CERTIFICATE OF CONFORMITY

Issued to:	NINGBO AUSTA SOLAR TECH CO.,LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
For the product:	Hybrid Inverter
Trade name:	AUSTA&OSDA
Type/Model:	AU3KESL-G3, AU3.6KESL-G3
Ratings:	See Annex
Manufactured by:	NINGBO AUSTA SOLAR TECH CO.,LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Factory:	AUSTA(JIAXING) SOLAR TECH CO.,LTD. No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China
Requirements:	Engineering Recommendation G98 Issue 2: 2025 (G98/2)

Type of product certification scheme: Type 1a (Type approval)

This Test Certificate is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6252419.50V1.1.

The examination has been carried out on one single specimen of the product. The certificate does not include an assessment of the manufacturer's production. Conformity of his production with the specimen tested by DEKRA is not the responsibility of DEKRA.

This Test Certificate expires at the latest on 24 June 2031 or expires upon withdrawal of one of the above mentioned standards.

Shanghai, 24 June 2026 Certificate Number: 6252419.01COC V1.2

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

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PCA-141

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Ratings of the test product:

Model	AU3KESL-G3	AU3.6KESL-G3
PV input:		
Max input voltage (Vdc)	500	
MPPT voltage range (Vdc)	150 – 425	
Start-up voltage (Vdc)	125	
Max input current (A)	18	18 / 18
Max short-circuits current (A)	23	23 / 23
No. of MPPT trace paths	1	2
Strings Per MPPT Tracker	1	1/1
AC input (from grid):		
Rated voltage (Vac)	L / N / PE, 220/230/240	
Max. current (A)	26.1	31.3
Max. power (VA)	6000	7200
Rated frequency (Hz)	50 / 60	
AC output (to grid):		
Rated power (W)	3000	3600
Max. apparent power (VA)	3300	3600
Rated current (A)	13	16
Rated voltage (Vac)	L / N / PE, 220/230/240	
Rated frequency (Hz)	50 / 60	
Power factor	0.8 leading …0.8 lagging	
EPS output:		
Rated power (W)	3000	3600
Max. current (A)	13	15,7
Rated voltage (Vac)	L / N / PE, 230	
Rated frequency (Hz)	50 / 60	
Battery:		
Battery type	Lead-acid or Li-ion	
Voltage range (Vdc)	40 - 60	
Max. charge / discharge current (A)	75	90
Topology	Transformerless	
Protective class	Class I	
Ingress protection (IP) rating	IP66	
Operating temperature	-40 to 60°C (>45°C derating)	
Altitude (m)	3000	
Dimension (W x H x D)	384 x 450 x 226 mm	
Weight	18 kg	
Software version:	DSP: Ver 1.0.0 ARM: Ver 1.0.0	

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G98/2 Form C: Type Test Verification Report	
Extract form test report number:	**6252419.50**

1. Operating Range:				**P**
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.				
Model: AU3.6KESL-G3				
Test 1:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
196.0	47.0	3087.8	0.999	30
Test 2:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
195.5	47.5	3085.1	0.999	5500
Test 3:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
253.4	51.5	3585.4	0.999	5500
Test 4:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
253.1	52.0	3591.8	0.999	900
Test 5:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
230.5	50.0	3590.6	0.999	5500
Test 6:				
Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.5	47.0 Hz to 52.0 Hz	+1 Hzs^{-1}	5.1s	no trip
253.0	52.0 Hz to 49.0 Hz	-1 Hzs^{-1}	3.2s	no trip

2. Power Quality – Harmonics:						**P**
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).						
Model: AU3.6KESL-G3						
Micro-generator tested to BS EN 61000-3-2						
Micro-generator rating per phase (rpp)			3.6		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.			Single phase			
Harmonic	At 45-55% of **Registered Capacity**		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	0.023	--	0.019	--	1.080	
3	0.098	--	0.170	--	2.300	
4	0.010	--	0.008	--	0.430	
5	0.101	--	0.092	--	1.140	
6	0.005	--	0.005	--	0.300	
7	0.098	--	0.084	--	0.770	
8	0.004	--	0.004	--	0.230	
9	0.087	--	0.082	--	0.400	
10	0.003	--	0.003	--	0.184	
11	0.065	--	0.073	--	0.330	
12	0.003	--	0.003	--	0.153	
13	0.045	--	0.058	--	0.210	
14	0.004	--	0.003	--	0.131	
15	0.028	--	0.043	--	0.150	
16	0.003	--	0.003	--	0.115	
17	0.022	--	0.028	--	0.132	
18	0.002	--	0.002	--	0.102	
19	0.019	--	0.019	--	0.118	
20	0.001	--	0.002	--	0.092	
21	0.016	--	0.016	--	0.107	0.160
22	0.001	--	0.001	--	0.084	

23	0.014	--	0.014	--	0.098	0.147
24	0.001	--	0.001	--	0.077	
25	0.012	--	0.014	--	0.090	0.135
26	0.001	--	0.001	--	0.071	
27	0.010	--	0.013	--	0.083	0.124
28	0.001	--	0.001	--	0.066	
29	0.009	--	0.013	--	0.078	0.117
30	0.001	--	0.001	--	0.061	
31	0.008	--	0.012	--	0.073	0.109
32	0.001	--	0.001	--	0.058	
33	0.007	--	0.011	--	0.068	0.102
34	0.001	--	0.001	--	0.054	
35	0.007	--	0.010	--	0.064	0.096
36	0.001	--	0.001	--	0.051	
37	0.007	--	0.008	--	0.061	0.091
38	0.001	--	0.001	--	0.048	
39	0.007	--	0.007	--	0.058	0.087
40	0.001	--	0.001	--	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.

Model: AU3KESL-G3						
Micro-generator tested to BS EN 61000-3-2						
Micro-generator rating per phase (rpp)				3	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.				Single phase		
Harmonic	At 45-55% of **Registered Capacity**		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	0.020	--	0.022	--	1.080	
3	0.107	--	0.135	--	2.300	
4	0.008	--	0.009	--	0.430	
5	0.110	--	0.090	--	1.140	
6	0.006	--	0.005	--	0.300	
7	0.102	--	0.088	--	0.770	

8	0.005	--	0.004	--	0.230	
9	0.082	--	0.086	--	0.400	
10	0.004	--	0.004	--	0.184	
11	0.056	--	0.075	--	0.330	
12	0.003	--	0.003	--	0.153	
13	0.034	--	0.058	--	0.210	
14	0.002	--	0.003	--	0.131	
15	0.021	--	0.041	--	0.150	
16	0.002	--	0.002	--	0.115	
17	0.017	--	0.028	--	0.132	
18	0.002	--	0.002	--	0.102	
19	0.014	--	0.020	--	0.118	
20	0.001	--	0.002	--	0.092	
21	0.013	--	0.018	--	0.107	0.160
22	0.001	--	0.001	--	0.084	
23	0.014	--	0.016	--	0.098	0.147
24	0.001	--	0.001	--	0.077	
25	0.014	--	0.016	--	0.090	0.135
26	0.001	--	0.001	--	0.071	
27	0.013	--	0.015	--	0.083	0.124
28	0.001	--	0.001	--	0.066	
29	0.012	--	0.014	--	0.078	0.117
30	0.001	--	0.001	--	0.061	
31	0.011	--	0.012	--	0.073	0.109
32	0.001	--	0.001	--	0.058	
33	0.010	--	0.010	--	0.068	0.102
34	0.001	--	0.001	--	0.054	
35	0.008	--	0.009	--	0.064	0.096
36	0.001	--	0.001	--	0.051	
37	0.008	--	0.008	--	0.061	0.091
38	0.001	--	0.001	--	0.048	
39	0.007	--	0.006	--	0.058	0.087
40	0.001	--	0.001	--	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.

