SLOVENSKI STANDARD
SIST EN 50438:2014

01-januar-2014

Nadomešča:
SIST EN 50438:2008

Zahteve za vzporedno vezavo mikro generatorjev z javnim nizkonapetostnim razdelilnim omrežjem

Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks

Anforderungen für den Anschluss von Klein-Generatoren an das öffentliche Niederspannungsnetz

Prescriptions pour le raccordement de micro-générateurs en parallèle avec les réseaux publics de distribution à basse tension

Ta slovenski standard je istoveten z: **EN 50438:2013**

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 50438:2014 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50438

December 2013

ICS 29.160.20

Supersedes EN 50438:2007

English version

Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks

Exigences pour les installations de micro-génération destinées à être raccordées en parallèle avec les réseaux publics de distribution à basse tension

Anforderungen für den Anschluss von Klein-Generatoren an das öffentliche Niederspannungsnetz

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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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CENELEC

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

Ref. No. EN 50438:2013 E

Contents

Foreword

This document (EN 50438:2013) 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)	2014-11-04
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2016-11-04

This document supersedes EN 50438.2007.

EN 50438:2013 includes the following significant technical changes with respect to EN 50438:2007:

– introduction of a power reduction capability in case of over-frequency;

– introduction of reactive power capability

– update of national protection parameters settings in Annex A;

– modification of tests for the verification of interface protections (voltage and frequency);

– modification of the test for islanding detection;

– addition of a test for direct current injection.

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

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 future European Network Codes and current technical market needs. Its purpose is to give detailed description of functions to be implemented in products and methods to verify the compliance of the 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, e.g. settings for power response to over frequency.

CLC/TC 8X plans to review the Standard periodically, in order to ensure its compatibility with the evolution of the legal framework.

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1 Scope

This European Standard specifies technical requirements for the protection functions and the operational capabilities of micro-generating plants, designed for operation in parallel with public low-voltage distribution networks.

This European Standard applies irrespectively of the micro-generating plants' primary source of energy, where micro-generation refers to equipment with nominal currents up to and including 16 A per phase, single or multi phase 230/400 V or multi phase 230 V (phase-to-phase nominal voltage).

For practical reasons, this European Standard refers to the distribution system operator in case settings have to be defined and/or provided, even when these settings are to be defined and/or provided by another actor according to national and European legal framework.

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

NOTE 2 Further national requirements especially for the connection to the grid and the operation of the micro-generator can apply as long as they are not in conflict with this EN.

In some countries, this document may be applied to generators with higher nominal currents used mostly in domestic and small commercial installations. These countries are listed in Annex G.

The provisions of this European Standard are not intended to ensure by themselves the safety of DSO personnel or their contracted parties.

The following aspects are included in the scope:

- all micro-generation technologies are applicable.

The following aspects are excluded from the scope:

- multiple units that for one installation, in aggregate, exceed 16 A;
- issues of revenue rebalancing, metering or other commercial matters;
- requirements related to the primary energy source e.g. matters related to gas fired generator units;

- island operation of generating plants, both intentional and unintentional, where no part of the public distribution network is involved;
- active front ends of drives feeding energy back into the distribution network for short duration.

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 50110 (all parts), *Operation of electrical installations*

EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*

HD 60364 (all parts), *Low-voltage electrical installations (IEC 60364 series)*

EN 61000-3-2:2006, *Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current <= 16 A per phase) (IEC 61000-3-2:2005)*

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 (IEC 61000-3-3)*

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

EN 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)*

HD 60364-5-551, *Low-voltage electrical installations — Part 5-55: Selection and erection of electrical equipment — Other equipment — Clause 551: Low-voltage generating sets (IEC 60364-5-55:2001/A2:2008 (CLAUSE 551))*

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

3 Terms and definitions

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

3.1
active factor
ratio of the active power to the apparent power, for a two-terminal element or a two-terminal circuit under sinusoidal conditions

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

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

3.2
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

Note 1 to entry: In the context of small-scale generation this concept is sometimes referred to as "micro-CHP".

