VERTIX® SYSTEMS

Guide to connecting micro-generation systems to the Distribution Network Operator

1. Introduction

When planning to install solar PV systems you will need to demonstrate compliance with the requirements of Engineering Recommendation (EREC) G98 or EREC G99 before a connection is commissioned.

EREC G98 applies to low voltage micro-generation systems (up to 3.68KW) and EREC G99 applies to larger micro-generation schemes (over 3.68KW). These requirements apply to installations in England, Wales and Scotland. Northern Ireland has different versions of EREC G98 and EREC G99 in use.

For G98 installations either Form A (for multiple premises) or Form B (for single installations) will need to be submitted. These are straightforward to complete.

2. Information required for Form A or Form B

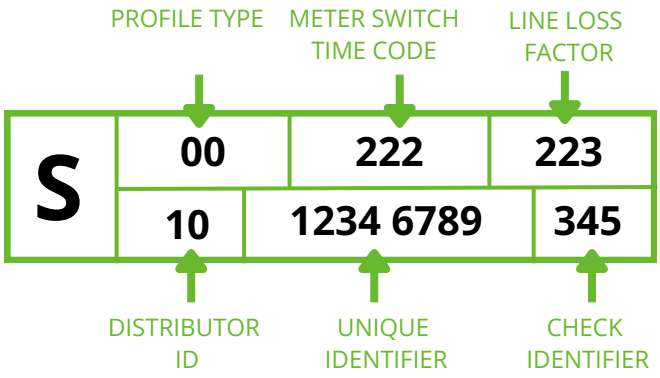
There are 2 main pieces of information you will require to complete G98 Form A or Form B.

- Meter number known as MPAN (Meter Point Administrator Number)
- Inverter ENA Type Test System Reference Number

Meter Point Administration Number

This is a unique 21 digit number that is preceded by an 'S' and identifies a domestic property's electricity supply. It is used primarily to identify a property's electricity supply (the 13 digit unique identifier), but also contains information about the tariff type, location and network operator. This can be found on any electricity bill for the property.

It is the 13 digit unique identifier number that will be required for Form A or Form B.



Inverter ENA Type Test System Reference Number

The Energy Network Association (ENA) holds an online register of equipment manufacturers who have submitted Engineering Recommendation (EREC) G98 Form C: Type Test Verification Report. This register can be used to find the System Reference Number for the manufacturer and electrical item you plan to use on your installation. This is required for G98 Form A or Form B.

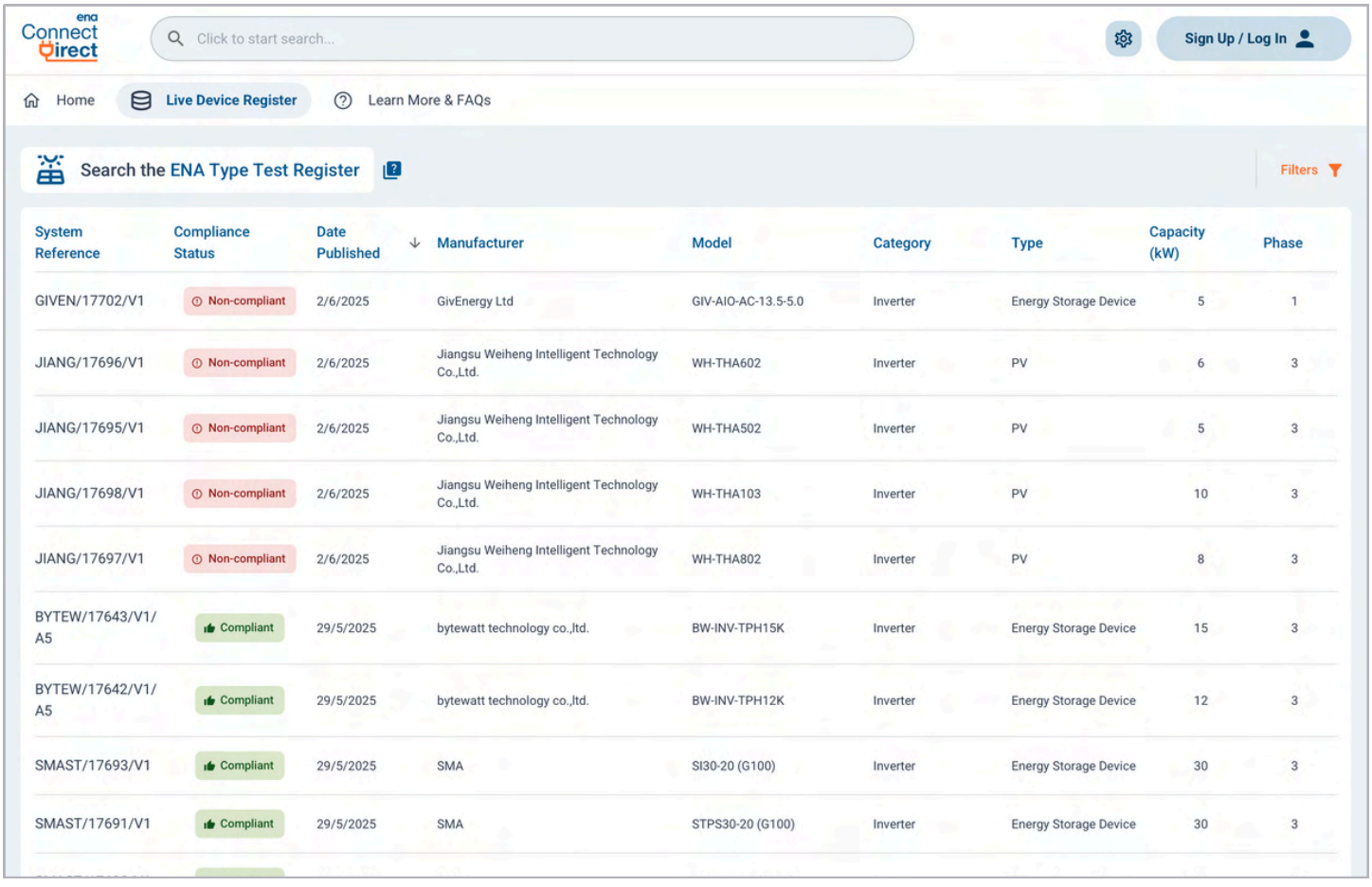
Submissions made by equipment manufacturers are assessed by an ENA validator and if a device is deemed suitable it is marked as compliant on the register.

