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# G98/99 Applications

Incentive in Connections Engagement

December 2021

Stay connected...



[www.enwl.co.uk](http://www.enwl.co.uk)



- Last year we took away an ICE action to provide further support on the G98/G99 application process to our customers.
- This included a presentation outlining the process for G98/G99 (Type A) applications and explaining where to get the required info:

We will provide support to our customers to help with the G98/G99 application process.

We will publish example application forms for common scenario G98/G99 applications as a reference guide to help customers complete application forms.

- This presentation looks to provide a number of examples on how to complete these forms utilising different technologies

# Types of generation at LV



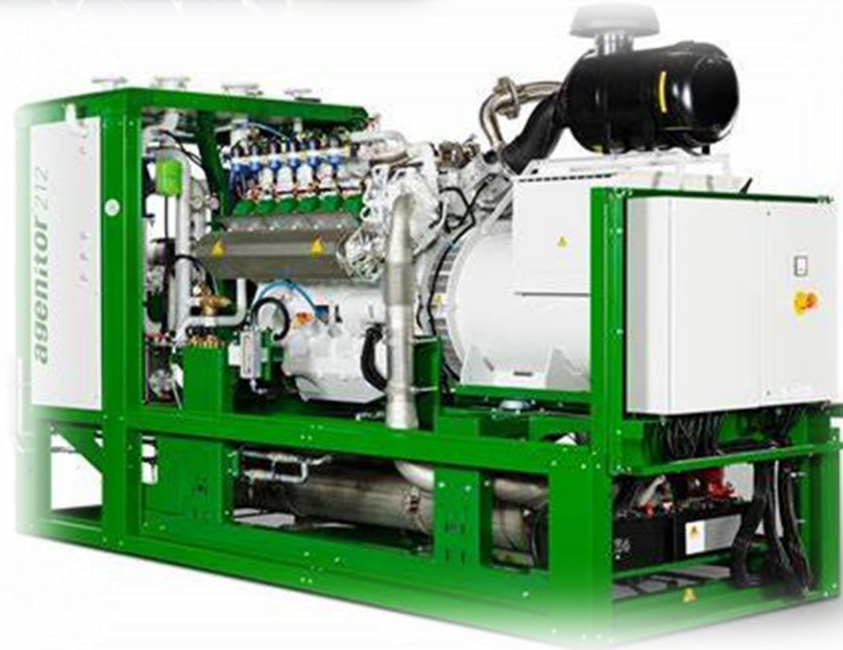
➤ Photovoltaic (PV)



➤ Battery Storage



➤ Combined Heat and Power (CHP)



# Summary of forms



## Summary of G98 and G99 Forms

**Covered in this presentation**

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro- generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- <b>Form C</b>	If fully type tested but not registered with the ENA- <b>Form C</b>	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested- <b>Form A2-2</b> synchronous <b>Form A2-3</b> inverter connected gen	<b>PGMD**</b> <b>Form B2-1</b>	<b>PGMD**</b> <b>Form C2-1</b>	
Site Compliance and Commissioning Checks					<b>Form A2-4</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form B2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form C2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						<b>Form B3</b>	<b>Form C3</b>	

\*Standard Application Form

\*\*Power Generating Module Document



- Having the actual generator required for installation on your initial application helps us model the generation effectively, hence giving you a more accurate study and quotation
- Wrong forms submitted – please refer to slide 4 to make sure you utilise the correct form for each stage
- Not filling out the Manufacturer’s Reference Number in the application form – providing this really helps speed up the process as we can confirm compliance faster – please refer to slides 17, 18 & 19 for guidance on providing this

# Compliant vs. Awaiting assessment/ Further information required

<http://www.ena-eng.org/gen-ttr/>



## ENA

## Status

## Comment

208 Devices Found

System Reference ID	Completion Date	Published ID	Manufacturer ID	Model ID	Category	Type	Registered Capacity	No. of Phases
SA10000001	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000001	Inverter	PV	2.000	Three
SA10000002	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000002	Inverter	PV	2.000	Three
SA10000003	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000003	Inverter	PV	1.000	Three
SA10000004	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000004	Inverter	PV	1.000	Three
SA10000005	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000005	Inverter	PV	1.000	Three
SA10000006	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000006	Inverter	PV	1.000	Three
SA10000007	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000007	Inverter	PV	1.000	Three
SA10000008	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000008	Inverter	PV	1.000	Three
SA10000009	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000009	Inverter	PV	1.000	Three
SA10000010	Compliant	10.04.2021	Sole (Energy Services) Megra Group	SA10000010	Inverter	PV	1.000	Three

Compliant

- Proof of compliance helps prevent delays to your application as it has been ENA approved for G98/99 compliance (relevant evidence form will already be completed on the website)
- Reduces the amount of information to provide

141 Devices Found

System Reference ID	Completion Date	Published ID	Manufacturer ID	Model ID	Category	Type	Registered Capacity	No. of Phases
SA10000011	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000011	Inverter	PV	2.000	One
SA10000012	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000012	Inverter	PV	2.000	One
SA10000013	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000013	Inverter	PV	2.000	One
SA10000014	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000014	Inverter	PV	2.000	One
SA10000015	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000015	Inverter	PV	2.000	One
SA10000016	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000016	Inverter	PV	2.000	One
SA10000017	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000017	Inverter	PV	2.000	One
SA10000018	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000018	Inverter	PV	2.000	One
SA10000019	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000019	Inverter	PV	2.000	One
SA10000020	Awaiting assessment	3 Aug 2021	Sole (Energy Services) Megra Group	SA10000020	Inverter	PV	2.000	One

Awaiting assessment

Although the equipment has been type tested (i.e. not green on the ENA database) you will need to provide further evidence in the form of:

- Generator operating parameters (generator owner should be able to provide this)
- Complete evidence documents (A2-1, A2-2, A2-3 etc.) at your own expense with a suitable certified technician/engineer
- You will need to add extra time for these steps in advance of energisation

9 Devices Found

System Reference ID	Completion Date	Published ID	Manufacturer ID	Model ID	Category	Type	Registered Capacity	No. of Phases
SA10000021	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000021	Inverter	PV	2.000	Three
SA10000022	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000022	Inverter	PV	2.000	Three
SA10000023	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000023	Inverter	PV	2.000	Three
SA10000024	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000024	Inverter	PV	2.000	Three
SA10000025	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000025	Inverter	PV	2.000	Three
SA10000026	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000026	Inverter	PV	2.000	Three
SA10000027	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000027	Inverter	PV	2.000	Three
SA10000028	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000028	Inverter	PV	2.000	Three
SA10000029	Further information required	15 Jul 2021	Sole (Energy Services) Megra Group	SA10000029	Inverter	PV	2.000	Three