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

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	2025-11-15	Test end date	2025-11-18
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		
Model:	AU3.6KESL-G3		

Single Phase

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	1.609%	1.574%	0	1.831%	1.784%	0	0.114	0.110
Normalised to standard impedance	1.609%	1.574%	0	1.831%	1.784%	0	0.114	0.110
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	0.4	Ω	XI	0.25	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 **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.

Annex

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Test start date	2025-11-15	Test end date	2025-11-18
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		
Model:	AU3KESL-G3		

Single Phase

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.961%	0.914%	0	1.389%	1.364%	0	0.115	0.112
Normalised to standard impedance	0.961%	0.914%	0	1.389%	1.364%	0	0.115	0.112
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	0.4	Ω	Xl	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A #	Ω	Xl	N/A #	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.

4. Power quality – DC injection:				**P**
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%.				
Model: AU3.6KESL-G3				
Single Phase				
Test power level	10%	55%	100%	
Recorded DC injection value in Amps	0.009	0.008	0.012	
as % of rated AC current	0.06%	0.05%	0.07%	
Limit	0.25%	0.25%	0.25%	
Model: AU3KESL-G3				
Single Phase				
Test power level	10%	55%	100%	
Recorded DC injection value in Amps	0.010	0.018	0.030	
as % of rated AC current	0.07%	0.13%	0.23%	
Limit	0.25%	0.25%	0.25%	

5. Power Factor:				**P**
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.				
Model: AU3.6KESL-G3				
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)	
Measured value	0.999	0.999	0.999	
Power Factor Limit	>0.95	>0.95	>0.95	
Model: AU3KESL-G3				
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)	
Measured value	0.999	0.999	0.999	
Power Factor Limit	>0.95	>0.95	>0.95	

6. Protection – Frequency tests:						**P**
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.						
Model: AU3.6KESL-G3						
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	47.49 Hz	20.09 s	47.7 Hz 30 s	No trip
U/F stage 2	47.0 Hz	0.5 s	47.00 Hz	0.590 s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0 Hz	0.5 s	52.02 Hz	0.585 s	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 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.						

7. Protection – Voltage tests:						**P**
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.						
Model: AU3.6KESL-G3						
Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	0.8 pu (184 V)	2.5 s	184.0 V	2.59 s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0 s	261.7 V	1.09 s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	273.2 V	0.545 s	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.						

8. Protection – Loss of Mains test:	**P**

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.

For test condition A, EUT output = 100 % P_n, test condition B, EUT output = 50 % to 66 % P_n, and test condition C, EUT output = 25 % to 33 % P_n.

Model: AU3.6KESL-G3

For **Inverter**s 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 0.5s**	171 ms	161 ms	222 ms	161 ms	155 ms	220 ms

No.	P_{EUT} a) (% of EUT rating)	Reactive load (% of Q_L)	P_{AC} b) (% of nominal)	Q_{AC} c) (% of nominal)	Run-on time (ms)	P_{EUT} (kW)	Actual Q_f	V_{DC} d)	Remarks e)
1	100	100	0	0	233	3.62	1.00	356	Test A at BL
2	66	66	0	0	206	2.25	1.00	287	Test B at BL
3	33	33	0	0	209	1.06	1.00	200	Test C at BL
4	100	100	-5	-5	215	3.61	0.97	356	Test A at IB
5	100	100	-5	0	222	3.60	1.00	356	Test A at IB
6	100	100	-5	+5	228	3.65	1.02	356	Test A at IB
7	100	100	0	-5	232	3.61	0.98	356	Test A at IB
8	100	100	0	+5	228	3.60	1.01	356	Test A at IB
9	100	100	+5	-5	225	3.65	1.02	356	Test A at IB
10	100	100	+5	0	220	3.65	0.97	356	Test A at IB
11	100	100	+5	+5	217	3.60	1.00	356	Test A at IB
12	66	66	0	-5	161	2.28	0.97	287	Test B at IB
13	66	66	0	-4	173	2.25	0.98	287	Test B at IB
14	66	66	0	-3	176	2.20	0.99	287	Test B at IB
15	66	66	0	-2	187	2.23	0.99	287	Test B at IB
16	66	66	0	-1	200	2.25	1.00	287	Test B at IB
17	66	66	0	+1	196	2.26	1.00	287	Test B at IB
18	66	66	0	+2	179	2.20	1.01	287	Test B at IB
19	66	66	0	+3	174	2.25	1.01	287	Test B at IB
20	66	66	0	+4	166	2.26	1.02	287	Test B at IB
21	66	66	0	+5	155	2.20	1.02	287	Test B at IB
22	33	33	0	-5	171	1.00	0.97	200	Test C at IB
23	33	33	0	-4	189	1.05	0.98	200	Test C at IB
24	33	33	0	-3	197	1.03	0.98	200	Test C at IB
25	33	33	0	-2	201	1.06	0.99	200	Test C at IB

26	33	33	0	-1	207	1.02	1.00	200	Test C at IB
27	33	33	0	+1	207	1.05	1.00	200	Test C at IB
28	33	33	0	+2	199	1.00	1.01	200	Test C at IB
29	33	33	0	+3	190	1.06	1.01	200	Test C at IB
30	33	33	0	+4	182	1.07	1.02	200	Test C at IB
31	33	33	0	+5	161	1.05	1.02	200	Test C at IB

Note:

a) P_{EUT}: EUT output power.

b) P_{ac}: Active power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

c) Q_{ac}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

d) For test condition A, > 75 % of rated input voltage range used, for test condition B, 50 % of rated input voltage range, ±10 % used, for test condition C, < 20 % of rated input voltage range used. Based on EUT rated input operating range. For example, if range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

e) BL: Balance condition, IB: Imbalance condition.

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.

8.Protection – Frequency change, Vector Shift Stability test:			**P**
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.			
Model: AU3.6KESL-G3			
	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

8.Protection – Frequency change, RoCoF Stability test:			**P**
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.			
Model: AU3.6KESL-G3			
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

9. Limited Frequency Sensitive Mode – Over frequency test:					**P**
This test should be carried out in accordance with A.1.2.9. 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.1.2.9.					
Model: AU3.6KESL-G3					
Alternatively, simulation results should be noted below:					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	3610.01	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	3573.58	50.45	9.88%		-
Step c) 50.70 Hz ±0.10 Hz	3428.48	50.70	11.90%		-
Step d) 51.15 Hz ±0.05 Hz	2999.71	51.15	8.85%		-
Step e) 50.70 Hz ±0.10 Hz	3412.98	50.70	10.96%		-
Step f) 50.45 Hz ±0.05 Hz	3571.21	50.45	9.28%		-
Step g) 50.00 Hz ±0.01 Hz	3610.18	50.00	-		-
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	1804.8	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	1762.1	50.45	8.59%		-
Step c) 50.70 Hz ±0.10 Hz	1569.2	50.70	9.20%		-

Step d) 51.15 Hz ±0.05 Hz	1264.9	51.15	10.02%		-
Step e) 50.70 Hz ±0.10 Hz	1558.1	50.70	8.78%		-
Step f) 50.45 Hz ±0.05 Hz	1744.1	50.45	9.02%		-
Step g) 50.00 Hz ±0.01 Hz	1840.4	50.00	-		-

The frequency at each step should be maintained for at least one minute and the Active Power reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.3. The Droop should be determined from the measurements between 50.4 Hz and 51.15 Hz. The allowed tolerance for the frequency measurement shall be ± 0.05 Hz. The allowed tolerance for Active Power output measurement shall be ±10% of the required change in Active Power.

