

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		Hybrid Inverter: Inverter vision max 1.0 (10.0 kW),	
Manufacturer name		SOLARWATT GmbH	
Address		Maria-Reiche-Straße 2a, 01109 Dresden, Germany	
Tel	+49-351-8895-100	Fax	
E-mail	peter.bachmann@solarwatt.com	Web site	www.solarwatt.de
Registered Capacity , use separate sheet if more than one connection option.	Connection Option		
	/	kW single phase system	
	10	kW three phase system	
Energy storage capacity for Electricity Storage devices	/		
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/N1.			
Signed		On behalf of	SOLARWATT GmbH

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.

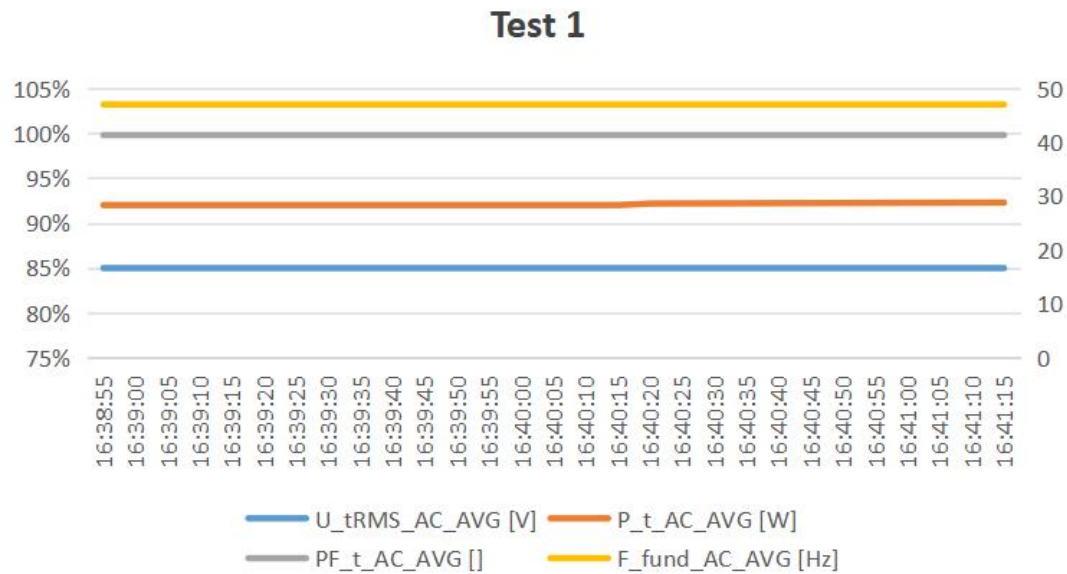
Test 1

Voltage = 85% of nominal (195.5 V)

Frequency = 47.0 Hz

Power factor = 1

Period of test 20 seconds



Test 2

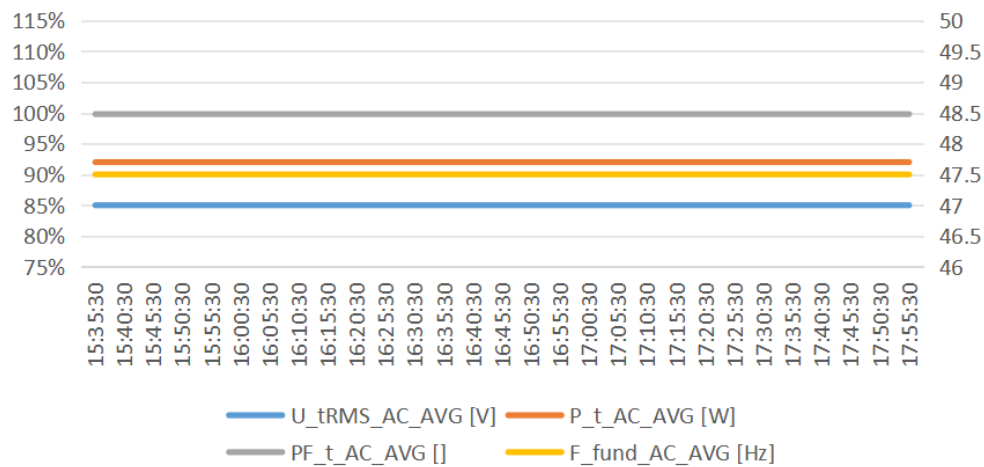
Voltage = 85% of nominal (195.5 V)