Further information required

# G98 Application



# Summary of forms



## Summary of G98 and G99 Forms

**G98**

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro- generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- <b>Form C</b>	If fully type tested but not registered with the ENA- <b>Form C</b>	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested- <b>Form A2-2</b> synchronous <b>Form A2-3</b> inverter connected gen	<b>PGMD**</b> <b>Form B2-1</b>	<b>PGMD**</b> <b>Form C2-1</b>	
Site Compliance and Commissioning Checks					<b>Form A2-4</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form B2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form C2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						<b>Form B3</b>	<b>Form C3</b>	

\*Standard Application Form

\*\*Power Generating Module Document







# Guide to completing G98 Form A & B



- It is vitally important to get the Manufacturer's Reference Number entered on Form A & B correct as Electricity North West cannot check compliance without it
- Manufacturer's Reference Number is obtained from the ENA Type Test Register website
- <http://www.ena-eng.org/gen-ttr/>

**Type Test Register** Home Guest User Guide Contact Us ena energy networks association

Find/Browse Devices Introduction Latest Devices Search Results

Search Model or Reference

Manufacturer: x Solis (Ginlong) (previously Ningbo Ginlong)

Device Category: x Inverter

Device Type: Select one or more

Published between: Month/Year and Month/Year

Registered capacity between: 2.9 and 3.1

Search/Filter

**Step 1 : Select manufacturer, device category and an appropriate registered capacity range**

**Step 2 : Click the Search/Filter button**

**Step 3 : identify the micro generator model using this column**

**Step 4 : The System Reference of the micro generator to be entered on the Form B**

27 Devices Found

System Reference	Published	Manufacturer	Model	Category	Type	Registered Capacity	No. of Phases
<a href="#">SOLIS/01480/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01464/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01448/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01440/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES-NI	Inverter	PV	3 kW	One
<a href="#">SOLIS/01379/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01368/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01365/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RAI-3K-48ES-5G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01364/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES	Inverter	PV	3 kW	One
<a href="#">SOLIS/00807/V1/A1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00808/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00809/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES	Inverter	PV	3 kW	One
<a href="#">SOLIS/00810/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00811/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One



- If the generator is fully type tested to G98 standards, but not registered with the ENA you will be required to submit a Form C as part of the commissioning stage
  - This will confirm that the generation conforms to G98 standards and is acceptable to connect
- These tests should be conducted by a competent and reputable testing company or by the manufacturers themselves
- Information on how to fill in this form and on the tests performed can be found on the following document:
  - [https://www.ena-eng.org/gen-ttr/UserGuide/G98\\_G99\\_Guidance\\_Forms.pdf](https://www.ena-eng.org/gen-ttr/UserGuide/G98_G99_Guidance_Forms.pdf)
- Purchasing and installing generator that is type tested to G98 standards and registered with the ENA will forgo this requirement and save time with the installation and commissioning
  - It is worth checking the ENA Type Test Register website (<http://www.ena-eng.org/gen-ttr/>) to confirm this

# G99 Application



# Summary of forms



## Summary of G98 and G99 Forms

Type A

	Single premises Up to and including 16 A per phase	Multiple premises Up to and including 16 A per phase	Less than 50kW	Integrated Micro- generation & storage (each up to & including 16 A per phase)	Greater than 50kW & less than 1MW Type A	1MW to less than 10MW Type B	10MW to less than 50MW Type C	Greater than or equal to 50MW or >110kV Type D
Applicable Standard	G98	G98	G99	G99	G99	G99	G99	
Application		Form A	Form A1-1	Form A1-2	SAF*	SAF*	SAF*	
Notification	Form B	Form B	Form A3-1	Form A3-2	Form A3-1			
Evidence	If fully type tested but not registered with the ENA- <b>Form C</b>	If fully type tested but not registered with the ENA- <b>Form C</b>	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested – <b>Form A2-1</b> synchronous <50kW, <b>Form A2-2</b> synchronous >50kW or <b>Form A2-3</b> inverter connected gen	If not type tested- <b>Form A2-2</b> synchronous <b>Form A2-3</b> inverter connected gen	<b>PGMD**</b> <b>Form B2-1</b>	<b>PGMD**</b> <b>Form C2-1</b>	
Site Compliance and Commissioning Checks					<b>Form A2-4</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form B2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	<b>Form C2-2</b> if the Interface Protection is not Type Tested or for other site compliance tests	
Installation						<b>Form B3</b>	<b>Form C3</b>	

\*Standard Application Form

\*\*Power Generating Module Document



# Guide to completing G99 Form A1-2



- Engineering Recommendation G99 Form A1-2 is submitted to the DNO during the application stage for integrated micro-generation
- It covers systems up to a maximum installation capacity of 7.36kW (32 Amps) limited via a G100 export limitation scheme (ELS) to 3.68kW (16 Amps) of export.
- Completed by the applicant or installer
- Latest version available on the ENA website must be used
- Submitted to [connectionapplications@enwl.co.uk](mailto:connectionapplications@enwl.co.uk)

## Page 1

Form A1-2 : Application for connection of Fully Type Tested Integrated Micro Generation and Storage installations	
<p>For Integrated Micro Generation and Storage installations, this simplified application form can be used where all of the following eligibility criteria apply:</p> <ul style="list-style-type: none"> <li>• The Power Generating Modules are located in a single Generator's Installation;</li> <li>• The total aggregate capacity of the Power Generating Modules (including Electricity Storage devices) is between 16 A and 32 A per phase;</li> <li>• The total aggregate capacity of the Power Generating Modules that are Electricity Storage devices do not exceed 16 A per phase and the total aggregate capacity of the Power Generating Modules that are not Electricity Storage devices do not exceed 16 A per phase. Note that if the total aggregated capacity of Electricity Storage and non-Electricity Storage devices is no greater than 16 A per phase, the single premises procedure described in EREC G98 applies;</li> <li>• All of the Power Generating Modules (including Electricity Storage units) are connected via EREC G98 Type Tested Inverters (or EREC G83 Type Tested Inverters, where the Power Generating Module was installed prior to 27 April 2019)</li> <li>• An EREC G100 compliant export limitation scheme is present that limits the export from the Generator's Installation to the Distribution Network to 16 A per phase; and</li> <li>• The Power Generating Modules will not operate when there is a loss of mains situation.</li> </ul> <p>DNOs may have their own forms; refer to the DNO's websites and online application tools. If the Power Generating Module is registered with the ENA Type Test Verification Report Register, the application should include the Manufacturer's reference number (the Product ID).</p> <p>If all the eligibility criteria apply the DNO will confirm that the installation can proceed. The planned commissioning date stated on the application shall be within 10 working days and 3 months from the date the application is submitted.</p> <p>On completion of the installation the Installer shall submit the commissioning sheets, as required in EREC G100 alongside the EREC G99 forms.</p>	
To	ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA abcde@wxyz.com
DNO	
Generator Details:	
Generator (name)	
Address	
Post Code	
Contact person (if different from Generator)	
Telephone number	
E-mail address	