The resulting overall tolerance range for a nominal 10% Droop is +2.8% and – 1.5%, ie a Droop less than 12.8% and greater than 8.5%.

10. Power output with falling frequency test (For PV Inverter): **P**

This test should be carried out in accordance with A.1.2.7.

Model: AU3.6KESL-G3

Test sequence	Measured **Active Power** Output (W)	Frequency (Hz)	Primary power source
Test a) 50 Hz ± 0.01 Hz	3595.15	50.00	Photovoltaic array simulator
Test b) Point between 49.5 Hz and 49.6 Hz	3596.14	49.59	Photovoltaic array simulator
Test c) Point between 47.5 Hz and 47.6 Hz	3543.71	47.59	Photovoltaic array simulator

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

The test is regarded as passed if:
• the Micro-generator does not disconnect from the network at the operating points a) to c) when the network frequency is changed and
• the Micro-generator does not reduce output energy at point b) and
• the power reduction at point c) is less than or equal to the allowed power reduction according to paragraph 9.4.2 (Figure 3).

The following data shall be documented:
• variation of the network frequency with time;
• the measured Active Power with time.

11. Power output with falling frequency test (For Electricity Storage Device)

This test should be carried out in accordance with clause 9.4.3 and A.1.2.8.

Model: AU3.6KESL-G3

Test 1: 50 Hz to 49.0 Hz, from **100%** $P_{rated\text{-}import}$

Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3610	50.0	-	AC grid / Storage Battery
49.5	-3699	49.5	-	AC grid / Storage Battery
49.2	-1520	49.2	1.03%	AC grid / Storage Battery

49.0	-32.1	49.0	1.01%	AC grid / Storage Battery
Test 2: 50 Hz to 48.8 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3601	50.0	-	AC grid / Storage Battery
49.5	-3776	49.5	1.03%	AC grid / Storage Battery
49.2	-1510	49.2	0.99%	AC grid / Storage Battery
49.0	32.40	49.0	0.99%	AC grid / Storage Battery
48.9	764	48.9	0.99%	AC grid / Storage Battery
48.8	1510	48.8	-	AC grid / Storage Battery
Test 3: 50 Hz to 49.0 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-1450	50.0	-	AC grid / Storage Battery
49.5	-1480	49.5	-	AC grid / Storage Battery
49.2	672	49.2	1.02%	AC grid / Storage Battery
49.0	2190	49.0	0.99%	AC grid / Storage Battery
Test 4: 50 Hz to 48.8 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-1440	50.0	-	AC grid / Storage Battery
49.5	-1530	49.5	-	AC grid / Storage Battery
49.2	583	49.2	1.07%	AC grid / Storage Battery
49.0	2100	49.0	1.02%	AC grid / Storage Battery
48.9	2890	48.9	1.00%	AC grid / Storage Battery
48.8	3540	48.8	1.01%	AC grid / Storage Battery

12. Power output with increasing frequency test (For Electricity Storage Device)				
This test should be carried out in accordance with clause 9.4.4 and A.7.1.7				
Model: AU3.6KESL-G3				
Test 1: 48.5 Hz to 50.0 Hz, from **75%** $P_{rated\text{-}export}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	2650	48.5	-	AC grid / Storage Battery
49.2	2650	49.2	-	AC grid / Storage Battery
49.5	2650	49.5	-	AC grid / Storage Battery
49.8	251	49.8	0.90%	AC grid / Storage Battery
50.0	-1250	50.0	0.92%	AC grid / Storage Battery
Test 2: 48.5 Hz to 50.0 Hz, from 50% Prated-export				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	1730	48.5	-	AC grid / Storage Battery
49.2	1730	49.2	-	AC grid / Storage Battery
49.5	1730	49.5	-	AC grid / Storage Battery
49.8	-632	49.8	0.91%	AC grid / Storage Battery
50.0	-2200	50.0	0.92%	AC grid / Storage Battery
Test 3: 48.5 Hz to 50.0 Hz, from **25%** $P_{rated\text{-}export}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	951	48.5	-	AC grid / Storage Battery
49.2	950	49.2	-	AC grid / Storage Battery
49.5	950	49.5	-	AC grid / Storage Battery
49.8	-1410	49.8	0.91%	AC grid / Storage Battery
50.0	-2990	50.0	0.91%	AC grid / Storage Battery
Test 4: 48.5 Hz to 50.0 Hz, from **33%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	-1220	48.5	-	AC grid / Storage Battery
49.2	-1240	49.2	-	AC grid / Storage Battery
49.5	-1230	49.5	-	AC grid / Storage Battery

49.8	-3210	49.8	1.09%	AC grid / Storage Battery
50.0	-3820	50.0	1.38%	AC grid / Storage Battery

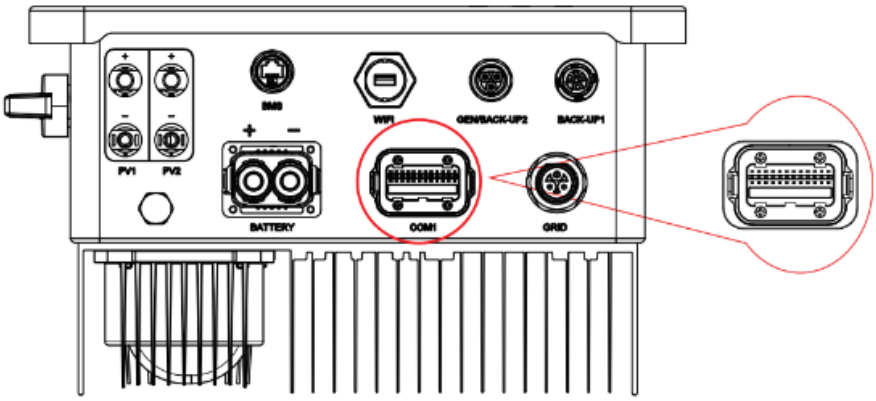
13. Re-connection timer					**P**
Model: AU3.6KESL-G3					
Test should prove that the reconnection sequence starts after a minimum delay of 20 s for restoration of voltage and frequency to within the stage 1 settings of Table 2. Both the time delay setting and the measured delay should be provided in 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 10.1.			
30 s	45.6 s	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 **Micro-generator** does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
Measured reconnection time		43.92 s	43.92 s	43.38 s	43.35 s

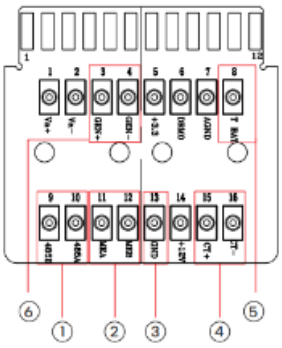
14. Fault level contribution:					**P**
These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (**Inverter** connected) and Annex A2 A.2.3.4 (Synchronous). Please complete each entry, even if the fault contribution is zero.					
Model: AU3.6KESL-G3					
For machines with electro-magnetic output			For **Inverter** output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	N/A	20ms	104	28.27
Initial Value of aperiodic current	A	N/A	100ms	67	28.27
Initial symmetrical short-circuit current*	I_k	N/A	250ms	67	0.08
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	68	0.05
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0.19	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.					