You can easily check whether a specific equipment manufacturer's electrical item is on the register, whether it is compliant and access test certificate data by visiting ENA Connect Direct website.
www.connect-direct.energynetworks.org.

If the equipment manufacturer and electrical item are not on the register, you or the installer would need to arrange your own test or ask the manufacturer to send you a test certificate. You would then be required to complete Engineering Recommendation (EREC) G98 Form C: Type Test Verification Report.

It is advisable to select an equipment manufacturer and electrical item that is listed on the ENA Live Device Register and has been deemed compliant by them.

Example of Live Device Register on ENA Connect Direct website

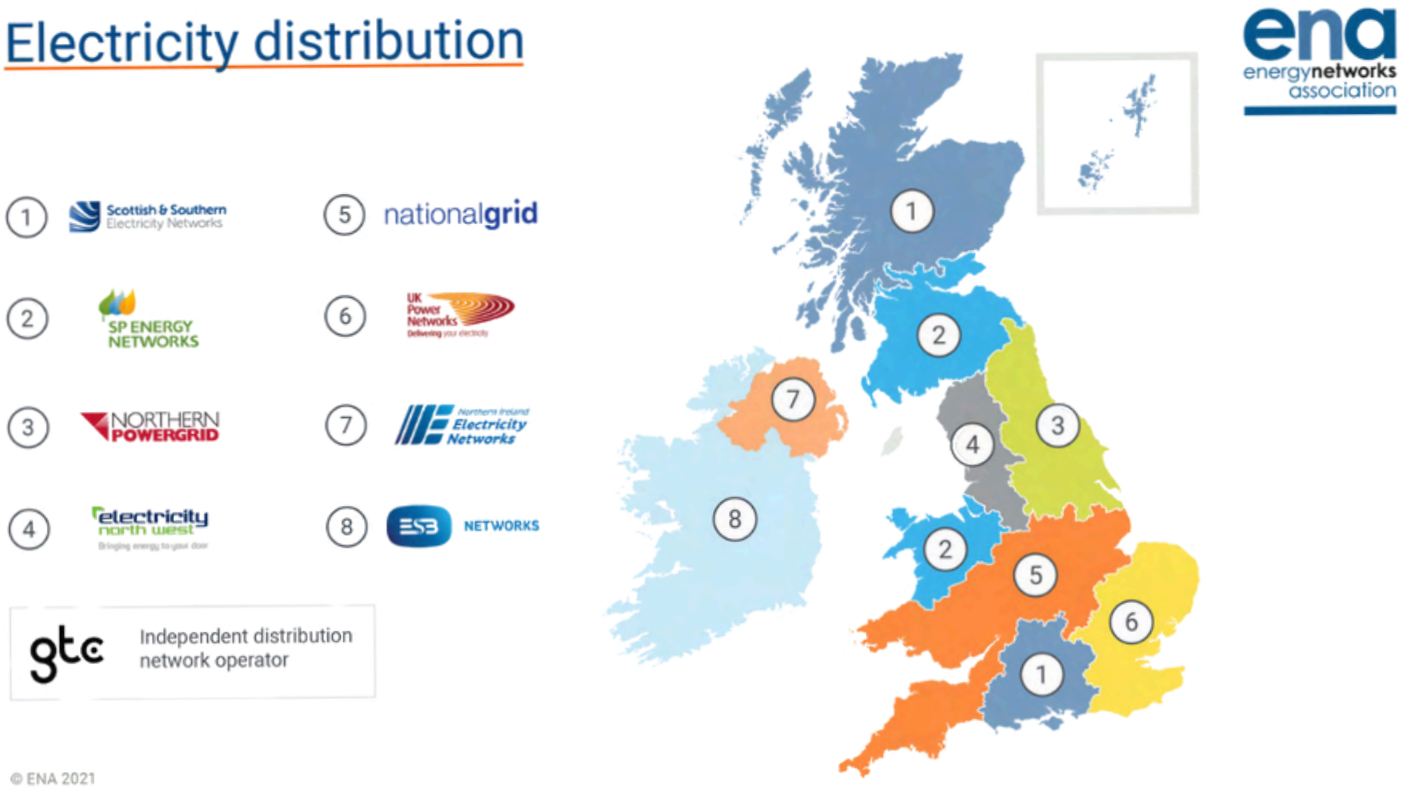


System Reference	Compliance Status	Date Published	Manufacturer	Model	Category	Type	Capacity (kW)	Phase
GIVEN/17702/V1	Non-compliant	2/6/2025	GivEnergy Ltd	GIV-AIO-AC-13.5-5.0	Inverter	Energy Storage Device	5	1
JIANG/17696/V1	Non-compliant	2/6/2025	Jiangsu Weiheng Intelligent Technology Co.,Ltd.	WH-THA602	Inverter	PV	6	3
JIANG/17695/V1	Non-compliant	2/6/2025	Jiangsu Weiheng Intelligent Technology Co.,Ltd.	WH-THA502	Inverter	PV	5	3
JIANG/17698/V1	Non-compliant	2/6/2025	Jiangsu Weiheng Intelligent Technology Co.,Ltd.	WH-THA103	Inverter	PV	10	3
JIANG/17697/V1	Non-compliant	2/6/2025	Jiangsu Weiheng Intelligent Technology Co.,Ltd.	WH-THA802	Inverter	PV	8	3
BYTEW/17643/V1/A5	Compliant	29/5/2025	bytewatt technology co.,ltd.	BW-INV-TPH15K	Inverter	Energy Storage Device	15	3
BYTEW/17642/V1/A5	Compliant	29/5/2025	bytewatt technology co.,ltd.	BW-INV-TPH12K	Inverter	Energy Storage Device	12	3