Generator owner's contact details

## Page 2

MPAN(s)						
Installer Details (Generation):						
Installer						
Accreditation / Qualification						
Address						
Post Code						
Contact person						
Telephone Number						
E-mail address						
Installer Details (Electricity Storage, if different from above):						
Installer						
Accreditation / Qualification						
Address						
Post Code						
Contact person						
Telephone Number						
E-mail address						
Installation details:						
Address						
Post Code						
MPAN(s)						
Details of Existing PGMs – where applicable:						
Manufacturer	Approximate Date of Installation	Technology Type (e.g. Solar, Wind, Biomass, Diesel/CHP)	Manufacturer's Ref No. where available	PGM Registered Capacity (kW)		
				3 - phase units	Single Phase Units	PH1 PH2 PH3

Installers details including accreditation (Generation)

Installers details including accreditation (storage)

Details about the site where the generator has been connected

Technical details of existing generation (see overleaf for guidance on the Manufacture's Reference No.)



# Guide to completing G99 Form A1-2



- Engineering Recommendation G99 Form A1-2 is submitted to the DNO during the application stage for integrated micro-generation
- It covers systems up to a maximum installation capacity of 7.36kW (32 Amps) limited via a G100 export limitation scheme (ELS) to 3.68kW (16 Amps) of export.
- Completed by the applicant or installer
- Latest version available on the ENA website must be used
- Submitted to [connectionapplications@enwl.co.uk](mailto:connectionapplications@enwl.co.uk)

## Page 3

Details of Proposed Additional Generating Unit(s) (including Electricity Storage):							
Manufacturer	Approximate Date of Installation	Technology Type (e.g. Solar, Wind, Biomass, Diesel/CHP, Electricity Storage)	Manufacturer's Ref No. where available	Generating Unit Capacity (kW)			Power Factor
				3-phase units	Single Phase Units		
				PH1	PH2	PH3	
Please confirm all of the statements are true by ticking each box:							
The Power Generating Modules are located in a single Generator's Installation.							
The total aggregate capacity of the Power Generating Modules (including Electricity Storage units) is between 16 A and 32 A per phase.							
The total aggregate capacity of the Power Generating Modules that are Electricity Storage devices do not exceed 16 A per phase and the total aggregate capacity of the Power Generating Modules that are not Electricity Storage devices do not exceed 16 A per phase.							
All of the Power Generating Modules (including Electricity Storage devices) are connected via EREC G98 Type Tested Inverters (or EREC G83 Type Tested Inverters, where the Power Generating Module was installed prior to 27 April 2019)							
An EREC G100 compliant export limitation scheme is present that limits the export from the Generator's Installation to the Distribution Network to 16 A per phase, and							
The Power Generating Modules will not operate when there is a loss of mains situation.							
The following information should be submitted with the application:							
Copy of single line diagram of export limitation scheme							
Explanation / description of export limitation scheme operation including a description of the fail-safe functionality eg the response of the scheme following failure of a:							
<ul style="list-style-type: none"> <li>• Power monitoring unit</li> <li>• Control unit</li> <li>• Power Generating Module interface unit</li> <li>• Demand control unit</li> <li>• Communication equipment</li> </ul>							
Note, fail-safe tests are not required at installations where all Generating Units are EREC G83 or EREC G98 Type Tested, aggregated capacity is not more than 32 A per phase and export capacity is limited to 16 A per phase.							
Additional details:							

Technical details of proposed additional generation (see overleaf for guidance on the Manufacturer's Reference No.)

Confirmation of operating and installation parameters

Details about information to be provided to the DNO

## Page 4

Target date for provision of connection / commissioning of Electricity Storage devices.*	
EREC G100 compliance declaration / EREC G100 Type Test reference as applicable:	
Signed :	Date :
Use continuation sheet where required.	
Record Power Generating Module Registered Capacity kW at 230 AC, to one decimal place, under PH1 for single phase supplies and under the relevant phase for two and three phase supplies.	
Include a schematic diagram for the proposed scheme.	
*The planned commissioning date shall be at least 10 working days from the date of application but not more than 3 months in advance (connection offers are only valid for 3 months).	

Target date for connection / commissioning

Signed declaration of compliance with EREC G98

# ENA Type Test Register



- It is vitally important to get the Manufacturer's Reference Number entered on the application form correct as Electricity North West cannot check compliance without it
- Manufacturer's Reference Number is obtained from the ENA Type Test Register website
- <http://www.ena-eng.org/gen-ttr/>

**Step 1 : Select manufacturer, device category and an appropriate registered capacity range**

**Step 2 : Click the Search/Filter button**

**Step 3 : identify the micro generator model using this column**

**Step 4 : The System Reference of the micro generator to be entered on the Form B**

System Reference	Published	Manufacturer	Model	Category	Type	Registered Capacity	No. of Phases
<a href="#">SOLIS/01480/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01464/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01448/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01440/V1</a>	11 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES-NI	Inverter	PV	3 kW	One
<a href="#">SOLIS/01379/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01368/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01365/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RAI-3K-48ES-5G	Inverter	PV	3 kW	One
<a href="#">SOLIS/01364/V1</a>	9 Oct 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES	Inverter	PV	3 kW	One
<a href="#">SOLIS/00807/V1/A1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00806/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00805/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	RHI-3K-48ES	Inverter	PV	3 kW	One
<a href="#">SOLIS/00804/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-mini-3000-4G	Inverter	PV	3 kW	One
<a href="#">SOLIS/00803/V1</a>	3 Sep 2019	Solis (Ginlong) (previously Ningbo Ginlong)	Solis-1P3K-4G	Inverter	PV	3 kW	One



# Post- Acceptance



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# NOTIFICATION: Guide to completing G99 Form A3-1



- Engineering Recommendation G99 Form A3-1 is submitted to the DNO during the notification stage for generation less than 50kW
- Completed by the applicant or installer – **to be completed prior to site commissioning/witness test**
- Used as a chance to make sure all information is submitted and accounted for
- Latest version available on the ENA website must be used
- Submitted to [connectionapplications@enwl.co.uk](mailto:connectionapplications@enwl.co.uk)

