (dow) 2022-02-01
conflicting with this document have to
be withdrawn

This document supersedes EN 50438:2013 and CLC/TS 50549-1:2015.

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

Rationale for the content and structure of this document.

1. Foreword

This Explanatory Note explains the rationale behind the content and structure of prEN 50549-1 and prEN 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 prEN 50549-1 and prEN 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 prEN50549, 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, IECV (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.

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 EN50549, 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 LV 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 European Standard 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 LV distribution network.

NOTE 3 Generating plants connected to a MV distribution network fall into the scope of EN 50549-2.

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 connected to a medium voltage distribution network with a maximum apparent power up to 150 kVA can comply with this European Standard as alternative to the requirements of EN 50549-2. 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;

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-