November 2022

Annex 1 to the guide for connection of power generating plants to the low-voltage grid (≤1 kV)

Type A

Version 1.3

Version log

|  |  |  |
| --- | --- | --- |
| **Version** | **Change** | **Date** |
| 1.0 | A translated version of the Danish Guide for Power generating plants LV. | 27-04-2018 |
| 1.1 | Annex B1.2 and B2.1 are updated, so is clear what is covered by the EN50549-1 | 20-12-2019 |
| 1.2 | Update of annex | 29-10-2021 |
| 1.3 | Layout update. Updated according to positive list. | 18-11-2022 |

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DOCUMENTATION FOR TYPE A POWER-GENERATING PLANTS

* 1. Documentation for type A power-generating plants

Please complete the documentation with power-generating plant data and send it to the DSO.

* + 1. Identification

|  |  |
| --- | --- |
| Power-generating plant: | Description of the power-generating plant: |
| Global Service Relation Number (GSRN-nummer): |  |
| Plant owner name and address: |  |
| Plant owner telephone number: |  |
| Plant owner e-mail address: |  |
| Type/model: |  |
| Nominal voltage (Un): |  |
| Rated power (Pn): |  |
| Primary energy source: | Wind  Solar  Other type of plant\*  \*Describe the type of plant in question |

* + 1. Positive list

|  |  |
| --- | --- |
| Is the power-generating plant included on the positive list?  If not, please fill out annex B1.2 as well.  \*If the power-generating plant is over 50kW and consists of multiple units, then the power-generating plant needs to document power quality in every connection. | Yes  No |

* + 1. Active power control
       1. Power response to overfrequency

|  |  |
| --- | --- |
| Is the frequency response function for overfrequency enabled?  If yes, what are the setting values?  Frequency threshold (fRO):  Droop:  Delay for islanding detection (minimum response time): | Yes  No  \_\_\_\_\_\_\_\_Hz  \_\_\_\_\_\_\_\_\_%  \_\_\_\_\_\_\_\_ms |

* + 1. Reactive power control
       1. Power Factor control

|  |  |
| --- | --- |
| Is the Power Factor control function enabled?  If yes, which set point is used?  (Values different from cos φ 1.0 must be agreed with the *DSO*) | Yes  No  \_\_\_\_\_\_\_\_ cosφ  Inductive  Capacitive |

* + - 1. Automatic Power Factor control

|  |  |
| --- | --- |
| Is the automatic Power Factor control function enabled?  (Must only be enabled subject to prior agreement with the DSO)  If yes, which set points are used?  Set point 1 – P/Pn  Set point 1 – Power Factor (inductive)  Set point 2 – P/Pn  Set point 2 – Power Factor (inductive)  Set point 3 – P/Pn  Set point 3 – Power Factor (inductive) | Yes  No  \_\_\_\_\_\_\_\_%  \_\_\_\_\_\_ cosφ  \_\_\_\_\_\_\_\_%  \_\_\_\_\_\_ cosφ  \_\_\_\_\_\_\_\_%  \_\_\_\_\_\_ cosφ |

* + - 1. Q control

|  |  |
| --- | --- |
| Is the Q control function enabled?  If yes, which set point is used?  (Values different from 0 kVAr must be agreed with the DSO) | Yes  No  \_\_\_\_\_\_\_\_kVAr |

* + 1. Protection
       1. Relay settings

Please state the actual values at the time of commissioning in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Protection function** | **Symbol** | **Setting** | | **Trip time** | |
| Overvoltage (step 2) | U>> |  | V |  | ms |
| Overvoltage (step 1) | U> |  | V |  | s |
| Undervoltage (step 1) | U< |  | V |  | s |
| Undervoltage (step 2)\* | U<< |  | V |  | ms |
| Overfrequency | f> |  | Hz |  | ms |
| Underfrequency | f< |  | Hz |  | ms |
| Frequency change\* | df/dt |  | Hz/s |  | ms |

\*At least one of the functions must be enabled

* + - 1. Additional requirements for grid protection of synchronous power-generating plants

|  |  |
| --- | --- |
| Is synchronous undervoltage relay used to prevent asynchronous connection? | Yes  No |

* + - 1. Additional relay settings for synchronous power-generating plants

Please state the actual values at the time of commissioning in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Protection function** | **Symbol** | **Setting** | | **Trip time** | |
| Overcurrent | I> |  | A |  | ms |
| Synchronous undervoltage\* |  |  | V |  | ms |

\*If a synchronous undervoltage relay is used.

* + 1. Signature

|  |  |
| --- | --- |
| Date of commissioning: |  |
| Contractor: |  |
| Responsible |  |
| Signature  (Responsible): |  |
| Plant owner: |  |
| Signature (plant owner): |  |

* 1. Documentation for type A power-generating plants

Please complete the documentation with power-generating plant data and send it to the DSO.

* + 1. Identification

|  |  |
| --- | --- |
| Power-generating plant: | Description of the power-generating plant: |
| Plant owner name and address: |  |
| Plant owner telephone number: |  |
| Plant owner e-mail address: |  |
| Type/model: |  |
| Nominal voltage (Un): |  |
| Rated power (Pn): |  |
| Primary energy source: | Wind  Solar  Other type of plant\*  \*Describe the type of plant in question |

* + 1. EN50549-1

|  |  |
| --- | --- |
| Is the power-generating plant in accordance with the requirements in EN50549-1?  If yes, please provide reference to documentation:  Demands in *italic* must be answered.  Demands in questions with normal letters are included in EN50549-1 | Yes  No |