## Page 1

Form A3-1 : Installation Document for Type A Power Generating Modules	
Please complete and provide this document for every Power Generating Facility.	
Part 1 should be completed for the Power Generating Facility.	
Part 2 should be completed for each of the Power Generating Modules being commissioned. Where the installation is phased the form should be completed on a per Generating Unit basis as each part of the installation is completed in accordance with EREC G99 paragraph 15.3.3. For phased installations reference to PGM in this form should be read as reference to Generating Units.	
Form A3-1 Part 1	
To ABC electricity distribution DNO 99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com	
<b>Generator Details:</b>	
Generator (name)	
Address	
Post Code	
Contact person (if different from Generator)	
Telephone number	
E-mail address	
MPAN(s)	
Generator signature	
<b>Installer Details:</b>	
Installer	
Accreditation / Qualification	
Address	

Generator manufacturer details

Installer details

## Page 2

Post Code							
Contact person							
Telephone Number							
E-mail address							
Installer signature							
<b>Installation details</b>							
Address							
Post code							
Location within Generator's Installation							
Location of Lockable Isolation Switch							
<b>Summary details of Power Generating Modules - where multiple Power Generating Modules will exist within one Generator's Installation.</b>							
Manufacturer / Reference	Date of Installation	Technology Type	Manufacturers Ref No. (Product ID) or Reference to Form A2-1/2/3 or combination of above as applicable	Power Generating Module Registered Capacity in kW			Power Factor
				3-Phase Units	Single Phase Units		
				PH 1	PH 2	PH 3	
Emerging technology classification (if applicable).							
<b>Commissioning Checks.</b>							
Description						Confirmation	
Generator's Installation satisfies the requirements of BS7671 (IET Wiring Regulations).						Yes / No*	

Site of installation details

Technical details of proposed additional generation (see overleaf for guidance on the Manufacture's Reference No.)

Commissioning checks

# NOTIFICATION: Guide to completing G99 Form A3-1



- Engineering Recommendation G99 Form A3-1 is submitted to the DNO during the notification stage for generation less than 50kW
- Completed by the applicant or installer – **to be completed prior to site commissioning/witness test**
- Used as a chance to make sure all information is submitted and accounted for
- Latest version available on the ENA website must be used
- Submitted to [connectionapplications@enwl.co.uk](mailto:connectionapplications@enwl.co.uk)

## Page 3

Suitable lockable points of isolation have been provided between the PGMs and the rest of the Generator's Installation.	Yes / No*
Labels have been installed at all points of isolation in accordance with EREC G99.	Yes / No*
Interlocking that prevents PGMs being connected in parallel with the DNO's Distribution Network (without synchronising) is in place and operates correctly.	Yes / No*
Balance of Multiple Single Phase PGMs. Confirm that design of the Generator's Installation has been carried out to limit output power imbalance to below 16 A per phase, as required by EREC G99.	Yes / No*
<b>Form A3-1 Part 2</b>	
Power Generating Module reference or name	
<b>Information to be enclosed.</b>	
Description	Confirmation
Schedule of protection settings (may be included in circuit diagram)	Yes / No*
As installed Standard Application Form data, unless already provided.	Yes / No*
Final copy of circuit diagram	Yes / No*
<b>Commissioning Checks.</b>	
The Interface Protection settings have been checked and comply with EREC G99.	Yes / No / N/A (Type Tested)*
The PGM successfully synchronises with the DNO's Distribution Network without causing significant voltage disturbance.	Yes / No*
The PGM successfully runs in parallel with the DNO's Distribution Network without tripping and without causing significant voltage disturbances.	Yes / No*
The PGM successfully disconnects without causing a significant voltage disturbance, when it is shut down.	Yes / No*
Interface Protection operates and disconnects the DNO's Distribution Network quickly (within 1 s) when a suitably rated switch, located between the PGM and the DNO's incoming connection, is opened.	Yes / No*
The PGM remains disconnected for at least 20 s after switch is reclosed.	Yes / No*
Loss of tripping and auxiliary supplies. Where applicable, loss of supplies to tripping and protection relays results in either PGM forced trip or an alarm to a 24 hour manned control centre.	Yes / No*

Commissioning checks

Information to be enclosed and provided to the DNO

Commissioning checks

## Page 4

*Circle as appropriate. If "No" is selected the Power Generating Facility is deemed to have failed the commissioning tests and the Power Generating Module shall not be put in service.	
Additional comments / observations:	
Declaration – to be completed by Generator or Generator's Appointed Technical Representative.	
I declare that for the Type A Power Generating Module within the scope of this EREC G99, and the installation:	
<ol style="list-style-type: none"> <li>1. Compliance with the requirements of EREC G99 is achieved.</li> <li>2. The commissioning checks detailed in Form A2-4 have been successfully completed*.</li> <li>3. The commissioning checks detailed in this Form A3-1 have been successfully completed.</li> </ol>	
*delete if not applicable ie if the Interface Protection and ride through capabilities are Type Tested	
Name:	
Signature:	Date:
Company Name:	
Position:	
Declaration – to be completed by DNO Witnessing Representative if applicable. Delete if not witnessed by the DNO.	
I confirm that I have witnessed:	
<ol style="list-style-type: none"> <li>1. The commissioning checks detailed in Form A2-4*;</li> <li>2. The commissioning checks detailed in this Form A3-1 on behalf of and that the results are an accurate record of the checks.</li> </ol>	
*delete if not applicable ie if the Interface Protection and ride through capabilities are Type Tested	
Name:	
Signature:	Date:
Company Name:	

To be filled in if 'No' is circled in the of the previous questions

Declaration from the generator or generators approved technical representative

Used to confirm that the generator will operate within proposed operating parameters and all relevant information has been provided to the DNO

To be completed by the DNO for the witness test stage

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Cover Sheet*



**Form A2-3: Compliance Verification Report for Type A Inverter Connected Power Generating Modules**

This form should be used by the **Manufacturer** to demonstrate and declare compliance with the requirements of EREC G99. The form can be used in a variety of ways as detailed below:

- To obtain Fully Type Tested status**  
The **Manufacturer** can use this form to obtain **Fully Type Tested** status for a **Power Generating Module** by registering this completed form with the Energy Networks Association (ENA) Type Test Verification Report Register.
- To obtain Type Tested status for a product**  
This form can be used by the **Manufacturer** to obtain **Type Tested** status for a product which is used in a **Power Generating Module** by registering this form with the relevant parts completed with the Energy Networks Association (ENA) Type Test Verification Report Register. Where the **Manufacturer** is seeking to obtain **Type Tested** status for an **Interface Protection** device the appropriate section of Form A2-4 should be used.
- One-off Installation**  
This form can be used by the **Manufacturer** or **Installer** to confirm that the **Power Generating Module** has been tested to satisfy all or part of the requirements of this EREC G99. This form shall be submitted to the **DNO** as part of the application.

