

## Guide to Annex 1 (B1.2)

To get your plant on the positive list, you must fill out the annex 1 (B1.2) in the “Guide for connection of power-generating plants to the low-voltage grid”. Beside the annex 1 (B1.2) you also need to send the technical documents that support your answers in annex 1 (B1.2). All the documents must be sent to [positivlister@greenpowerdenmark.dk](mailto:positivlister@greenpowerdenmark.dk), where the application will be processed.

But what kind of technical documents are we talking about? Below we give some examples of documents:

- Annex 1 (B1.2)
- CE Declaration of conformity
- Installation and operation manual
- Test Certificate
- Test report (e.g., according EN50549-1, VDE 4105 or EN50438)
- Other relevant documents that support your answers in B1.2

In all relevant test reports and documents, it is important, that it is clear which model a document is valid for and that the documents are signed.

If you have an EN50549-1 test report, most of the requirements are fulfilled, and therefore you only need to fill out the questions which are written with *“italic”* letters. These are the questions where the requirements from “Guide for connection of power-generating plants to the low-voltage grid” either deviates from EN50549-1 or EN50549-1 does not cover the requirements.

The requirements that need additional documentation are listed below:

- Permitted reduction of active power during underfrequency:
  - The requirement for Denmark is 6% of  $P_n/Hz$  and in EN50549-1 the requirement is 10% of  $P_n/Hz$ .
- Power response to overfrequency (LFSM-O)
  - There are specific requirements for DK1 and DK2.
  - The Danish requirement says the droop reference must be nominal active power, in EN50549-1 you can choose to use actual active power or nominal active power.
- Control functions:

- Power factor control
  - Automatic power factor control
  - Q control
  - All the functions are required in Denmark, but in EN50549-1 it is only recommended.
- Power Quality:
    - The EN50549-1 does not include power quality.
    - For voltage fluctuations and flicker, the plant must follow EN61000-3-3 ( $\leq 11\text{kW}$ ) or EN61000-3-11 ( $\leq 50\text{kW}$ ).
    - For harmonics, the plant must follow EN61000-3-2 ( $\leq 11\text{kW}$ ) or EN61000-3-12 ( $\leq 50\text{kW}$ ).
    - In addition, plants between 50kW and 125kW must comply with the requirements and limit values specified in sections 4.6.1.3 to 4.6.1.7 in the “Guide for connection of power generating plants to the low-voltage grid ( $\leq 1\text{ kV}$ )”.
  - DC-injection:
    - There is no limit for DC-current injection in EN50549-1 or the EN61000 series.
  - Current unbalance:
    - The plant may have a single-phase connection when the nominal power does not exceed 16A ( $\approx 3680\text{W}$ ).
    - If it is a three-phase system, the current between the phases must not exceed 16A.

It is also possible to apply without an EN50549-1 test report, when you must answer all questions and provide technical documentation supporting the answer.

The positive list is exclusively for small production units up to 125kW and therefore a plant with a capacity of 125kW or more can not be added to the list.

If a plant falls under the category of an *Energy Storage System*, a different annex needs to be filled out. This annex (now referred to as an appendix) is written by Energinet and can be found on their website through the following link: [Regulations for grid connection \(energinet.dk\)](https://www.energinet.dk/da/Regulationer/Regulationer-for-grid-connection).

Look for “Technical Regulation 3.3.1 for Battery Plants / Electrical Energy Storage Facilities”.

The rest of this document is an example of how the Annex 1 (B1.2) can be filled out.

## Example of how to fill out annex 1 (B1.2)

Areas highlighted with **yellow** are **examples** of how each field can be filled out.

### B1.2. Documentation for type A power-generating plants

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

#### B1.2.1. Identification

Power-generating plant:	Description of the power-generating plant:  <b>Three Phase Inverter</b>
Plant owner name and address:	<b>SolarEnergy A/S</b> <b>Vodroffsvej 59</b> <b>2000 Frederiksberg C</b>
Plant owner telephone number:	<b>+45 12 34 56 78</b>
Plant owner e-mail address:	<b>SE@email.com</b>
Type/model:	<b>SPI-15K</b>
Nominal voltage ( $U_n$ ):	<b>230V</b>
Rated power ( $P_n$ ):	<b>15kW</b>
Primary energy source:	<div style="text-align: right;">           Wind <input type="checkbox"/>            Solar <input checked="" type="checkbox"/>            Other type of plant* <input type="checkbox"/> </div> <p>*Describe the type of plant in question</p>

#### B1.2.2. EN50549-1

<p>Is the power-generating plant in accordance with the requirements in EN50549-1?</p> <p><b>If yes, only questions in <i>italic</i> have to be answered.</b></p> <p>Demands in questions with normal letters are included in EN50549-1</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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### B1.2.3. Tolerance of frequency and voltage deviations

#### B1.2.3.1. Phase jump

<p>Does the power-generating plant remain connected during voltage phase jumps of 20 degrees at the POC as specified in section 4.1.1?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 12 in "TEST REPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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#### B1.2.3.2. Operating area for voltage and frequency

<p>Is the power-generating plant capable of remaining 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?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 20-21 in "TEST REPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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#### B1.2.3.3. Frequency change

<p>Will the power-generating plant remain connected in case of frequency changes of 2.0 Hz/s at the POC?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 13 in "TEST REPORT – SPI-15K.pdf"</p> <p>- - To be completed for synchronous power generating plant</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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#### B1.2.3.4. Permitted reduction of active power during underfrequency