SMAST/17693/V1	Compliant	29/5/2025	SMA	SI30-20 (G100)	Inverter	Energy Storage Device	30	3
SMAST/17691/V1	Compliant	29/5/2025	SMA	STPS30-20 (G100)	Inverter	Energy Storage Device	30	3

3. Distribution Network Operators (DNO)

You will need to identify the relevant DNO for the geographic area where your micro-generation scheme is being installed and submit the correct G98 or G99 compliance to them. Each DNO has their own version of the G98 and G99 forms available on their website, and some include the facility to submit these online.

The DNO owns, operates and maintains the public electricity distribution system in one or more regions in the UK. They hold a Distribution Network Operator Licence and under the terms of their licence, each DNO is allowed to distribute electricity both inside and outside its legacy geographic area.



4. Demonstrating compliance with EREC G98

G98 application Form A or Form B should be used for registering small-scale embedded generation systems with the local distribution network operator (DNO) and ensuring compliance with EREC G98. It applies to low voltage micro-generation systems up to 16 amps per phase (3.68 kW per phase).

In electrical distribution low voltage systems are voltages up to 1000v and 240V on a single-phase supply, is typical for domestic supply in the UK. If 240V is multiplied by 16 Amp, then a power of 3.840KW is derived. EREC G98 talks about a maximum output of 3.680 KW, which is lower than this calculation. This is because the average voltage according to the European Union is 230V. 16 Amp x 230V = 3.68KW. The reality is that mainland Europe supply voltage is 220V and the UK supply voltage is 240V.