A combination of (2) and (3) can be used as required, together with Form A2-4 where compliance of the **Interface Protection** is to be demonstrated on site.

Note:  
Within this Form A2-3 the term **Power Park Module** will be used but its meaning can be interpreted within Form A2-3 to mean **Power Park Module**, **Generating Unit** or **Inverter** as appropriate for the context. However, note that compliance shall be demonstrated at the **Power Park Module** level.

If the **Power Generating Module** is **Fully Type Tested** and registered with the Energy Networks Association (ENA) Type Test Verification Report Register, the Installation Document (Form A3-1 or A3-2) should include the **Manufacturer's** reference number (the Product ID), and this form does not need to be submitted.

Where the **Power Generating Module** is not registered with the ENA Type Test Verification Report Register or is not **Fully Type Tested** this form (all or in parts as applicable) needs to be completed and provided to the **DNO**, to confirm that the **Power Generating Module** has been tested to satisfy all or part of the requirements of this EREC G99.

PGM technology		Name of technology	
Manufacturer name		Name of manufacturer	
Address		Address of Manufacturer	
Tel	Number of Manufacturer	Web site	Website of Manufacturer
E-mail	Email of Manufacturer		
Registered Capacity		9.9kVA	

Technical details of proposed generation (see slides 18 & 19 for guidance on the Manufacture's Reference No.)

Manufacture's details

- If your generation/inverter is type test **compliant** on the ENA Database, this form will already be completed
- If it is **awaiting assessment** you may have to provide information in the generator/inverters operating performance (this can be provided by our generator manufacturer)
- If the generation/inverter is a one-off build you may have to complete the evidence documents (A2-1, A2-2, A2-3 etc.) at your own expense with a suitable certified technician/engineer
- You will need to add extra time for these steps in advance of energisation

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Testing conducted*



There are four options for Testing: (1) Fully Type Tested, (2) Partially Type Tested, (3) one-off installation, (4) tested on site at time of commissioning. The check box below indicates which tests in this Form have been completed for each of the options. ~~With the exception of Fully Type Tested PGMs tests may be carried out at the time of commissioning (Form A4).~~  
 Insert Document reference(s) for **Manufacturers' Information**

Tested option:	1. Fully Type Tested	2. Partially Type Tested	3. One-off Manufacturers' Info.	4. Tested on Site at time of Commissioning
0. Fully Type Tested - all tests detailed below completed and evidence attached to this submission		N/A	N/A	N/A
1. Operating Range	N/A			
2. PQ – Harmonics				
3. PQ – Voltage Fluctuation and Flicker				
4. PQ – DC Injection (Power Park Modules only)				
5. Power Factor (PF)				
6. Frequency protection trip and ride through tests				
7. Voltage protection trip and ride through tests				
8. Protection – Loss of Mains Test, Vector Shift and <del>RoCoF</del> Stability Test				
9. LFSM-O Test				
10. Protection – Reconnection Timer				
11. Fault Level Contribution				

There are four options for Testing: (1) Fully Type Tested, (2) Partially Type Tested, (3) one-off installation, (4) tested on site at time of commissioning. The check box below indicates which tests in this Form have been completed for each of the options. ~~With the exception of Fully Type Tested PGMs tests may be carried out at the time of commissioning (Form A4).~~  
 Insert Document reference(s) for **Manufacturers' Information**

Tested option:	1. Fully Type Tested	2. Partially Type Tested	3. One-off Manufacturers' Info.	4. Tested on Site at time of Commissioning
12. Self-monitoring Solid State Switch	N/A			
13. Wiring functional tests if required by para 15.2.1 (attach relevant schedule of tests)				
14. Logic Interface (input port)				

**Manufacturer compliance declaration.** - I certify that all products supplied by the company with the above **Type Tested Manufacturer's** reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site **Modifications** are required to ensure that the product meets all the requirements of EREC G99.

Signed	<b>Sign-off from Manufacturer</b>	On behalf of	<b>Manufacturer</b>
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Note that testing can be done by the **Manufacturer** of an individual component or by an external test house.

Where parts of the testing are carried out by persons or ~~organisations~~ other than the **Manufacturer** then that person or ~~organisation~~ shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

- This provides an overview of the tests required to prove compliance
- Some of the tests are completed on-site and some are provided by the manufacturer
- The manufacturer or someone with sufficient technical competence on behalf of the manufacturer will need to sign-off this sheet



# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Operating Range*



A2-3 Compliance Verification Report – Tests for Type A Inverter Connected Power Generating Modules – test record	
<p><b>1. Operating Range:</b> Five tests should be carried with the Power Generating Module operating at Registered Capacity and connected to a suitable test supply or grid simulation set. The power supplied by the primary source shall be kept stable within <math>\pm 5\%</math> of the apparent power value set for the entire duration of each test sequence.</p> <p>Frequency, voltage and Active Power measurements at the output terminals of the Power Generating Module shall be recorded every second. The tests will verify that the Power Generating Module can operate within the required ranges for the specified period of time.</p> <p>The Interface Protection shall be disabled during the tests.</p> <p>In case of a PV Power Park Module the PV primary source may be replaced by a DC source.</p> <p>In case of a full converter Power Park Module (eg wind) the primary source and the prime mover inverter/rectifier may be replaced by a DC source.</p>	
<p>Test 1</p> <p>Voltage = 85% of nominal (195.5 V), Frequency = 47 Hz, Power Factor = 1, Period of test 20 s</p>	<p>Tested with the specified conditions, in the 20 seconds period, the inverters operate normally</p>
<p>Test 2</p> <p>Voltage = 85% of nominal (195.5 V), Frequency = 47.5 Hz, Power Factor = 1, Period of test 90 minutes</p>	<p>Tested with the specified conditions, in the 90 minutes period, the inverters operate normally</p>
<p>Test 3</p> <p>Voltage = 110% of nominal (253 V), Frequency = 51.5 Hz, Power Factor = 1, Period of test 90 minutes</p>	<p>Tested with the specified conditions, in the 90 minutes period, the inverters operate normally</p>
<p>Test 4</p> <p>Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz, Power Factor = 1, Period of test 15 minutes</p>	<p>Tested with the specified conditions, in the 15 minutes period, the inverters operate normally</p>
<p>Test 5 RoCoF withstand</p> <p>Confirm that the Power Generating Module is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hz/s as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.</p>	<p>Tested with the specified conditions, the inverters operate normally</p>

This test confirms compliance with 11.2.2

ENA Type Test compliance is provided on the understanding that:

- Tests are up-to-date and in accordance with the most recent amendment of G99.
- Confirmation is provided that the device operates correctly under each test conditions;
- Evidence is provided of operation (graphical or tabular).