* + 1. Tolerance of frequency and voltage deviations
       1. Phase jump

|  |  |
| --- | --- |
| *Does the power-generating plant remain connected during voltage phase jumps of 20 degrees at the POC as specified in section 4.1.1?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Operating area for voltage and frequency

|  |  |
| --- | --- |
| Is the power-generating plant capable of remain connected to the public electricity supply grid within the voltage and frequency range specified in section 4.1.1 and 4.1.2 and on figure 4.1 and generating continuously within the normal operating range.  If yes, please provide reference to documentation: | Yes  No |

* + - 1. Frequency change

|  |  |
| --- | --- |
| Will the power-generating plant remain connected in case of frequency changes of 2.0 Hz/s at the POC?  If yes, please provide reference to documentation:  *- - To be completed for synchronous power generating plant* | Yes  No |

* + - 1. Permitted reduction of active power during underfrequency

|  |  |
| --- | --- |
| *Is the active power reduction at underfrequency less than the limit specified in section 4.1.2.2?*  *If yes, please provide reference to documentation:* | Yes  No |

* + 1. Start-up and reconnection of a power-generating plant
       1. Start-up and reconnection

|  |  |
| --- | --- |
| Will start-up and reconnection be performed more than three minutes after the voltage and frequency are within the ranges stated in section 4.2?  If yes, please provide reference to documentation: | Yes  No |

* + - 1. Active power increase gradient

|  |  |
| --- | --- |
| Does the power-generating plant comply with the requirement for maximum active power increase at connection as specified in section 4.2?  If yes, please provide reference to documentation: | Yes  No |

* + 1. Active power control
       1. Power response to overfrequency

|  |  |
| --- | --- |
| *Is the power-generating plant equipped with a frequency response function for overfrequency as specified in section 4.3.1?*  *If yes, please provide reference to documentation:* | Yes  No |

* + 1. Reactive power control
       1. Operating range

|  |  |
| --- | --- |
| Is the power-generating plant capable of supplying reactive power at Pn and varying operating voltages as specified in section 4.4?  If yes, please provide reference to documentation: | Yes  No |
| Is the power-generating plant capable of supplying reactive power when active power varies as specified in section 4.4?  If yes, please provide reference to documentation: | Yes  No |

* + - 1. Power Factor control

|  |  |
| --- | --- |
| *Is the power-generating plant equipped with a Power Factor control function as specified in section 4.4.2?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Automatic Power Factor control

|  |  |
| --- | --- |
| *Is the power-generating plant equipped with an automatic Power Factor control function as specified in section 4.4.3?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Q control

|  |  |
| --- | --- |
| *Is the power-generating plant equipped with Q control function as specified in section 4.4.4?*  *If yes, please provide reference to documentation:* | Yes  No |

* + 1. Protection
       1. Relay settings

*Please state default relay setting values in the table below. If the default values deviate from those specified in section 4.5.3, please include documentation showing that the relay settings can be adjusted to the correct values during commissioning.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Protection function** | **Symbol** | **Setting** | | **Trip time** | |
| *Overvoltage (step 2)* | U>> |  | V |  | ms |
| *Overvoltage (step 1)* | U> |  | V |  | s |
| *Undervoltage (step 1)* | U< |  | V |  | s |
| *Undervoltage (step 2)* | U<< |  | V |  | ms |
| *Overfrequency* | f> |  | Hz |  | ms |
| *Underfrequency* | f< |  | Hz |  | ms |
| *Frequency change* | df/dt |  | Hz/s |  | ms |
| *Please provide reference to documentation:* | | | | | |

* + - 1. Additional requirements for grid protection of synchronous power-generating plants

|  |  |
| --- | --- |
| *Is synchronous undervoltage relay used to prevent asynchronous connection?* | Yes  No |

* + - 1. Additional relay settings for synchronous power-generating plants

*Please state the relay settings in the table below.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Protection function** | **Symbol** | **Setting** | | **Trip time** | |
| *Overcurrent* | I> |  | A |  | ms |
| *Synchronous undervoltage\** |  |  | V |  | ms |

*\*If synchronous undervoltage relay is used.*

* + 1. Power quality

*For each power quality parameter, please specify how the result was obtained.*

* + - 1. Rapid voltage changes

|  |  |
| --- | --- |
| *Does the power-generating plant comply with the limit value for rapid voltage changes specified in section 4.6.1.3?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. DC content

|  |  |
| --- | --- |
| *Does the DC content during normal operation exceed 0.5% of the nominal current?*  *If no, please provide reference to documentation:* | Yes  No |

* + - 1. Current unbalance

|  |  |
| --- | --- |
| *Does the current unbalance during normal operation exceed 16 A?*  *Please provide reference to documentation:* | Yes  No |
| *Have steps been taken to ensure that the above limit is not exceeded if the power-generating plant consists of single-phase power-generating units?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Flicker

|  |  |
| --- | --- |
| *Is the flicker contribution for the entire power-generating plant below the limit value specified in section 4.6.1.4?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Harmonic overtones

|  |  |
| --- | --- |
| *Are all the harmonic overtones for the entire power-generating plant below the limit values specified in section 4.6.1.5?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Interharmonic overtones

Please only complete this section for power-generating plants above 50 kW.

|  |  |
| --- | --- |
| *Are all the interharmonic overtones for the entire power-generating plant below the limit values specified in section 4.6.1.6?*  *If yes, please provide reference to documentation:* | Yes  No |

* + - 1. Distortions in the 2-9 kHz frequency range

Please only complete this section for power-generating plants above 50 kW.

|  |  |
| --- | --- |
| *Are emissions of distortions in the 2-9 kHz frequency range less than 0.2% of the rated current In as required in section 4.6.1.7?*  *If yes, please provide reference to documentation:* | Yes  No |

* + 1. Signature

|  |  |
| --- | --- |
| Date: |  |
| Company: |  |
| Responsible: |  |
| Signature (Responsible): |  |