G98 Connection process for single premises

The connection process for G98 single premises is relatively simple with only a few steps to complete, as defined by the Energy Network Association (ENA). These steps are based on the requirements set out in EREC G98.

Form B Installation Document for connection under G98 should be completed and submitted to the relevant DNO for the geographic area where the installation is. Each DNO has their own version of Form B available on their website, and some include the facility to submit these online.

Connection process steps for single premises

A detailed explanation of the actions is available in Distributed Generation Connection Guide G98 and G99 available from Energy Network Association website.

G98 Connection process for multiple premises

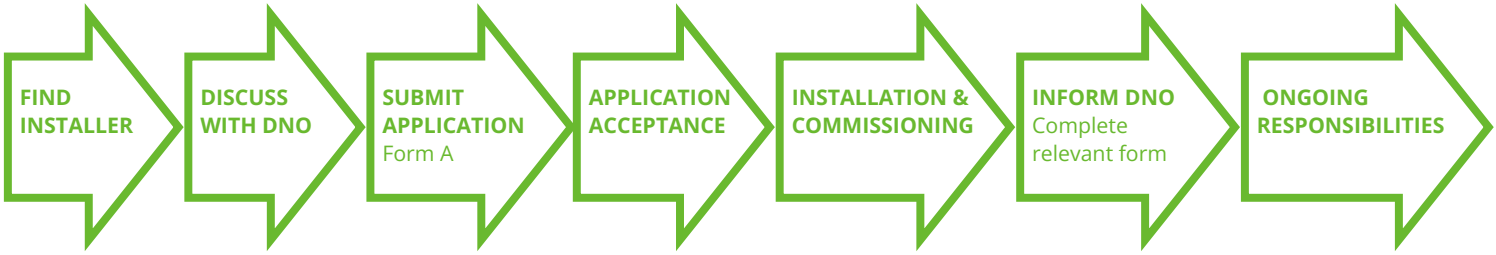
Multiple premises could include a housing refurbishment in the same street or a new housing development. The process for connection involves a few more steps than single premise installations, as defined by the Energy Network Association (ENA). These are based on the requirements set out in EREC G98.

One of the main additional steps is that you must discuss and exchange information with the DNO about the project prior to any work starting. This should be done during the planning phase as the DNO's response could impact how the project is planned.

Once information has been discussed and exchanged with the DNO, you will need to submit Form A Application for connection of multiple Micro-Generating installations to them.

Only when you have formally accepted the DNO's connection offer can construction start. Each DNO has their own version of Form A available on their website, and some include the facility to submit these online.

Connection process steps for multiple premises



A detailed explanation of the actions is available in Distributed Generation Connection Guide G98 and G99 available from Energy Network Association website.

5. Demonstrating compliance with EREC G99

EREC G99 is the regulation that applies to the connection of any form of generation device that runs in parallel or is synchronised with the main electrical utility grid and G99 application forms should be used for any integrated microgeneration and storage units that are generating over 16A (3.68kW per phase).

The connection application process for this is more complex and additional information is required as part of any submission, such as a signed letter of authority and site plans, as well as a connection design that must be accurate. Battery storage systems for domestic schemes can sometimes be large enough to fall under G99 requirements, and your installer should be able to advise on this.

G99 Connection process for single premises

The connection requirements are generally more complex the larger the power generating module is. For EREC G99, the type of power generating module (Power Park Modules or Synchronous Power Generating Modules) and their capacity and connection point (classified as A to D) impact the connection process that needs to be followed and the forms that need to be completed and submitted as part of this.

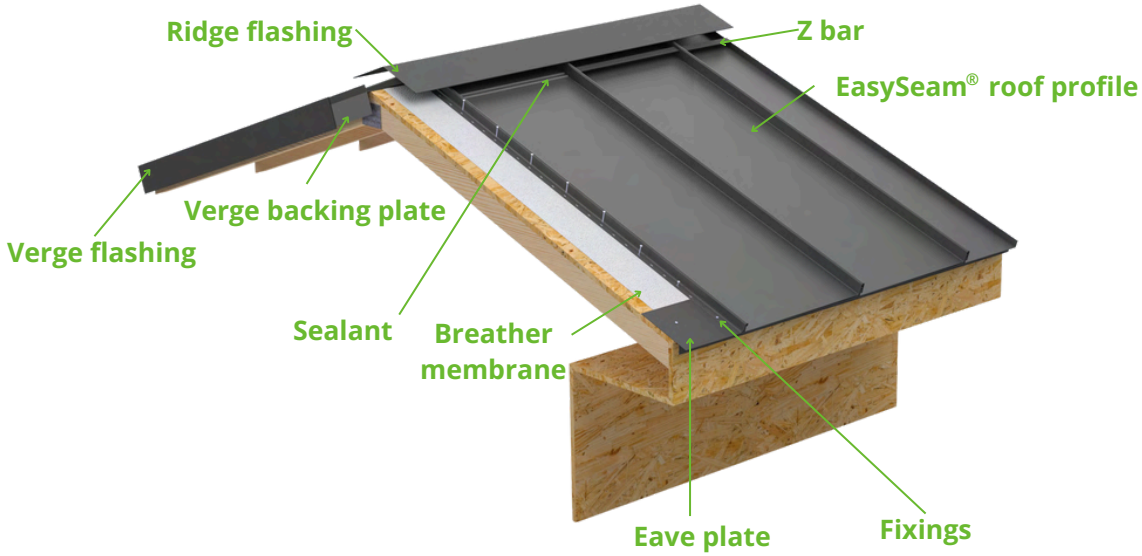
Each separate DNO has detailed guidance about the connection process and relevant G99 forms on their website.