- 11.2.1 Under abnormal conditions automatic low-frequency load-shedding provides for load reduction down to 47 Hz. In exceptional circumstances, the frequency of the DNO's Distribution Network could rise above 50.5 Hz. Therefore all Power Generating Modules should be capable of continuing to operate in parallel with the Distribution Network in accordance with the following:

(d) 47 Hz – 47.5 Hz Operation for a period of at least 20 s is required each time the frequency is within this range.

(e) 47.5 Hz – 49.0 Hz Operation for a period of at least 90 minutes is required each time the frequency is within this range.

(f) 49.0 Hz – 51.0 Hz Continuous operation of the Power Generating Module is required.

(g) 51.0 Hz – 51.5 Hz Operation for a period of at least 90 minutes is required each time the frequency is within this range.

(h) 51.5 Hz – 52 Hz Operation for a period of at least 15 minutes is required each time the frequency is within this range.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Harmonics*



2. Power Quality – Harmonics:						
For Power Generating Modules of Registered Capacity of less than 75 A per phase (ie. 50 kW) the test requirements are specified in Annex A.7.1.5. These tests should be carried out as specified in BS EN 61000-3-12 The results need to comply with the limits of Table 2 of BS EN 61000-3-12 for single phase equipment and Table 3 of BS EN 610000-3-12 for three phase equipment.						
For Power Generating Modules of Registered Capacity of greater than 75 A per phase (ie. 50 kW) the installation shall be designed in accordance with EREC G5.						
Power Generating Module tested to BS EN 61000-3-12						
Power Generating Module rating per phase (rpp)		<b>3</b>	kVA		Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of Registered Capacity		100% of Registered Capacity		Limit in BS EN 61000-3	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.0723	0.5543	0.0187	0.1434	8%	8%
3	0.1554	1.1914	0.1036	0.7943	21.6%	Not stated
4	0.0832	0.6379	0.0623	0.4776	4%	4%
5	0.6321	4.8461	0.4735	3.6302	10.7%	10.7%
6	0.0215	0.1648	0.0964	0.7391	2.67%	2.67%
7	0.1836	1.4076	0.2285	1.7518	7.2%	7.2%
8	0.0512	0.3925	0.0128	0.0981	2%	2%
9	0.1703	1.3056	0.1564	1.1991	3.8%	Not stated
10	0.1145	0.8778	0.0426	0.3266	1.6%	1.6%
11	0.0302	0.2315	0.0713	0.5466	3.1%	3.1%
12	0.0157	0.1204	0.0232	0.1779	1.33%	1.33%
13	0.0494	0.3787	0.0865	0.6632	2%	2%
THD <sup>17</sup>	---	5.52	---	4.48	23%	13%
PWHD <sup>18</sup>	---	7.23	---	6.37	23%	22%

These are the limits the generator needs to remain within – from looking at the highlighted results it is clear that this is compliant

A.7.1.4.1 The tests should be carried out as specified in BS EN 61000-3-12 and can be undertaken with a fixed source of energy at two power levels firstly between 45 and 55% and at 100% of Registered Capacity

- Ensure rating of device (per phase) is provided at the top of the table.
- Ensure tests limits are in accordance with BS EN 61000-3-12 and harmonics #2 - #13 are provided.
- It is a requirement that, for single and 3-phase devices, all harmonic data is provided. If device is 3-phase, ensure harmonic data for each phase is included (only one phase of three shown in this example)
- Ensure that THD and PWHD values are provided.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – Power Quality



**3. Power Quality – Voltage fluctuations and Flicker:**

For Power Generating Modules of Registered Capacity of less than 75 A per phase (ie. 50 kW) these tests should be undertaken in accordance with Annex A.7.1.4.3. Results should be normalised to a standard source impedance, or if this results in figures above the limits set in BS EN 61000-3-11 to a suitable Maximum Impedance.

For Power Generating Modules of Registered Capacity of greater than 75 A per phase (ie. 50 kW) the installation shall be designed in accordance with EREC P28.

	Starting			Stopping			Running	
	d max	d c	d(t)	d max	d c	d(t)	P st	P (t 2 hours)
Measured Values at test impedance	0.27%	0.17%	0	0.26%	0.18%	0	0.07	0.08
Normalised to standard impedance	0.27%	0.17%	0	0.26%	0.18%	0	0.07	0.08
Normalised to required maximum impedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1.0	0.65

Test Impedance	R	0.24	Ω	XI	0.15	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	XI	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A	Ω	XI	N/A	Ω

\* Applies to three phase and split single phase Power Generating Modules.

^ Applies to single phase Power Generating Module and Power Generating Modules using two phases on a three phase system

For voltage change and flicker measurements the following formula is to be used to convert the measured values to the normalised values where the Power Factor of the generation output is 0.98 or above.

Normalised value = Measured value x reference source resistance/measured source resistance at test point

Single phase units reference source resistance is 0.4 Ω

Two phase units in a three phase system reference source resistance is 0.4 Ω

Two phase units in a split phase system reference source resistance is 0.24 Ω

Three phase units reference source resistance is 0.24 Ω

Where the Power Factor of the output is under 0.98 then the XI to R ratio of the test impedance should be close to that of the Standard Impedance.

The stopping test should be a trip from full load operation.

The duration of these tests need to comply with the particular requirements set out in the testing notes for the technology under test. Dates and location of the test need to be noted below

Test start date	Insert Date	Test end date	Insert Date
Test location	Insert Location		

A.7.1.4.3 The voltage fluctuations and flicker emissions from the Power Park Module shall be measured in accordance with BS EN 61000-3-11 and the technology specific Annex A.7.3. The required maximum supply impedance should be calculated and recorded in the relevant part of Compliance Verification Report in Form A2-3 (Annex A.2).

- Ensure test & standard impedance is filled in on the form.
- If testing single phase device, test impedance is 0.4Ω
- If testing 3-phase device, test impedance is 0.24Ω
- If a different test impedance is used (*measured impedance*), it must be normalised to the standard impedance
  - E.g. for measured impedance of 0.5Ω and D<sub>max</sub> value = 0.6 (3 phase device):

- D<sub>max</sub> Normalised value:  $\frac{\text{Standard impedance}}{\text{Measured impedance}} \times \text{Measured value}$
- D<sub>max</sub> Normalised value =  $\frac{0.24}{0.5} \times 0.6 = 0.288$

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Power Quality* + *Power Factor*



A.7.1.4.4 The level of DC injection from the Power Park Module - connected prime mover in to the DNO's Distribution Network shall not exceed the levels specified in 9.4.6 when measured during operation at three levels, 10%, 55% and 100% of rating with a tolerance of ±5%.