Frequency = 47.5 Hz

Power factor = 1

Period of test 90 minutes

Test 2



Test 3

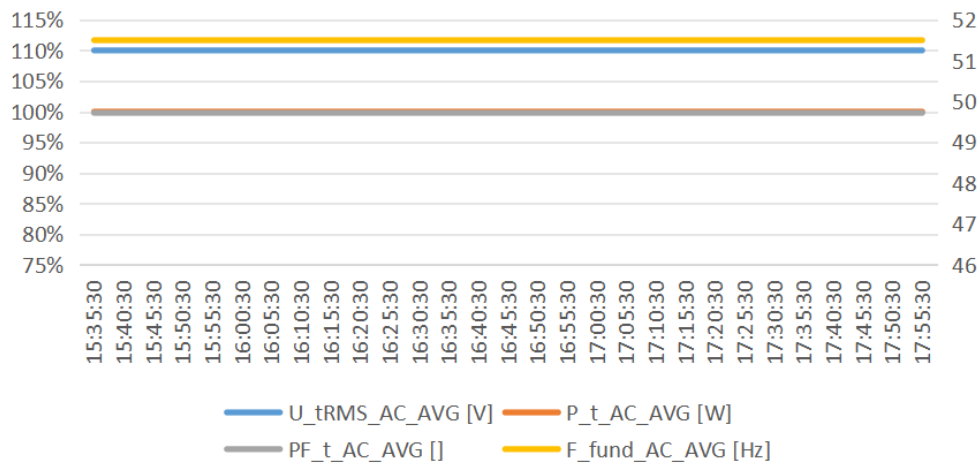
Voltage = 110% of nominal (253 V).

Frequency = 51.5 Hz

Power factor = 1

Period of test 90 minutes

Test 3



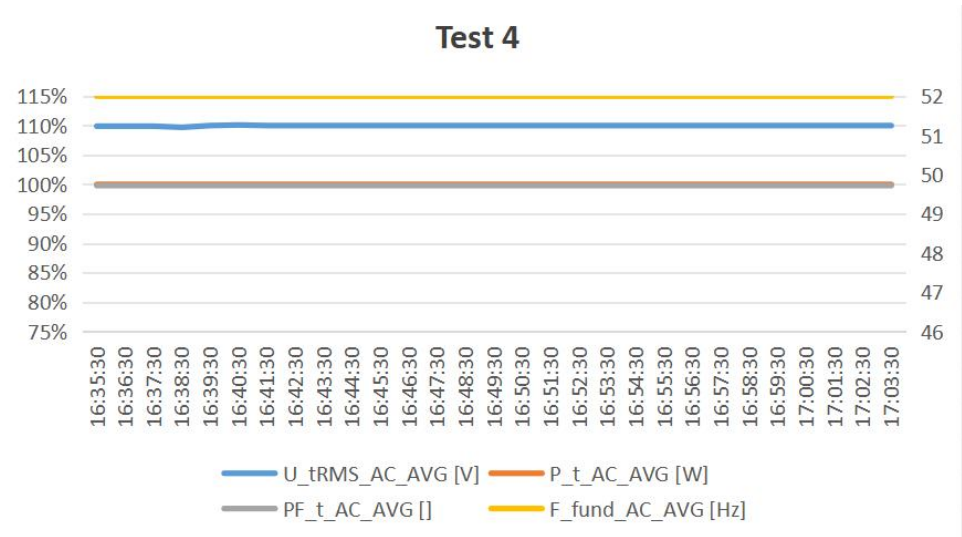
Test 4

Voltage = 110% of nominal (253 V).