15. 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)A	Yes
16. Self-Monitoring solid state switching: No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (**Inverter** connected).	
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.	N/A
17. 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, Manufacturer's declaration provided.
Additional comments.	

An external emergency stop switch is required.The pins 6 and 7 need to be connected to the normally open contacts of the emergency switch. When the switch is turned on,the power generation module will reduce its active power to zero immediately .

2.Communication line end connector





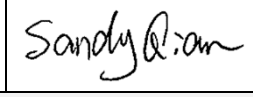
Pin	1	2	3&5	4	6
Function	BMS 485	METER 485	External NTC of Battery	GRID CT	GEN+/-

-End-

Test Report issued under the responsibility of:

TEST REPORT
Engineering Recommendation G98/2
Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019

Report	
Report Number. .....:	6252419.50V1.1
Date of issue.....:	2026-06-17
Total number of pages.....:	62 pages
Testing Laboratory .....:	DEKRA Testing and Certification (Shanghai) Ltd.
Address.....:	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China
Applicant's name .....:	NINGBO AUSTA SOLAR TECH CO.,LTD.
Address.....:	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Test specification:	
Standard .....:	Engineering Recommendation G98 Issue 2: 2025
Test procedure.....:	Type test
Non-standard test method……..:	N/A
Test Report Form No. .....:	G98/2_V1.0
Test Report Form(s) Originator .....:	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF.....:	Dated 2025-10
Test item description .....:	Hybrid Inverter
Trade Mark .....:	AUSTA&OSDA
Manufacturer.....:	Same as applicant
Model/Type reference.....:	AU3KESL-G3, AU3.6KESL-G3
Ratings.....:	See ratings of products on page 8

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**	DEKRA Testing and Certification (Shanghai) Ltd.	
Testing location/ address ..... :		No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China	
Tested by (name, function, signature)..... :		Yuan Chen (ENG)	
Approved by (name, function, signature) .. :		Sandy Qian (REW)	
☐	~~**Testing procedure: CTF Stage 1:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name, function, signature)..... :**~~			
~~**Approved by (name, function, signature) .. :**~~			
☐	~~**Testing procedure: CTF Stage 2:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name + signature)..... :**~~			
~~**Witnessed by (name, function, signature) . :**~~			
~~**Approved by (name, function, signature) .. :**~~			
☐	~~**Testing procedure: CTF Stage 3:**~~		
☐	~~**Testing procedure: CTF Stage 4:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name, function, signature)..... :**~~			
~~**Witnessed by (name, function, signature) . :**~~			
~~**Approved by (name, function, signature) .. :**~~			
~~**Supervised by (name, function, signature) :**~~			

List of Attachments (including a total number of pages in each attachment):

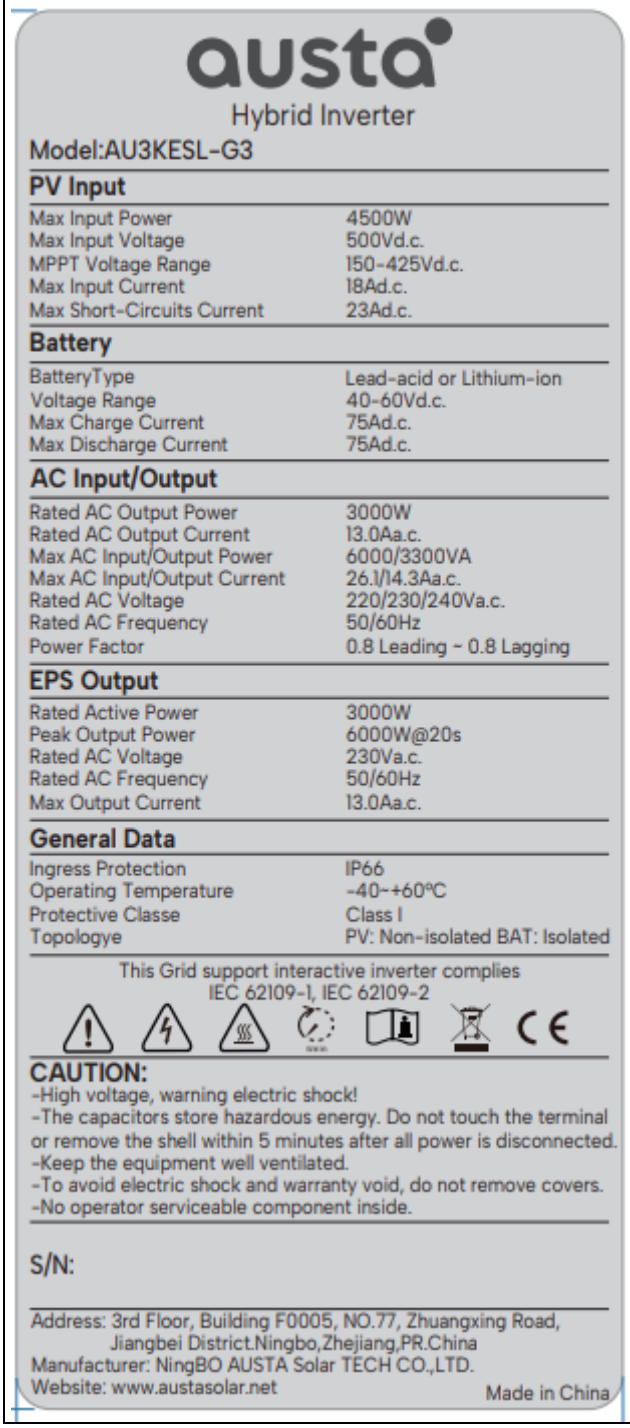
Appendix 1: Type Verification Test Report (38 pages)

Appendix 2: Photo Documentation (4 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All applicable clauses test according to standards: Engineering Recommendation G98 Issue 2: 2025	DEKRA Testing and Certification (Shanghai) Ltd. No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China

Copy of marking plate:
The artwork below may be only a draft.



austa
Hybrid Inverter
Model:AU3KESL-G3

PV Input

Max Input Power	4500W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18Ad.c.
Max Short-Circuits Current	23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	75Ad.c.
Max Discharge Current	75Ad.c.

AC Input/Output

Rated AC Output Power	3000W
Rated AC Output Current	13.0Aa.c.
Max AC Input/Output Power	6000/3300VA
Max AC Input/Output Current	26.1/14.3Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	3000W
Peak Output Power	6000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	13.0Aa.c.