A detailed explanation of the actions is available in Distributed Generation Connection Guide G98 and G99 available from Energy Network Association website.

6. EasySeam® Roof System

Vertix EasySeam Standing Seam Roof System offers a contemporary, robust, high-quality solution. It uses a metal standing seam profile to offer a durable solution that's quick and easy to install.

Offered as a complete kit of parts, EasySeam Roof System includes breather membrane, ridge, eaves and verge flashings, fixings and sealant, ensuring you get the very best aesthetics and quality for your whole roof.



EasySeam Solar Photo Voltaic options

EasySeam Roof System has been designed to accommodate a number of photo-voltaic (PV) solutions.

Laminate PV panel
Stick on laminate PV is almost invisible when used with a standing seam roof and has cabling hidden under the ridge cap.

Chrystalline PV panel
Fixed to standing seam roof with a clamp, with cabling hidden under the Chrystalline PV panel.

For more information about integration of Photo-voltaic (PV) panels, please refer to EasySeam Roof System Technical Guide.

7. Appendixes

Examples of ENA Engineering Recommendation G98 Forms.

Form A: Application for connection of multiple Micro-Generating installations

Form B: Installation Document for connection under G98

Form C: Type Test Verification Report

Each Distribution Network Operator (DNO) has their own version of Form A and Form B available on their website, and some include the facility to submit these online.

Form A: Application for connection of multiple Micro-Generating installations

To ABC electricity distribution DNO
99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com

Developer/Customer Details:	
Developer / **Customer** (name)	
Address	
Post Code	
Contact person (if different from **Customer**)	
Telephone number	
E-mail address	
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	

Proposed Micro-generator Details:

Address	Post Code	MPAN	**Micro-generator Registered Capacity** in kW at 230 V AC			Energy storage capacity for **Electricity Storage** devices (kWh)	**Manufacturer's** Ref No (this number should be registered on the ENA Type Test Register as the system reference)
			PH1	PH2	PH3		

Use continuation sheet where more than 10 **Micro-generator**s are to be installed.

Please include an electronic map with the location of each Customer Installation highlighted in red.

Record **Micro-generator Registered Capacity** in kW at 230 V AC, to one decimal place, under PH1 for single phase supplies and under the relevant phase for two and three phase supplies. For example 2.8 kW. Detail on a separate sheet if there are any proposals to limit export to a lower figure than that of the **Micro-generator**.

Form B: Installation Document for connection under G98

Please complete and provide this document for each premises, once **Micro-generator** installation is complete.

To ABC electricity distribution **DNO**
99 West St, Imaginary Town, ZZ99 9AA abced@wxyz.com

Customer Details:	
Customer (name)	
Address	
Post Code	
Contact person (if different from **Customer**)	
Telephone number	
E-mail address	
Customer signature	
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	
Installer signature	
Installation details	
Address	
Post Code	
MPAN(s)	
Location within **Customer's Installation**	

Location of Isolation Lockable Switch	

Details of Micro-generators. Use a separate line for new and existing installations and for different technology type. Use PH 1 column for single phase supply.

Manufacturer	Date of Installation	Energy source and energy conversion technology (enter codes from tables 1 and 2 below)	**Manufacturer**'s Ref No (this number should be registered on the ENA Type Test Register as the system reference)	**Micro-generator Registered Capacity** in kW				Energy storage capacity for **Electricity Storage** devices (kWh)
				3-Phase Units	Single Phase Units			
					PH1	PH2	PH3	

Declaration – to be completed by Installer for Micro-generators Tested to EREC G98

I declare that the relevant **Micro-generators** and the installation which together form a **Micro-generating Plant** within the scope of EREC G98 at the above address, conform to the requirements of EREC G98. This declaration of compliance is confined to **Micro-generating Plant** tested to EREC G98 or EREC G83 as applicable at the time of commissioning.