Frequency = 52.0

Hz Power factor = 1

Period of test 15 minutes



Test 5

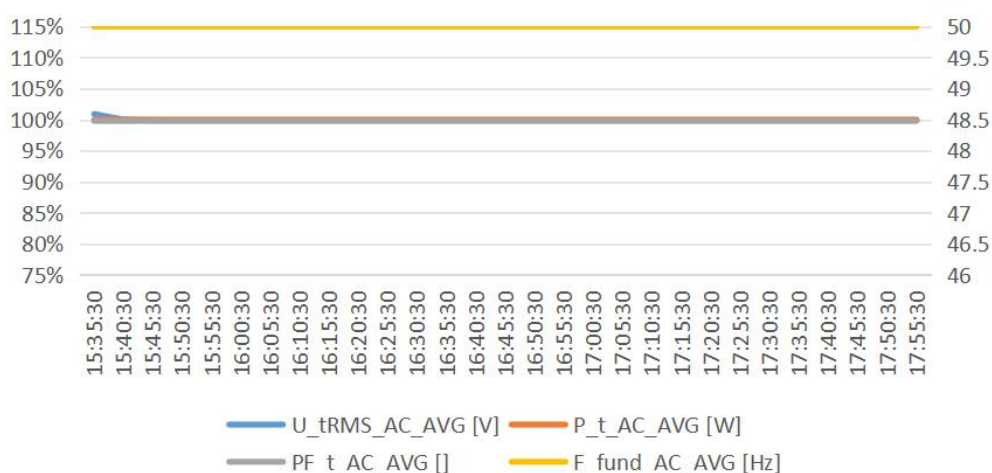
Voltage = 100% of nominal (230 V).

Frequency = 50.0

Hz Power factor = 1

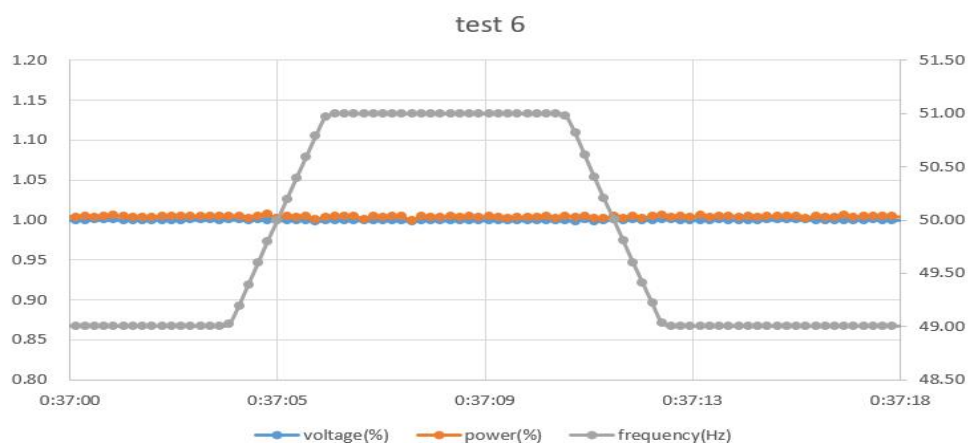
Period of test 90 minutes

Test 5



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.



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)				3.33		kW		Model: ,	
For 3-phase Micro-generators , 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.						Inverter vision max 1.0 (10.0 kW)			

Harm onic	At 45-55% of Registered Capacity						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.013	0.022	0.023	0.090	0.152	0.159	8%	8%
3	0.250	0.305	0.187	1.727	2.107	1.292	21.6%	Not stated
4	0.034	0.039	0.039	0.235	0.269	0.269	4%	4%
5	0.127	0.110	0.110	0.877	0.760	0.760	10.7%	10.7%
6	0.027	0.032	0.029	0.186	0.221	0.200	2.67%	2.67%
7	0.070	0.068	0.057	0.483	0.470	0.394	7.2%	7.2%
8	0.019	0.014	0.011	0.235	0.359	0.442	2%	2%
9	0.034	0.052	0.064	0.055	0.069	0.111	3.8%	Not stated
10	0.008	0.010	0.016	0.145	0.242	0.152	1.6%	1.6%
11	0.021	0.035	0.022	0.062	0.035	0.055	3.1%	3.1%
12	0.009	0.005	0.008	0.124	0.062	0.083	1.33%	1.33%
13	0.018	0.009	0.012	0.235	0.359	0.442	2%	2%
THD ¹				1.834%	2.144%	1.643%	23%	13%
PWH D ²				1.723%	2.034%	1.523%	23%	22%