3.3
commissioning
process of putting into operation a micro-generator, apparatus, equipment, building, or facility

3.4
decommissioning
process of removing a micro-generator, apparatus, equipment, building, or facility from operation

3.5
disconnection
separation of the active parts of the micro-generator from the network with mechanical contacts providing at least the equivalent of basic insulation

Note 1 to entry: Passive components like filters, auxiliary power supply to the micro-generator and sense lines can remain connected.

Note 2 to entry: For the design of basic insulation all voltage sources will be considered.

3.6
displacement angle
phase difference angle 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.

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

3.7
LV distribution network
low voltage part of the electric power system used for the transfer of electricity within an area of consumption to consumers

3.8
distribution system operator
DSO
natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution network in a given area and, when applicable, its interconnections with other systems and for ensuring the long term ability of the system to meet reasonable demands for the distribution of electricity

3.9
droop
ratio of the per-unit change in frequency $(\Delta f)/f_n$ (where f_n is the nominal frequency) to the per-unit change in power $(\Delta P)/ P_M$ (where P_M is the actual active power at the instance when the frequency reaches the frequency threshold used to activate the droop control):

$$s = - (\Delta f/f_n) / (\Delta P/ P_M)$$

[SOURCE: IEV 603-04-08, modified — the full definition has been altered.]

3.10
electrical installation
assembly of wiring and electrical equipment that is used within the domestic premises for the distribution and/or use of electric energy

3.11
inform and fit
process of installing and commissioning a micro-generator with prior notification of the DSO, followed by commencement of operation without the need of prior formal approval of the DSO

3.12
installer[1)]
person who has received sufficient training to apply safe methods of work to install a micro-generator in compliance with the requirements of this standard

3.13
interface protection
electrical protection required to ensure that the micro-generator is disconnected for any event that could impair the integrity or degrade the safety of the distribution network

1) Based on national regulations, other terms may apply.