<p>Is the active power reduction at underfrequency less than the limit specified in section 4.1.2.2?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 68-71 in "TESTREPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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## B1.2.4. Start-up and reconnection of a power-generating plant

### B1.2.4.1. 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?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If yes, please provide reference to documentation:  See page 110 in "TESTREPORT – SPI-15K.pdf"	

### B1.2.4.2. 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?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If yes, please provide reference to documentation:  See page 111 in "TESTREPORT – SPI-15K.pdf"	

## B1.2.5. Active power control

### B1.2.5.1. Power response to overfrequency

Is the power-generating plant equipped with a frequency response function for overfrequency as specified in section 4.3.1?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If yes, please provide reference to documentation:  See page 73 and 81-83 in "TESTREPORT – SPI-15K.pdf"	

## B1.2.6. Reactive power control

### B1.2.6.1. Operating range

Is the power-generating plant capable of supplying reactive power at $P_n$ and varying operating voltages as specified in section 4.4?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If yes, please provide reference to documentation:  See page 25 in "TESTREPORT – SPI-15K.pdf"	
Is the power-generating plant capable of supplying reactive power when active power varies as specified in section 4.4?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If yes, please provide reference to documentation:  See page 26 in "TESTREPORT – SPI-15K.pdf"	

### B1.2.6.2.

#### B1.2.6.3. Power Factor control

<p>Is the power-generating plant equipped with a Power Factor control function as specified in section 4.4.2?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 56-58 in "TESTREPORT – SPI-15K.pdf"</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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#### B1.2.6.4. Automatic Power Factor control

<p>Is the power-generating plant equipped with an automatic Power Factor control function as specified in section 4.4.3?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 61 in "TESTREPORT – SPI-15K.pdf"</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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#### B1.2.6.5. Q control

<p>Is the power-generating plant equipped with Q control function as specified in section 4.4.4?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 50 in "TESTREPORT – SPI-15K.pdf"</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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### B1.2.7. Protection

#### B1.2.7.1. 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 <sub>&gt;&gt;</sub>	264,5	V	200	ms
Overvoltage (step 1)	U <sub>&gt;</sub>	253,0	V	60	s
Undervoltage (step 1)	U <sub>&lt;</sub>	195,5	V	50	s
Undervoltage (step 2)	U <sub>&lt;&lt;</sub>	184,0	V	200	ms
Overfrequency	f <sub>&gt;</sub>	51,5	Hz	200	ms
Underfrequency	f <sub>&lt;</sub>	47,5	Hz	200	ms
Frequency change	df/dt	±2,5	Hz/s	80	ms

Please provide reference to documentation:

See page 7 in "USER MANUAL – SPI-15K.pdf"

### ~~B1.2.7.2. Additional requirements for grid protection of synchronous power-generating plants~~

Is synchronous undervoltage relay used to prevent asynchronous connection?

Yes   
No

### ~~B1.2.7.3. Additional relay settings for synchronous power-generating plants~~

Please state the relay settings in the table below.

Protection function	Symbol	Setting	Trip time
Overcurrent	$I_{\Delta}$	A	ms
Synchronous undervoltage*		$V_{\Delta}$	ms

\*If synchronous undervoltage relay is used.

### B1.2.8. Power quality

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

#### B1.2.8.1. Rapid voltage changes

Does the power-generating plant comply with the limit value for rapid voltage changes specified in section 4.6.1.3?

Yes   
No

If yes, please provide reference to documentation:

See page 18 in "TESTREPORT – SPI-15K.pdf"

#### B1.2.8.2. DC content

Does the DC content during normal operation exceed 0.5% of the nominal current?

Yes   
No

If no, please provide reference to documentation:

See page 89 in "TESTREPORT – SPI-15K.pdf"

#### B1.2.8.3. Current unbalance

Does the current unbalance during normal operation exceed 16 A?

Yes   
No

Please provide reference to documentation:

See page 92 in "TESTREPORT – SPI-15K.pdf"

<p>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?</p> <p>If yes, please provide reference to documentation:</p> <p>No, it is a 3-Phase inverter.</p>	<p>Yes <input type="checkbox"/></p> <p>No <input checked="" type="checkbox"/></p>
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**B1.2.8.4. Flicker**

<p>Is the flicker contribution for the entire power-generating plant below the limit value specified in section 4.6.1.4?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 5 in "EMC TEST REPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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**B1.2.8.5. Harmonic overtones**

<p>Are all the harmonic overtones for the entire power-generating plant below the limit values specified in section 4.6.1.5?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 133-141 in "TESTREPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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**B1.2.8.6. Interharmonic overtones**

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

<p>Are all the interharmonic overtones for the entire power-generating plant below the limit values specified in section 4.6.1.6?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 142-149 in "TESTREPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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**B1.2.8.7. Distortions in the 2-9 kHz frequency range**

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

<p>Are emissions of distortions in the 2-9 kHz frequency range less than 0.2% of the rated current <math>I_n</math>, as required in section 4.6.1.7?</p> <p>If yes, please provide reference to documentation:</p> <p>See page 150-155 in "TESTREPORT – SPI-15K.pdf"</p>	<p>Yes <input checked="" type="checkbox"/></p> <p>No <input type="checkbox"/></p>
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### B1.2.9. Signature

Date:	01-01-2023
Company:	SolarEnergy A/S
Responsible:	John Johnson
Signature (Responsible):	