Signature:	Date:

Form C: Type Test Verification Report

All Micro-generators connected to the **DNO Distribution Network** shall be **Fully Type Tested**. This form is the **Manufacturer**'s declaration of compliance with the requirements of EREC G98.

This form should be used when making a Type Test submission to the Energy Networks Association (ENA)
Type Test Register.

If the **Micro-generator** is **Fully Type Tested** and already registered with the ENA Type Test Register, the **Installation Document** should include the **Manufacturer**'s Reference Number (the system reference), and this form does not need to be submitted.

Manufacturer's reference number	
Micro-generator technology	
Manufacturer name	
Address	

Tel		Fax	
E-mail		Web site	

Registered Capacity, use separate sheet if more than one connection option.	Connection Option	
		kW single phase, single, split or three phase system
		kW three phase
		kW two phases in three phase system
		kW two phases split phase system
Energy storage capacity for **Electricity Storage** devices		kWh

Manufacturer Type Test declaration. - I certify that all products supplied by the company with the above **Fully Type Tested** 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 G98.

Signed		On behalf of	

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.	
Operating Range: This test should be carried out as specified in A.1.2.10. Pass or failure of the test should be indicated in the fields below (right hand side), for example with the statement “Pass”, “No disconnection occurs”, etc. Graphical evidence is preferred.	
Test 1 Voltage = 85% of nominal (195.5 V) Frequency = 47.0 Hz Power factor = 1 Period of test 20 seconds	Test results or chart to confirm operation
Test 2 Voltage = 85% of nominal (195.5 V) Frequency = 47.5 Hz Power factor = 1 Period of test 90 minutes	Test results or chart to confirm operation
Test 3 Voltage = 110% of nominal (253 V). Frequency = 51.5 Hz Power factor = 1 Period of test 90 minutes	Test results or chart to confirm operation
Test 4 Voltage = 110% of nominal (253 V). Frequency = 52.0 Hz Power factor = 1 Period of test 15 minutes	Test results or chart to confirm operation

Test 5 Voltage = 100% of nominal (230 V). Frequency = 50.0 Hz Power factor = 1 Period of test 90 minutes	Test results or chart to confirm operation
Test 6 RoCoF withstand Confirm that the **Micro-Generating Plant** is capable of staying connected to the **Distribution Network** and operate at rates of change of frequency up to 1 Hzs-8 as measured over a period of 500 ms.	Test results or chart to confirm operation

Power Quality – Harmonics: These tests should be carried out as specified in BS EN 61000-3-2. The chosen test should be undertaken with a fixed source of energy at two power levels a) between 45 and 55% and b) at 100% of **Registered Capacity**. The test requirements are specified in Annex A1 A.1.3.1 (**Inverter** connected) or Annex A2 A.2.3.1 (Synchronous).			
Micro-generator tested to BS EN 61000-3-2			
Micro-generator rating per phase (rpp)		kW	
For 3-phase **Micro-generator**s, tick this box if harmonic measurements are identical for all three phases. If the harmonics are not identical for each phase, please replicate this section with the results for each phase.			

Harmonic	At 45-55% of **Registered Capacity**[1]		100% of **Registered Capacity**			
	Measured Value MV in Amps		Measured Value MV in Amps		Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2					1.080	
3					2.300	
4					0.430	
5					1.140	
6					0.300	
7					0.770	
8					0.230	
9					0.400	
10					0.184	
11					0.330	
12					0.153	
13					0.210	
14					0.131	
15					0.150	

1 See the note in A.2.3.1 if 45-55% of **Registered Capacity** is below the minimum stable operating level. If an alternative loading level is chosen, the level should be indicated on the test form and the reason for not testing at 45-55% of **Registered Capacity** should be stated. The additional comments box at the end of the harmonics test sheet can be used for this.

16					0.115	
17					0.132	
18					0.102	
19					0.118	
20					0.092	
21					0.107	0.160
22					0.084	
23					0.098	0.147
24					0.077	
25					0.090	0.135
26					0.071	
27					0.083	0.124
28					0.066	
29					0.078	0.117
30					0.061	
31					0.073	0.109
32					0.058	
33					0.068	0.102
34					0.054	
35					0.064	0.096
36					0.051	
37					0.061	0.091
38					0.048	
39					0.058	0.087
40					0.046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.
Additional comments:

Power Quality – Voltage fluctuations and Flicker: These tests should be undertaken in accordance with EREC G98 Annex A1 A.1.3.3 (**Inverter** connected) or Annex A2 A.2.3.3 (Synchronous).