3.14
Interface protection system timing

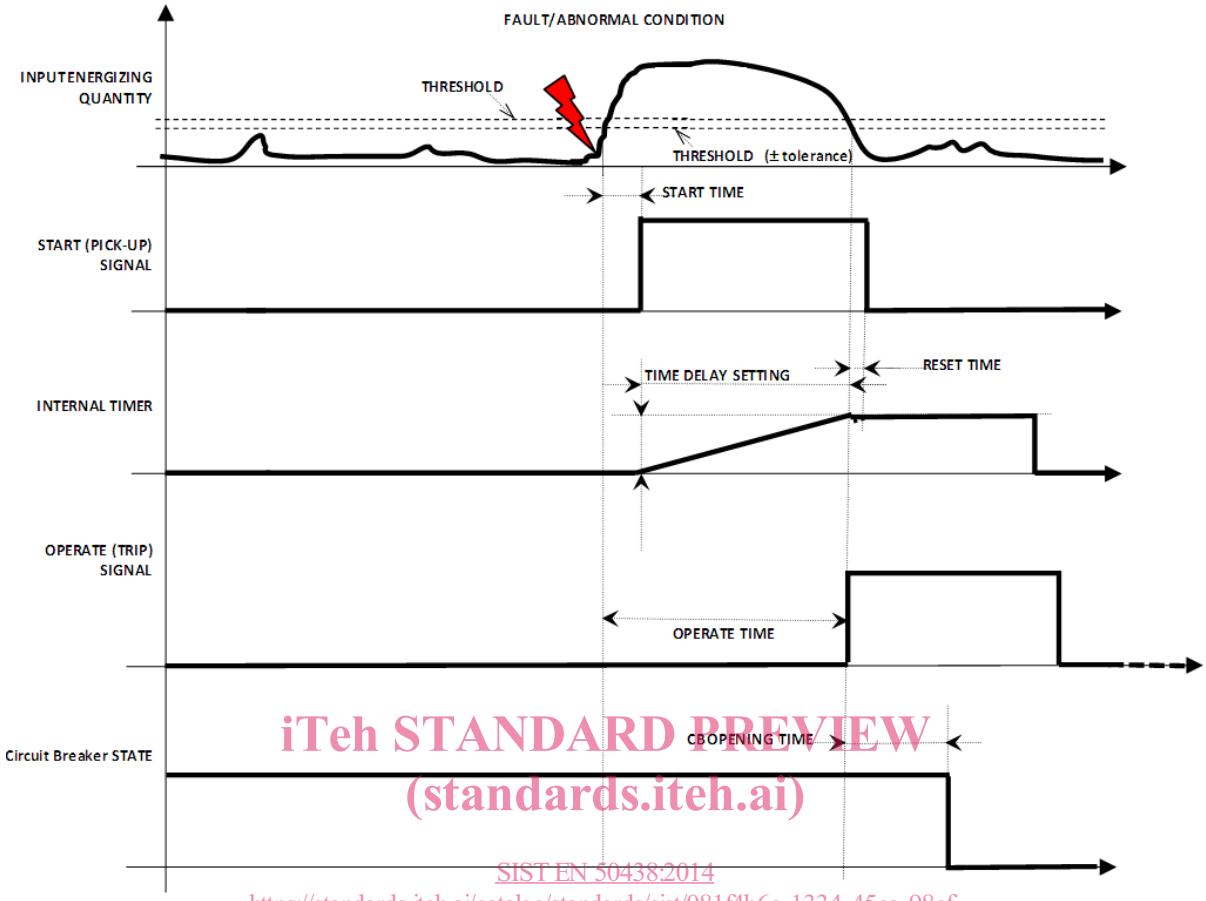

Figure 1 — Main times defining interface protection performance

3.14.1
energising quantity
energising quantity by which the protection function is activated when it is applied under specified conditions

Note 1 to entry: See also Figure 1.

[SOURCE: IEV 442-05-58, modified — the full definition has been altered.]

3.14.2
time delay setting
intentional delay that might be adjustable by the user

Note 1 to entry: See also Figure 1.

3.14.3
start time
duration of the time interval between the instant when the characteristic quantity of the measuring relay in reset condition is changed, under specified conditions, and the instant when the start signal asserts

Note 1 to entry: See also Figure 1.

[SOURCE: EN 60255-151:2009, 3.5]

3.14.4
operate time (from)
duration of the time interval between the instant when the characteristic quantity of a measuring relay in reset condition is changed, under specified conditions, and the instant when the relay operates

Note 1 to entry: See also Figure 1.

Note 2 to entry: Operate time is start time plus time delay setting.

[SOURCE: IEV 447-05-05, modified — Note 2 to entry has been added.]

3.14.5
reset time
duration of the time interval between the instant when the characteristic quantity of a measuring relay in operate condition is changed, under specified conditions, and the instant when the relay resets

Note 1 to entry: See also Figure 1.

[SOURCE: IEV 447-05-06]

3.14.6
disconnection time
sum of operate time of the protection system and the opening time (CB opening time in Figure 1) of the interface switch

3.15
islanding
situation where a section of the electricity network, containing generation, becomes physically disconnected from the rest of the public distribution network or user's network and one or more generators maintain a supply of electrical energy to the isolated section of the network

3.16
isolation
cut off for reasons of safety from all or a discrete section of the electrical installation by separating the electrical installation or section from every source of electrical energy

3.17
Loss of Mains (LoM) detection
function that will detect the micro-generator operating in an islanding situation

3.18
low voltage
LV
voltage whose nominal r.m.s. value is $U_n \leq 1$ kV

3.19
micro-generator
source of electrical energy and all associated interface equipment able to be connected to a regular electric circuit in a low voltage electrical installation and designed to operate in parallel with a public low voltage distribution network with nominal currents up to and including 16 A per phase

[SOURCE: IEV 617-04-10, modified — the content of an original Note after the definition has been included at the end of the present definition.]