Harm onic	At 100% of Registered Capacity						Limit in BS EN 61000-3-12	
	Measured value (MV) in Amps			Measured value (MV) in %				
	L1	L2	L3	L1	L2	L3	1 phase	3 phase
2	0.044	0.024	0.032	0.304	0.166	0.221	8%	8%
3	0.192	0.242	0.239	1.326	1.671	1.651	21.6%	Not stated

4	0.009	0.008	0.014	0.062	0.055	0.097	4%	4%
5	0.080	0.104	0.120	0.553	0.718	0.829	10.7%	10.7%
6	0.018	0.008	0.008	0.124	0.055	0.055	2.67%	2.67%
7	0.061	0.056	0.060	0.421	0.387	0.414	7.2%	7.2%
8	0.008	0.008	0.007	0.055	0.055	0.048	2%	2%
9	0.036	0.037	0.041	0.249	0.256	0.283	3.8%	Not stated
10	0.013	0.017	0.012	0.090	0.117	0.083	1.6%	1.6%
11	0.037	0.031	0.025	0.256	0.214	0.173	3.1%	3.1%
12	0.005	0.002	0.011	0.035	0.014	0.076	1.33%	1.33%
13	0.023	0.022	0.023	0.159	0.152	0.159	2%	2%
THD ³				1.439%	1.623%	1.565%	23%	13%
PWHD ⁴				1.321%	1.564%	1.453%	23%	22%

¹ THD = Total Harmonic Distortion

² PWHD = Partial Weighted Harmonic Distortion

³ THD = Total Harmonic Distortion

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	2026-06-23	Test end date	2026-06-26
Test location	Maria-Reiche-Straße 2aD 01109 Dresden, Germany		
	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	0.668	0.136	0	0.567	0.143	0	0.083	0.083
Normalised to standard impedance	0.668	0.136	0	0.567	0.143	0	0.083	0.083
Normalised to required maximum impedance	NA	NA	NA	NA	NA	NA	NA	NA
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	X	0.15	Ω		
Standard Impedance	R	0.24 *	Ω	X	0.15 *	Ω		

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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%.

Inverter vision max 1.0 (10.0 kW)

Test power level	10%	55%	100%
Recorded DC value in Amps	0.025	0.026	0.031
as % of rated AC current	0. 17%	0.18%	0.21%
Limit	0.25%	0.25%	0.25%

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	47.48 Hz	20.03s	47.7 Hz 30 s	No trip
U/F stage 2	47 Hz	0.5 s	46.90 Hz	0.53s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F stage 1	52Hz	0.5s	52.07Hz	0.527s	51.8 Hz 120.0 s	No trip
					52.2 Hz 0.45 s	No trip

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 protection 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	182.1V	2.56s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	262.2 V	1.0 s	262.0V	1.058s	258.2 V 5.0 s	No trip
O/V stage 2	273.7 V	0.5 s	273.0V	0.526s	269.7 V 0.95 s	No trip
					277.7 V 0.45 s	No trip

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 Inverters shall be tested in accordance with BS EN 62116. Other **Micro-generators** should be tested in accordance with A.2.2.4 at 10%, 55% and 100% of rated power.