The standard test impedance is 0.4 Ω for a single phase **Micro-generating Plant** (and for a two phase unit in a three phase system) and 0.24 Ω for a three phase **Micro-generating Plant** (and for a two phase unit in a split phase system). Please ensure that both test and standard impedance are completed on this form. If the test impedance (or the measured impedance) is different to the standard impedance, it must be normalised to the standard impedance as follows (where the **Power Factor** of the generation output is 0.98 or above):

d max normalised value = (Standard impedance / Measured impedance) x Measured value.

Where the **Power Factor** of the output is under 0.98 then the X 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 needs to comply with the particular requirements set out in the testing notes for the technology under test.

The test date and location must be declared.

Test start date				Test end date				
Test location								
	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	Pst	Plt 2 hours
Measured Values at test impedance								
Normalised to standard impedance								
Normalised to required maximum impedance								
~~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		Ω	X		Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	X	0.15 * 0.25 ^	Ω
Maximum Impedance	R		Ω	X		Ω

*Applies to three phase and split single phase **Micro-generators**. Delete as appropriate.

^ Applies to single phase **Micro-generators** and **Micro-generators** using two phases on a three phase system. Delete as appropriate.

Power quality – DC injection: This test should be carried out in accordance with A 1.3.4 as applicable.

The % **DC** injection ("as % of rated AC current" below) is calculated as follows:

% **DC** injection = Recorded **DC** value in Amps / base current

where the base current is the **Registered Capacity** (W) / 230 V. The % **DC** injection should not be greater than 0.25%.

Test power level	20%	50%	75%	100%
Recorded **DC** value in Amps				
as % of rated AC current				
Limit	0.25%	0.25%	0.25%	0.25%

Power Quality – Power factor: This test shall be carried out in accordance with A.1.3.2 and A.2.3.2 at three voltage levels and at **Registered Capacity** and the measured **Power Factor** must be greater than 0.95 to pass. Voltage to be maintained within ±1.5% of the stated level during the test.

	216.2 V	230 V	253 V
Measured value			
Power Factor Limit	>0.95	>0.95	>0.95

Protection – Frequency tests: These tests should be carried out in accordance with Annex A1 A.1.2.3
(**Inverter** connected) or Annex A2 A.2.2.3 (Synchronous). For trip tests, frequency and time delay should be stated. For "no trip tests", "no trip" can be stated.

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			47.7 Hz 30 s	
U/F stage 2	47 Hz	0.5 s			47.2 Hz 19.5 s	
					46.8 Hz 0.45 s	
O/F stage 1	52 Hz	0.5 s			51.8 Hz 120.0 s	
					52.2 Hz 0.45 s	

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

Protection – Voltage tests: These tests should be carried out in accordance with Annex A1 A.1.2.2 (**Inverter** connected) or Annex A2 A.2.2.2 (Synchronous). For trip tests, voltage and time delay should be stated. For “no trip tests”, “no trip” can be stated.

Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V	184 V	2.5 s			188 V 5.0 s	
					180 V 2.45 s	
O/V stage 1	262.2 V	1.0 s			258.2 V 5.0 s	
O/V stage 2	273.7 V	0.5 s			269.7 V 0.95 s	
					277.7 V 0.45 s	

Note for Voltage tests the Voltage required to trip is the setting ±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 ±4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection – Loss of Mains test: For PV **Inverter**s shall be tested in accordance with BS EN 62116. Other **Micro-generator**s should be tested in accordance with A.2.2.4 at 10%, 55% and 100% of rated power.

To be carried out at three output power levels with a tolerance of plus or minus 5% in Test Power levels.2

2 See the note in A.2.2.4 if the suggested loading levels are below the minimum stable operating level. If alternative loading levels are chosen, the level should be indicated on the test form and the reason for not testing at

Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of **Registered Capacity**	95% of **Registered Capacity**	95% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**
Trip time. Limit is 0.5 s						
For Multi phase **Micro-generators** confirm that the device shuts down correctly after the removal of a single fuse as well as operation of all phases.						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of **Registered Capacity**	95% of **Registered Capacity**	95% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**
Trip time. Ph1 fuse removed						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of **Registered Capacity**	95% of **Registered Capacity**	95% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**
Trip time. Ph2 fuse removed						
Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of **Registered Capacity**	95% of **Registered Capacity**	95% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**	105% of **Registered Capacity**
Trip time. Ph3 fuse removed						
Note for technologies which have a substantial shut down time this can be added to the 0.5 s in establishing that the trip occurred in less than 0.5 s. Maximum shut down time could therefore be up to 1.0 s for these technologies.						
Indicate additional shut down time included in above results.					ms	
Additional comments:						

10%/55% of **Registered Capacity** should be stated. The additional comments box at the end of the loss of mains test sheet can be used for this.