3.20
micro-generating plant
electrical installation with one or more micro-generators with nominal currents in sum not exceeding 16 A per phase

3.21
nominal voltage
U_n
voltage by which a supply network is designated or identified and to which certain operating characteristics are referred

3.22
notification
process of informing the DSO of the commissioning of a micro-generation system, or its decommissioning

3.23
operate value
value of the input energising quantity (or characteristic quantity) at which a measuring relay operates

Note 1 to entry: See also Figure 1.

[SOURCE: IEV 447-02-10, modified — Note 1 to entry with the cross-reference to Figure 1 has been added.]

3.24
point of connection
POC
interface at which the generating plant is connected to a public distribution network

3.25
quality factor
Q_f
measure of the strength of resonance of the islanding test load

Note 1 to entry: In a parallel resonant circuit, such as a load on a power system:

$$Q_f = R\sqrt{\frac{C}{L}}$$

where

Q_f is quality factor;
R is effective load resistance;
C is reactive load capacitance (including shunt capacitors);
L is reactive load inductance.

With C and L tuned to the power system fundamental frequency, Q_f for the resonant circuit drawing active power, *P*, reactive powers Q_L, for inductive load and Q_C for capacitive load, Q_f can be determined by:

$$Q_f = \left(\frac{1}{P}\right)\sqrt{|Q_L|.|Q_C|}$$

where
P is active power, in W;
Q_L is inductive load, in VAr_L;
Q_C is capacitive load, in VAr_C.

3.26
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]

3.27
simple separation
separation between electric circuits or between an electric circuit and local earth by means of basic insulation

[SOURCE: IEV 826-12-28]

3.28
stationary fuel cell power system
generator system that uses a fuel cell module to generate electrical power and heat that is connected and fixed in place

[SOURCE: IEC/TS 62282-1:2010, 3.49 and 3.49.3, modified — the two original definitions have been combined.]

3.29
switch-disconnector
switch which, in the open position, satisfies the isolating requirements specified for a disconnector

[SOURCE: IEV 441-14-12]

3.30
user
person with responsibility for the premises in which the micro-generator is installed, normally referred to in other documentation as the customer / consumer / network user

4 Technical requirements

4.1 Electrical installation

4.1.1 General

Low voltage electrical installations shall comply with national and local regulation.

In case of any hardware malfunctioning, disconnection is required.

NOTE Only such hardware malfunctioning is taken into account that is relevant for the compliance of the micro-generating plant with this standard.

4.1.2 Over-current protection

The micro-generating plant shall be protected against over-current according to the HD 60364 series. When selecting the over-current protection within the domestic installation it is necessary to ensure correct selectivity with the DSO's protection devices.

4.1.3 Earthing

Earthing shall be according to HD 60364-5-551 and the relevant national standards.

When a micro-generator is operating in parallel with the distribution network, there shall be no direct connection between the generator winding (or pole of the primary energy source in the case of a DC sourced micro-generator) and the DSO's earth terminal. For installations where the customer provides his own earth terminal, e.g. when connected to a TT system, it is also advisable to avoid connecting the generator winding to this earth terminal.

NOTE The reason for this precaution is to avoid damage to the generator during faults on the distribution network and to ensure correct operation of protective devices.

For a micro-generator which is designed to operate in parallel with a distribution network but which is connected via an inverter (e.g. a PV array or a stationary fuel cell power system) it is permissible to connect one pole of the DC side of the inverter to the distribution network if there is insulation between the AC and the DC sides of the inverter. In such cases, the installer/manufacturer shall take all reasonable precautions to ensure that the micro-generator will not impair the integrity of the distribution network and will not suffer unacceptable damage for all credible operating conditions, including faults on the distribution network.

4.2 Normal operating range

4.2.1 General

Generating plants have to be able to operate in the operating range specified below regardless the topology and the settings of the interface protection.