The DC injection requirements can be satisfied by the installation of an isolation transformer on the AC side of an Inverter-connected Power Park Module. A declaration that an isolating transformer is fitted can be made in lieu of the tests noted above.

4. Power quality – DC injection: The tests should be carried out on a single Generating Unit. Tests are to be carried out at three defined power levels ±5%. At 230 V a 50 kW three phase Inverter has a current output of 217 A so DC limit is 543 mA. These tests should be undertaken in accordance with Annex A.7.1.4.4.									
Test power level	10%			55%			100%		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
Recorded value in Amps	11.2	11.6	12.5	13.4	17.3	17.6	17.8	20.4	22.9
as % of rated AC current	0.086	0.089	0.096	0.103	0.133	0.135	0.137	0.157	0.176
Limit	0.25%			0.25%			0.25%		

- Perform at 3 Test power levels (10%, 55% & 100%)
- Correct calculation for “as % of rated AC current”:
  - **Base current** =  $\frac{\text{Registered Capacity (W)}}{230}$
  - **% DC injection** =  $\frac{\text{Recorded DC value (A)}}{\text{Base current (A)}}$
- **Note:** calculation is the same for 1 phase and 3 phase devices

5. Power Factor: The tests should be carried out on a single Power Generating Module. Tests are to be carried out at three voltage levels and at Registered Capacity. Voltage to be maintained within ±1.5% of the stated level during the test. These tests should be undertaken in accordance with Annex A.7.1.4.2.			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.9983	0.9978	0.9988
Power Factor Limit	>0.95	>0.95	>0.95

- Perform tests to the 3 voltages: (216.2V/0.94pu, 230V/1pu & 253V/1.1pu)
- Ensure power factor is > 0.95pu.
  - 11.1.5 When operating at **Registered Capacity** the **Power Generating Module** shall be capable of operating at a **Power Factor** within the range 0.95 lagging to 0.95 leading relative to the voltage waveform unless otherwise agreed with the **DNO**.



**6. Protection – Frequency tests:** These tests should be carried out in accordance with the Annex A.7.1.2.3.

Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.52Hz	20.039s	47.7 Hz 30 s	Yes
U/F stage 2	47 Hz	0.5 s	46.96Hz	0.537s	47.2 Hz 19.5 s	Yes
					46.8 Hz 0.45 s	Yes
O/F	52 Hz	0.5 s	52.03Hz	0.543s	51.8 Hz 120.0 s	Yes
					52.2 Hz 0.45 s	Yes

Note. For frequency trip tests the frequency required to trip is the setting  $\pm 0.1$  Hz. In order to measure the time delay a larger deviation than the minimum required to operate the protection can be used. The "No trip tests" need to be carried out at the setting  $\pm 0.2$  Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

- Ensure trip/no-trip times are up-to-date and in accordance with **most recent amendment** of EREC G99.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Protection - Voltage tests*



7. Protection – Voltage tests: These tests should be carried out in accordance with Annex A.7.1.2.2.						
Function	Setting		Trip test		"No trip tests"	
U/V	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
L1-N	0.8 pu (184 V)	2.5 s	183.2V	2.544s	188 V 5.0 s	Yes
L2-N			183.7V	2.538s		Yes
L3-N			182.9V	2.536s		Yes
					180 V 2.45 s	Yes
<u>O/V_stage 1</u>	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
L1-N	1.14 pu (262.2 V)	1.0 s	262.5V	1.042s	258.2 V 5.0 s	Yes
L2-N			262.9V	1.035s		Yes
L3-N			263.0V	1.038s		Yes
<u>O/V_stage 2</u>	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
L1-N	1.19 pu (273.7 V)	0.5 s	274.6V	0.537s	269.7 V 0.95 s	Yes
L2-N			273.9V	0.546s		Yes
L3-N			274.1V	0.543s		Yes
					277.7 V 0.45 s	Yes

Note for Voltage tests the Voltage required to trip is the setting  $\pm 3.45$  V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting  $\pm 4$  V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

- Ensure trip/no-trip times are up-to-date and in accordance with **most recent amendment** of EREC G99.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Protection – Loss of Mains test*



8. Protection – Loss of Mains test: These tests should be carried out in accordance with BS EN 62116. Annex A.7.1.2.4.						
The following sub set of tests should be recorded in the following table.						
Test Power and imbalance	33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0.33s	0.22s	0.21s	0.31s	0.34s	0.20s
Loss of Mains Protection, Vector Shift Stability test. This test should be carried out in accordance with Annex A.7.1.2.6.						
	Start Frequency DCV	Change	Confirm no trip			
Positive Vector Shift	49.5 Hz	+50 degrees	Yes			
Negative Vector Shift	50.5 Hz	- 50 degrees	Yes			
Loss of Mains Protection, RoCoF Stability test: This test should be carried out in accordance with Annex A.7.1.2.6.						
Ramp range	Test frequency ramp:		Test Duration		Confirm no trip	
49.0 Hz to 51.0 Hz	+0.95 Hzs <sup>-1</sup>		2.1 s		Yes	
51.0 Hz to 49.0 Hz	-0.95 Hzs <sup>-1</sup>		2.1 s		Yes	

## • Protection – Loss of Mains Test

- **Non-PV Inverter:** Complete with test power at 10, 55 & 100% for +/- 5% of Registered Capacity (first test) - ensure trip time is within limit of 0.5s (unless additional shut down time is included, limit = 1s) – in accordance with BS EN 50438.
- **Multi-phase Micro-generators:** Same as above but for all phases – ensure trip time is within limit of 0.5s (unless additional shut down time is included, limit = 1s).
- **PV Inverter:** Complete test power and imbalance (Test 22, 12, 5, 31, 21 & 10) – ensure trip time is within limit of 0.5s in accordance with BS EN 62116.

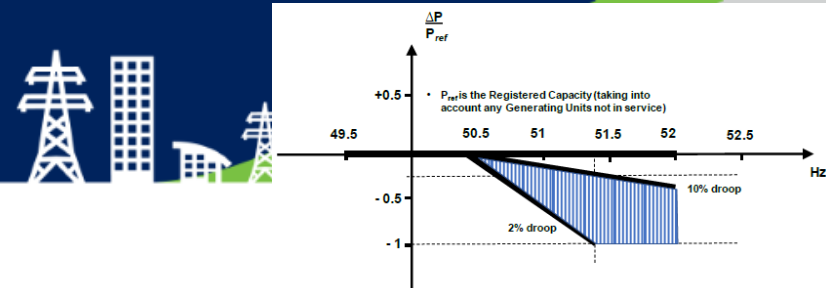
## • Protection – Frequency Change, Vector Shift Stability Test:

- Confirm device does not trip under positive/negative vector shift.