General Data

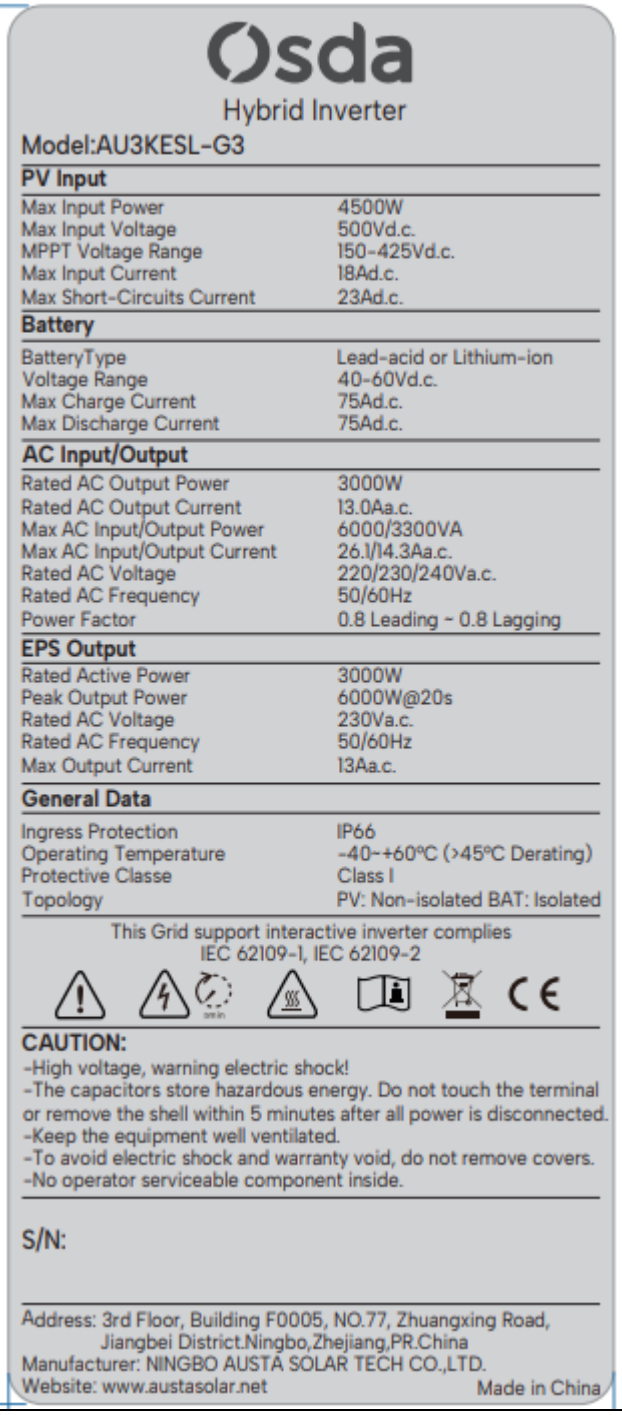
Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2

CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.

S/N:

Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net
Made in China



Osda
Hybrid Inverter
Model:AU3KESL-G3

PV Input

Max Input Power	4500W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18Ad.c.
Max Short-Circuits Current	23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
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Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	3000W
Peak Output Power	6000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	13Aa.c.

General Data

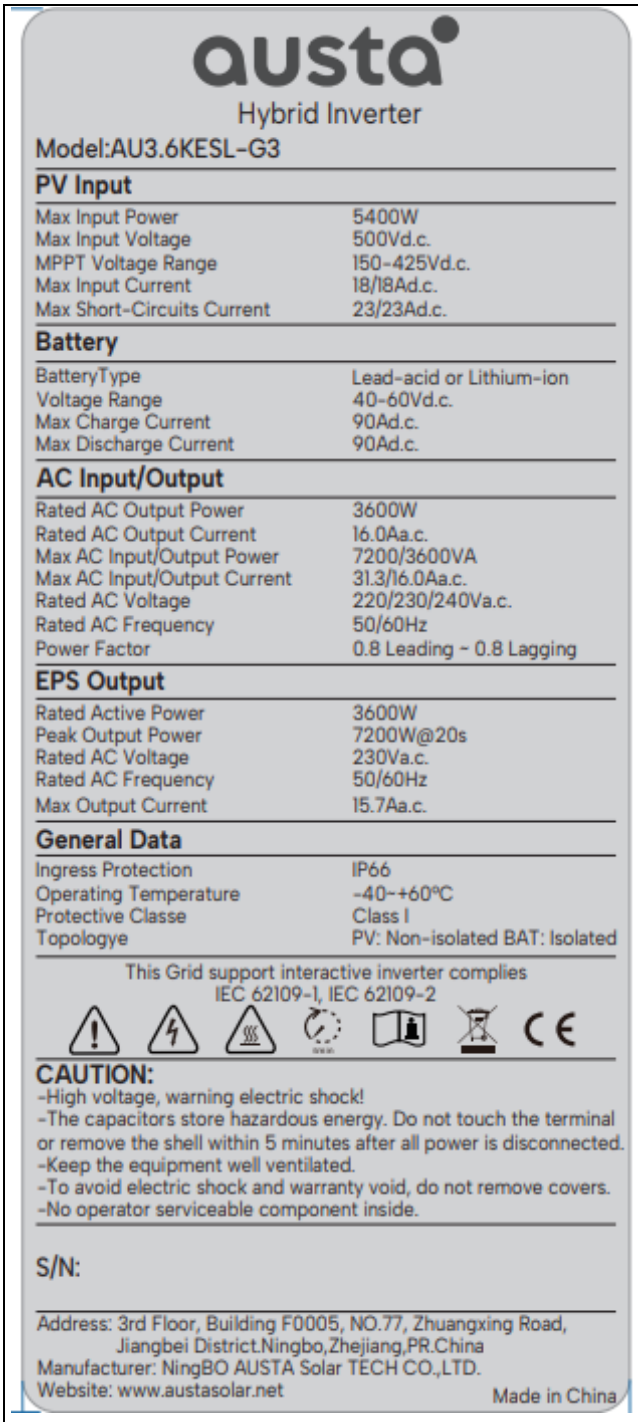
Ingress Protection	IP66
Operating Temperature	-40~+60℃ (>45℃ Derating)
Protective Classe	Class I
Topology	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2

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Manufacturer: NINGBO AUSTA SOLAR TECH CO.,LTD.
Website: www.austasolar.net
Made in China



austa

Hybrid Inverter

Model:AU3.6KESL-G3

PV Input

Max Input Power	5400W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	90Ad.c.
Max Discharge Current	90Ad.c.