For **Inverters** tested to BS EN 62116 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 0.5 s ²	0.446s	0.266s	0.298s	0.360s	0.237s	0.355s

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	No trip
Negative Vector Shift	50.0 Hz	- 50 degrees	No trip

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	No trip
51.0 Hz to 49.0 Hz	-0.95 Hzs ⁻¹	2.1 s	No trip

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(W)	Frequency (Hz)	Primary Power Source	Active Power Gradient
Step a) 50.00 Hz ± 0.01 Hz	10012	50.00		NA

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Step b) 50.45 Hz ± 0.05 Hz	9910	50.45	DC SOURCE	10.3%
Step c) 50.70 Hz ± 0.10 Hz	9424	50.70		9.7%
Step d) 51.15 Hz ± 0.05 Hz	8471	51.15		10.2%
Step e) 50.70 Hz ± 0.10 Hz	9448	50.70		9.9%
Step f) 50.45 Hz ± 0.05 Hz	9918	50.45		10.1%
Step g) 50.00 Hz ± 0.01 Hz	10010	50.00		NA
Test sequence at Registered Capacity 40% - 60%	Measured Active Power Output(W)	Frequency (Hz)	Primary Power Source	Active Power Gradient
Step a) 50.00 Hz ± 0.01 Hz	5005	50.00	DC SOURCE	NA
Step b) 50.45 Hz ± 0.05 Hz	4922	50.45		9.8%
Step c) 50.70 Hz ± 0.10 Hz	4486	50.70		10.4%
Step d) 51.15 Hz ± 0.05 Hz	3562	51.15		9.6%
Step e) 50.70 Hz ± 0.10 Hz	4507	50.70		10.2%
Step f) 50.45 Hz ± 0.05 Hz	4929	50.45		9.7%
Step g) 50.00 Hz ± 0.01 Hz	5009	50.00		NA

Limited Frequency Sensitive Mode – Underfrequency test: (Electricity Storage Power Generating Module only) The test should be carried out using the specific threshold frequency of 49.5 Hz, a ramp rate of 2.0Hzs-1 and Droop of 1.0%.

The test should be carried out in accordance with A.1.2.8

	Final power output at lower frequency (kW)		Final consumption at 50Hz (kW)	
Test 1, 100% Rated Import Capacity to 49.0 Hz	0.03		-9.98	
Test 2, 100% Rated Import Capacity to 48.8 Hz	4.11		-9.98	
Test 3, 40% Rated Import Capacity to 49.0Hz	6.09		-4.13	
Test 4, 40% Rated Import Capacity to 48.8Hz	9.98		-4.13	

Power output with falling frequency test: This test should be carried out in accordance with EN

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50438 Annex D.3.2 active power feed-in at under-frequency and under steady state conditions.			
Test sequence	Measured Active Power Output	Frequency	Primary power source
Test a) 50 Hz $\pm$ 0.01 Hz	10061.49W	50.00 Hz	11095.89W
Test b) Point between 49.5 Hz and 49.6 Hz	10089.81W	49.55 Hz	11096.10W
Test c) Point between 47.5 Hz and 47.6 Hz	10088.47W	47.55 Hz	11094.72W
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.			
60s	72s	At 257.0 V	At 191.5 V	At 47.9 Hz	At 52.1 Hz
Confirmation that the Micro-generator does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection

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	i_p		20 ms	0V	0A
Initial Value of aperiodic current	A		100 ms	0V	0 A
Initial symmetrical short-circuit current*	I_k		250 ms	0 V	0 A
Decaying (aperiodic) component of short circuit current*	i_{DC}		500 ms	0V	0 A

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Reactance/Resistance Ratio of source*	X/R		Time to trip	12ms	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
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) High level description of logic interface: By default the logic interface will take the form of a simple binary output that can be operated by a simple switch or contactor. When the switch is closed the Power Generating Module can operate normally. When the switch is opened the Power Generating Module will reduce its Active Power to zero within 5 s. The signal from the Micro generator that is being switched is DC 3.3V	Yes

Self-Monitoring solid state switching: No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (Inverter connected).	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.	NA
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
Additional comments	
High level description of logic interface : By default the logic interface will take the form of a simple binary output that can be operated by a simple switch or contactor. When the switch is closed the Power Generating Module can operate normally. When the switch is opened the Power Generating Module will reduce its Active Power to zero within 5 s. The signal from the Micro generator that is being switched is DC 3.3V	