## • Protection – Frequency change, RoCoF Stability Test:

- Confirm device does not trip in either the ramp up/ramp down test duration.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Over frequency test*



9. Limited Frequency Sensitive Mode – Over frequency test: The test should be carried out using the specific threshold frequency of 50.4 Hz and <u>Droop</u> of 10%. This test should be carried out in accordance with Annex A.7.1.3.				
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4.				Y/N
Alternatively, test results should be noted below:				
Test sequence at Registered Capacity >80%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	9141W	50.00Hz	9237W	↓
Step b) 50.45Hz ±0.05Hz	9018W	50.45Hz		↓
Step c) 50.70Hz ±0.10Hz	7991W	50.70Hz		↓
Step d) 51.15Hz ±0.05Hz	6227W	51.15Hz		↓
Step e) 50.70Hz ±0.10Hz	8021W	50.70Hz		↓
Step f) 50.45Hz ±0.05Hz	8994W	50.45Hz		↓
Step g) 50.00Hz ±0.01Hz	9158W	50.00Hz		54kW/min
Test sequence at Registered Capacity 40% - 60%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	4725W	50.00Hz	4821W	-
Step b) 50.45Hz ±0.05Hz	4470W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	3514W	50.70Hz		-
Step d) 51.15Hz ±0.05Hz	1757W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	3496W	50.70Hz		-
Step f) 50.45Hz ±0.05Hz	4508W	50.45Hz		9327W
Step g) 50.00Hz ±0.01Hz	9204W	50.00Hz	9327W	54kW/min

- Ensure that measured active power output provides a droop less than 10% (tolerance band of 8.5% to 12.8%).
  - 11.2.4.1 Each **Power Generating Module** shall be capable of reducing **Active Power** output in response to the frequency on the **Total System** when this rises above 50.4 Hz. The **Power Generating Module** shall be capable of operating stably during **LFSM-O** operation. If a **Power Generating Module** has been contracted to operate in **Frequency Sensitive Mode** the requirements of **LFSM-O** shall apply when the frequency exceeds 50.5 Hz.
    - (a) The rate of change of **Active Power** output shall be at a minimum a rate of 2% of output per 0.1 Hz deviation of system frequency above 50.4 Hz (i.e. a **Droop** of 10%) as shown in Figure 11.2. For the avoidance of doubt, this would not preclude a **Generator** from designing the **Power Generating Module** with a **Droop** of less than 10%, but in all cases the **Droop** should be 2% or greater.
    - (b) The **Power Generating Module** shall be capable of initiating a power frequency response with an initial delay that is as short as possible. If the initial delay exceeds 2 s the **Generator** shall justify the delay, providing technical evidence to the **DNO**, who will pass this evidence to the **NETSO**.
    - (c) For deviations in frequency up to 50.9 Hz at least half of the proportional reduction in **Active Power** output shall be achieved within 10 s of the time of the frequency increase above 50.4 Hz.
    - (d) For deviations in frequency beyond 50.9 Hz the measured rate of change of **Active Power** reduction shall exceed 0.5% s<sup>-1</sup> of the initial output.
    - (e) The **LFMS-O** response shall be reduced when the frequency subsequently falls again and, when to a value less than 50.4 Hz, at least half the proportional increase in **Active Power** shall be achieved in 10 s. For a frequency excursion returning from beyond 50.9 Hz the measured rate of change of **Active Power** increase shall not exceed 0.5% s<sup>-1</sup>.
  - If the reduction in **Active Power** is such that the **Power Generation Module** reaches its **Minimum Stable Operating Level**, it shall continue to operate stably at this level.

$$1^{st} \text{ Droop } \% = \frac{\left( \frac{\text{Step D freq} - \text{Step B freq}}{50} \right)}{\left( \frac{\text{Step B power} - \text{Step D power}}{\text{Step B power}} \right)} \times 100$$

$$2^{nd} \text{ Droop } \% = \frac{\left( \frac{\text{Step D freq} - \text{Step F freq}}{50} \right)}{\left( \frac{\text{Step F power} - \text{Step D power}}{\text{Step F power}} \right)} \times 100$$



# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Re-connection timer + Fault level contribution*



10. Protection – Re-connection timer.					
Test should prove that the reconnection sequence starts after a minimum delay of 20 s for restoration of voltage and frequency to within the stage 1 settings of Table 10.1.					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of Table 10.1.			
30s	45.6s	At 1.16 pu (266.2 V)	At 0.78 pu (180.0 V)	At 47.4 Hz	At 52.1 Hz
Confirmation that the Power Generating Module does not re-connect.		Yes	Yes	Yes	Yes

- Provide both the time delay and measured delay settings – both should be greater than 20s.
- Provide confirmation that device does **not** reconnect at 266.2V, 180V, 47.4Hz & 52.1Hz.

11. Fault level contribution: These tests shall be carried out in accordance with EREC G99 Annex A.7.1.5.		
For Inverter output		
Time after fault	Volts	Amps
20ms	53.2V	16.25A
100ms	53.0V	0A
250ms	52.8V	0A
500ms	52.8V	0A
Time to trip	0.055s	In seconds

- Ensure correct fault level contribution is provided for the correct type of device.

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Self-Monitoring solid state switching + Wiring functional tests*



12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.7.	
It has been verified that in the event of the solid state switching device failing to disconnect the Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 s.	N/A (Solid state switch means electronic switch, Solis inverter uses mechanical dual relay protection with relay checks, which drops the voltage below 50V in 0.5s)

13. Wiring functional tests: If required by para 15.2.1.	
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning)	N/A (Not applicable. Refer to 15.2.1, inverter is using special connector for wiring)

- Declare Yes or N/A – not both

# EVIDENCE: A2-3 Form: 9.9kVA Solar Installation – *Logic interface + Additional comments*



14. Logic interface (input port).	
Confirm that an input port is provided and can be used to shut down the module.	Yes (Logic interface is marked as "DRM" either on inverter or on external DRM device depending on inverter model. Please see inverter or external DRM device manual for detail.

Additional comments.

Section for additional comments at the bottom of the form – unless using non-standard configuration this box can be left blank like in this example

- Confirmation of the presence of a logic interface must be provided.
  - **11.1.3 Power Generating Modules connected to the DNO's Distribution Network shall be equipped with a logic interface (input port) in order to cease *Active Power* output within 5 s following an instruction being received at the input port**