AC Input/Output

Rated AC Output Power	3600W
Rated AC Output Current	16.0Aa.c.
Max AC Input/Output Power	7200/3600VA
Max AC Input/Output Current	31.3/16.0Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	3600W
Peak Output Power	7200W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	15.7Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

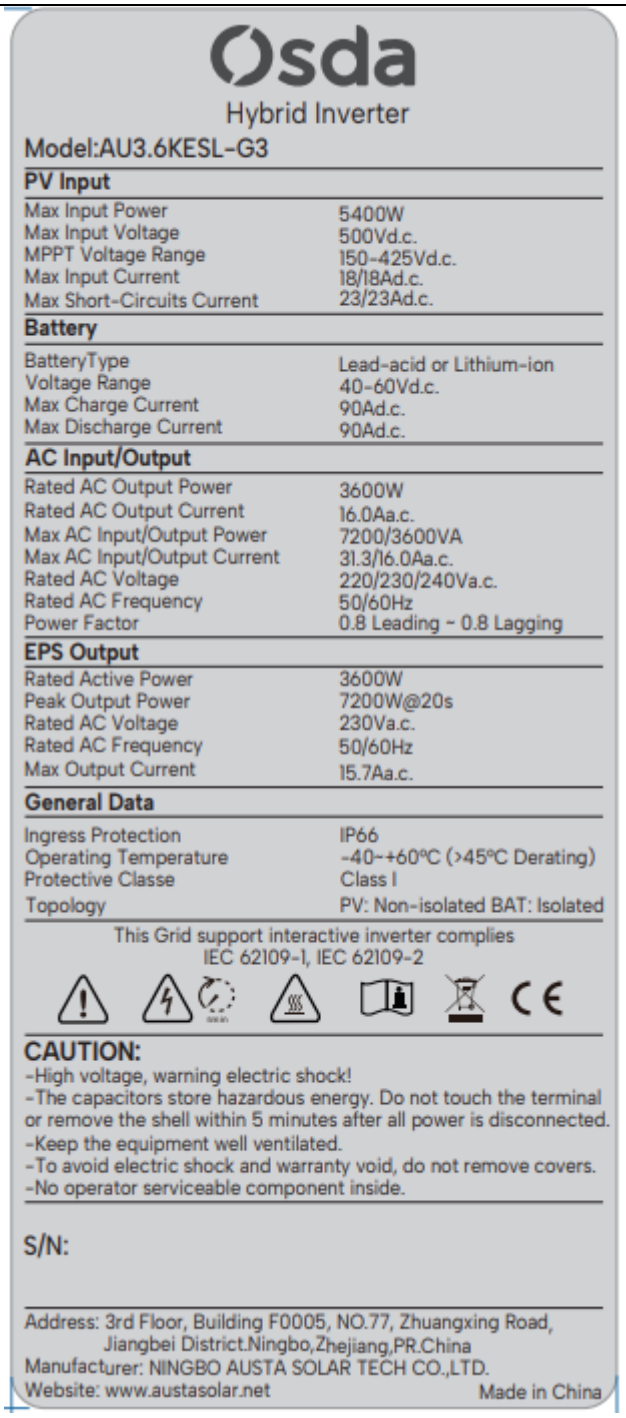
This Grid support interactive inverter complies IEC 62109-1, IEC 62109-2

CAUTION:

-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.

S/N:

Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net
Made in China



Osda

Hybrid Inverter

Model:AU3.6KESL-G3

PV Input

Max Input Power	5400W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	90Ad.c.
Max Discharge Current	90Ad.c.

AC Input/Output

Rated AC Output Power	3600W
Rated AC Output Current	16.0Aa.c.
Max AC Input/Output Power	7200/3600VA
Max AC Input/Output Current	31.3/16.0Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	3600W
Peak Output Power	7200W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	15.7Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃ (>45℃ Derating)
Protective Classe	Class I
Topology	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies IEC 62109-1, IEC 62109-2

CAUTION:

-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.

S/N:

Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NINGBO AUSTA SOLAR TECH CO.,LTD.
Website: www.austasolar.net
Made in China

Remark:

As Great Britain public Low Voltage Distribution Networks grid code G98 required, only 230 Vac / 50Hz output setting was verified in this test report. And this report only for the generator which is no greater than 16 A per phase.

Test item particulars:

Equipment mobility	movable / hand-held / stationary / <u>fixed</u> / transportable / for building-in
Connection to the mains	pluggable equipment / direct plug-in / <u>permanent connection</u> / for building-in
Environmental category	<u>outdoor</u> / indoor unconditional / indoor conditional
Over voltage category Mains	OVC I / OVC II / <u>OVC III</u> / OVC IV
Over voltage category PV	OVC I / <u>OVC II</u> / OVC III / OVC IV
Mains supply tolerance (%)	±10%
Tested for power systems	TN
IT testing, phase-phase voltage (V)	N/A
Class of equipment	<u>Class I</u> / Class II / Class III / Not classified
Mass of equipment (kg)	See model list
Pollution degree	Outside PD3; Inside PD2
IP protection class	IP66

Possible test case verdicts:

- test case does not apply to the test object	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
- test object does not evaluate according to manufacturer requirements	N/E
- this clause is information reference for installation	Info.

Testing:

Date of receipt of test item	2025-10-22 (samples provided by applicant)
Date (s) of performance of tests	2025-11-01 to 2025-11-20

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.
This report is not used for social proof function in China market.
"(see Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Use of uncertainty ofmeasurement for decisions on conformity (decision rule):

No decision rule is specified by this standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method"

Name and address of factory (ies):

AUSTA(JIAXING) SOLAR TECH CO.,LTD.

No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China

General product information:

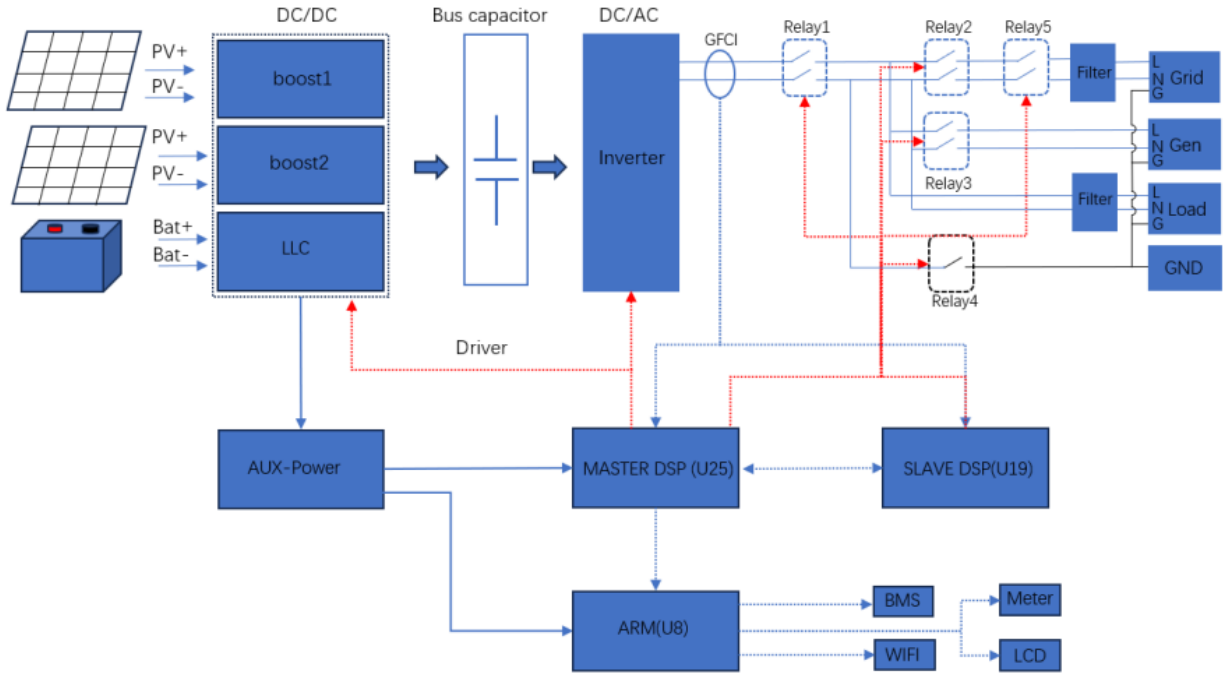
This product is a single-phase Hybrid inverter, which converts the DC voltage of solar panels into three - phase AC voltage and connects to the low-voltage grid to achieve power generation function. It can also control and dispatch power between grid, battery and back up. Inverter can dispatch AC power from grid to back up side, and also rectify AC power into DC power to charge the battery. The power flow between inverter and battery is bi-directional DC power. The specific dispatch mode and power flow direction is controlled by end user via inverter screen settings or APP settings

There is an auxiliary power supply inside the product. The product can generate full power up to ambient temperature 45°C. When the temperature exceeds 45°C, the output power derates linearly until maximum ambient temperature 60°C.