For **Inverter**s tested to BS EN 62116 the following sub set of tests should be recorded in the following table.

Test Power and 33% imbalance	-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 0.5 s[3]						

Protection – Frequency change, Vector Shift Stability test: This test should be carried out in accordance with EREC G98 Annex A1 A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). Confirmation is required that the **Micro-generating Plant** does not trip under positive / negative vector shift.

	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.0 Hz	+50 degrees	
Negative Vector Shift	50.0 Hz	- 50 degrees	

Protection – Frequency change, RoCoF Stability test: The requirement is specified in section 11.3, test procedure in Annex A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). Confirmation is required that the **Micro-generating Plant** does not trip for the duration of the ramp up and ramp down

test. Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+0.95 Hzs-1	2.1 s	
51.0 Hz to 49.0 Hz	-0.95 Hzs-1	2.1 s	

Limited Frequency Sensitive Mode – Overfrequency test: This test should be carried out in accordance with A.1.2.8. The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%. The measurement tolerances are contained in A.1.2.8.

Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output	Frequency	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz				-
Step b) 50.45 Hz ±0.05 Hz				-
Step c) 50.70 Hz ±0.10 Hz				-
Step d) 51.15 Hz ±0.05 Hz				-
Step e) 50.70 Hz ±0.10 Hz				-
Step f) 50.45 Hz ±0.05 Hz				-

3 If the device requires additional shut down time (beyond 0.5 s but less than 1 s) then this should be stated on this form.

Step g) 50.00 Hz ±0.01 Hz Test sequence at				
Registered Capacity 40% - 60%	Measured **Active Power** Output	Frequency	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz				-
Step b) 50.45 Hz ±0.05 Hz				-
Step c) 50.70 Hz ±0.10 Hz				-
Step d) 51.15 Hz ±0.05 Hz				-
Step e) 50.70 Hz ±0.10 Hz				-
Step f) 50.45 Hz ±0.05 Hz				-
Step g) 50.00 Hz ±0.01 Hz				

Power output with falling frequency test: This test should be carried out in accordance with A.1.2.7.

Test sequence	Measured **Active Power** Output	Frequency	Primary power source
Test a) 50 Hz ± 0.01 Hz			
Test b) Point between 49.5 Hz and 49.6 Hz			
Test c) Point between 47.5 Hz and 47.6 Hz			

NOTE: The operating point in Test (b) and (c) shall be maintained for at least 5 minutes

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 2. Both the time delay setting and the measured delay should be provided in this form; both should be greater than 20 s to pass. Confirmation should be provided that the **Micro-generating Plant** does not reconnect at the voltage and frequency settings below; a statement of "no reconnection" can be made.

Time delay setting	Measured delay		Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 2.			
			At 266.2 V	At 180.0 V	At 47.4 Hz	At 52.1 Hz
Confirmation that the **Micro-generator** does not re-connect.						

Fault level contribution: These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (**Inverter** connected) and Annex A2 A.2.3.4 (Synchronous). Please complete each entry, even if the fault contribution is zero.

For machines with electro-magnetic output	For **Inverter** output

Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	***ip***		20 ms		
Initial Value of aperiodic current	***A***		100 ms		
Initial symmetrical short-circuit current*	***Ik***		250 ms		
Decaying (aperiodic) component of short circuit current*	***iDC***		500 ms		
Reactance/Resistance Ratio of source*	***X/R***		Time to trip		In seconds

For rotating machines and linear piston machines the test should produce a 0 s – 2 s plot of the short circuit current as seen at the **Micro-generator** terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot

Logic Interface (input port)	
Confirm that an input port is provided and can be used to reduce the **Active Power** output to zero	Yes / NA
Provide high level description of logic interface, e.g. details in 9.4.3 such as AC or **DC** signal (the additional comments box below can be used)	Yes / NA
Self-Monitoring solid state switching: No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (**Inverter** connected).	Yes / NA
It has been verified that in the event of the solid state switching device failing to disconnect the **Micro-generator**, the voltage on the output side of the switching device is reduced to a value below 50 V within 0.5 s.	
Cyber security	
Confirm that the **Manufacturer** or **Installer** of the **Micro-generator** has provided a statement describing how the **Micro-generator** has been designed to comply with cyber security requirements, as detailed in 9.7.	Yes / NA
Additional comments	

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