The relay4 between phase N and GND shall be in the open position in final use.

The product does not provide galvanic separation between the PV input and AC output circuit (Non-isolation or transformerless type).

Block Diagram



Model difference:

AU3KESL-G3 and AU3.6KESL-G3 are family design products. All models are identical in hardware as well as software except for electrical rating.

The product was tested on:

Unless otherwise specified, all the tests were performed on model AU3.6KESL-G3 and also applicable for all other models stated in this report.

Hardware version:

Control	Input / Output	Power	LLC	ARM	LCD
31700000805	31700000806	31700000804	31700000803	31700000801	31700000802

Software version: DSP: Ver 1.0.0 ARM: Ver 1.0.0

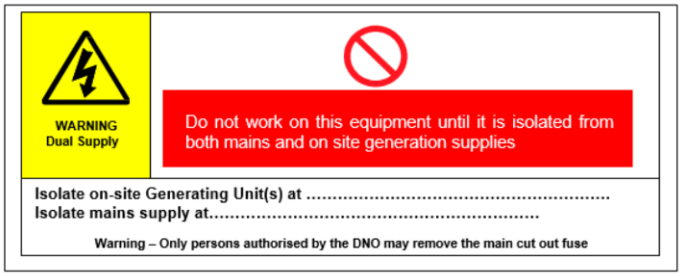
Ratings of products:

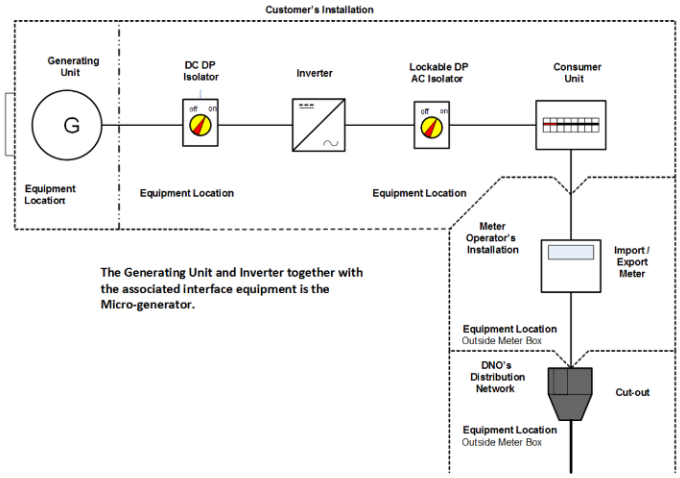
Model	AU3KESL-G3	AU3.6KESL-G3
PV input:		
Max input voltage (Vdc)	500	
MPPT voltage range (Vdc)	150 – 425	
Start-up voltage (Vdc)	125	
Max input current (A)	18	18 / 18
Max short-circuits current (A)	23	23 / 23
No. of MPPT trace paths	1	2
Strings Per MPPT Tracker	1	1/1
AC input (from grid):		
Rated voltage (Vac)	L / N / PE, 220/230/240	
Max. current (A)	26.1	31.3
Max. power (VA)	6000	7200
Rated frequency (Hz)	50 / 60	
AC output (to grid):		
Rated power (W)	3000	3600
Max. apparent power (VA)	3300	3600
Rated current (A)	13	16
Rated voltage (Vac)	L / N / PE, 220/230/240	
Rated frequency (Hz)	50 / 60	
Power factor	0.8 leading …0.8 lagging	
EPS output:		
Rated power (W)	3000	3600
Max. current (A)	13	15,7
Rated voltage (Vac)	L / N / PE, 230	
Rated frequency (Hz)	50 / 60	
Battery:		
Battery type	Lead-acid or Li-ion	
Voltage range (Vdc)	40 - 60	
Max. charge / discharge current (A)	75	90
Topology	Transformerless	
Protective class	Class I	
Ingress protection (IP) rating	IP66	
Operating temperature	-40 to 60°C (>45°C derating)	
Altitude (m)	3000	
Dimension (W x H x D)	384 x 450 x 226 mm	
Weight	18 kg	
Software version:	DSP: Ver 1.0.0 ARM: Ver 1.0.0	

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
5	**CONNECTION PROCEDURE**		-
5.1	**Single Premises Connection Procedure**		-
5.1.1	In most instances the installation of Micro-generating Plant, the aggregate Registered Capacity of which is no greater than 16 A per phase, connected in parallel with the public Low Voltage Distribution Network, will have negligible impact on the operation of the public Low Voltage Distribution Network; as such there will be no need for the DNO to carry out detailed network studies to assess the impact of the connection. As required by the ESQCR Certificate of Exemption (2008) the Installer shall provide the DNO with all necessary information on the installation no later than 28 days after the Micro-generating Plant has been commissioned; the format and content shall be as shown in Appendix 3 Form B Installation Document.		Info.
5.1.2	This procedure will not apply where an Installer plans (within the next 28 days) or has already installed (in the previous 28 days) other Micro-generating Plants in a Close Geographic Region; in this case the procedure in 5.2 shall be followed. Failure to comply with this requirement may lead to the disconnection of the Micro-generating Plant under ESQCR (26) or failure of the Micro-generating Plant to operate as intended.		Info.
5.1.3	Installers installing Micro-generating Plant using the connect and notify process through the Connect Direct platform (https://connect-direct.energynetworks.org/) shall provide a clear photograph of the cut-out with the application so it can be visually checked for suitability.		Info.
5.2	**Multiple Premises Connection Procedure**		-
5.2.1	In the case of projects where the proposal is to install single or multiple Micro-generators in a number of Customer Installations in a Close Geographic Region, the Installer shall discuss the installation project with the local DNO at the earliest opportunity. The DNO will need to assess the impact that these connections may have on the Distribution Network and specify conditions for connection. The initial application will need to be in a format similar to that shown in Appendix 3 Form A. Connection of the Micro-generator is only allowed after the application for connection has been approved by the DNO and any DNO works facilitating the connection have been completed. Confirmation of the commissioning of each Micro-generator will need to be made no later than 28 days after commissioning; the format and content shall be as shown in Appendix 3 Form B Installation Document.		Info.
5.2.2	Upon receipt of a multiple premises connection application the DNO's response will be in accordance with the electricity generation standards set by the Authority for applications for connection to the Distribution Network.		Info.
5.3	**General**		Info.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
5.3.1	It is the responsibility of the Installer to ensure that the relevant information as specified in this section and in section 6 is forwarded to the local DNO as appropriate. The pro formas in Appendix 3 are designed to: a) simplify the connection procedure for both DNO and Micro-generator Installer; b) provide the DNO with all the information required to assess the potential impact of the Micro-generator connection on the operation of the Distribution Network; c) inform the DNO that the Micro-generator installation complies with the requirements of this EREC G98; and d) allow the DNO to accurately record the location of all Micro-generators connected to the Distribution Network.		Info.
6	**CERTIFICATION REQUIREMENTS**		P
6.1	**Type Test Certification**		P
6.1.1	Type Tested certification is the responsibility of the Manufacturer. The Manufacturer shall make available upon request a Type Test Verification Report confirming that the Micro-generator has been tested to satisfy the requirements of this EREC G98. The report shall detail the type and model of Micro-generator tested, the test conditions and results recorded. All of these details shall be included in a Type Test Verification Report. The required verification report and declaration are shown in Appendix 3 Form C. It is intended that Manufacturers of Micro-generators will use the requirements of this EREC G98 to develop type verification certification for each of their Micro-generator models.		P
6.1.2	Manufacturers of a Fully Type Tested Micro-generator should allocate a Manufacturer's reference number with the required details of the Micro-generator with the Energy Networks Association Type Test Verification Report Register.		P
6.2	**Compliance**		P
6.2.1	Compliance with the requirements detailed in this EREC G98 will ensure that the Micro-generator(s) is considered to be approved for connection to the DNO's Distribution Network.		P
6.2.2	The Micro-generator(s) shall conform to all relevant European Directives and should be labelled with a CE marking.		P
6.3	**Family approach to Type Testing**		P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.3.1	A family approach to type testing is acceptable, whereby Micro-generators that are the same model and produced by the same Manufacturer but vary in electrical output can be considered to be Fully Type Tested once one Micro-generator in the family has been shown to be compliant.4 The approach is permissible in the following range of Micro-generator electrical output:		P
	• For synchronous Micro-generators: o Lower limit: 1/√10 (0.3162) times the tested Micro-generator nameplate rating (W) o Upper limit: √10 (3.162) times the tested Micro-generator nameplate rating (W)		N/A
	• For all other Micro-generators: o Lower limit: 1/√10 (0.3162) times the tested Micro-generator nameplate rating (W) o Upper limit: 2 times the tested Micro-generator nameplate rating (W)		P
6.3.2	All absolute values (e.g. operating range tests) from the tested Micro-generator shall be transferred directly in the compliance forms of an assumed compliant Microgenerator of the same family. All relative results related to design Active Power or current (e.g. power quality fluctuation and flicker) from the tested Micro-generator shall be transferred to the compliance form of a Micro-generator in the same family according to the ratio of the respective nameplate rating (W) of the tested Microgenerator and the assumed compliant Micro-generator. For the avoidance of doubt, the Manufacturer shall register each Micro-generator in the family on the Energy Networks Association Type Test register.		P
6.3.3	It is the responsibility of the Manufacturer to provide technical justification that the results are transferable. For example, the Micro-generators have the same control systems.		P
7	**OPERATION AND SAFETY**		P
7.1	**Operational Requirements**		P
7.1.1	Compliance with this EREC G98 in respect of the design, installation, operation and maintenance of a Micro-generating Plant, will ensure that the Customer is discharging their legal obligations under ESQCR 22(1)(a) and the EU Network Code on Requirements for Grid Connection of Generators.		P
7.2	**Installation Wiring and Isolation**		Info.

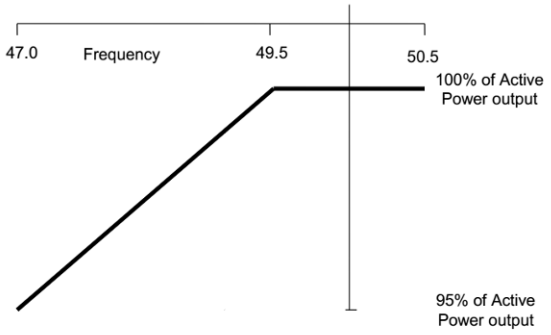
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.2.1	The installation that connects the Micro-generating Plant to the Connection Point shall comply with the requirements of BS 7671. All wiring between the Connection Point and the Micro-generator(s) shall be protected by a suitably rated protective device and shall be of suitable size and type for the rating of the Micro-generator. The Micro-generator(s) shall be connected via an accessible isolation switch that is capable of isolating all phases and neutral. The isolation switch shall be capable of being secured in the 'off' (isolated) position.	Must be taken under consideration for the installation.	Info.
7.3	**Labelling**		Info.
7.3.1	The Installer shall provide labelling at the Connection Point with the DNO's Distribution Network (cut-out), meter position, consumer unit and at all points of isolation between the Connection Point and the Micro-generating Plant within the Customer's premises to indicate the presence of a Micro-generating Plant. The labelling should be sufficiently robust and if necessary fixed in place to ensure that it remains legible and secure for the lifetime of the installation. Warning labels of the form shown in Figure 1 shall be used. It should be noted that the warning label does not imply a right on the Customer, Installer or maintainer to operate (remove / replace) the DNO's cut-out fuse and a note to this effect should be included on the warning label.  **Figure 1 – Example of a Warning Label**	Must be taken under consideration for the installation.	Info.
7.3.2	In addition to the warning label, this EREC G98 requires the following, up to date, information to be displayed at the Connection Point with the DNO's Distribution Network.		Info.
	a) A circuit diagram relevant to the installation showing the circuit wiring, including all protective devices, between the Micro-generator and the DNO's fused cut-out. This diagram should also show by whom all apparatus is owned and maintained; and	Must be taken under consideration for the installation.	Info.
	b) A summary of the Interface Protection settings incorporated within the Micro-generator.	Must be taken under consideration for the installation.	Info.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.3.3	Figure 2 shows an outline example of the type of circuit diagram that will need to be displayed. Figure 2 is non-prescriptive and is for illustrative purposes only.  **Figure 2 – Example of the type of circuit diagram**		Info.
7.3.4	The Installer shall advise the Customer that it is the Customer's responsibility to ensure that this safety information is kept up to date. The installation operating instructions shall contain the Manufacturer's contact details eg name, telephone number and web address.	Must be taken under consideration for the installation.	Info.
7.4	**Maintenance & Routine Testing**		N/A
7.4.1	Periodic testing of the Micro-generator is recommended at intervals prescribed by the Manufacturer. This information shall be included in the installation and user instructions. The method of testing and/or servicing should be included in the servicing instructions.	Must be taken under consideration after the installation.	N/A
7.5	**Phase Unbalance**		N/A
7.5.1	There is no requirement to balance phases on installations below or equal to 16 A per phase.		N/A
7.5.2	For multiple installations of Micro-generators (eg new housing developments), balancing the Micro-generators evenly against the load on the three phases will need to be considered by the DNO. The DNO will advise the Installer of any phase balancing requirements.	Three phase inverter up to 16 A.	N/A
7.6	**Voltage Management Units**		P

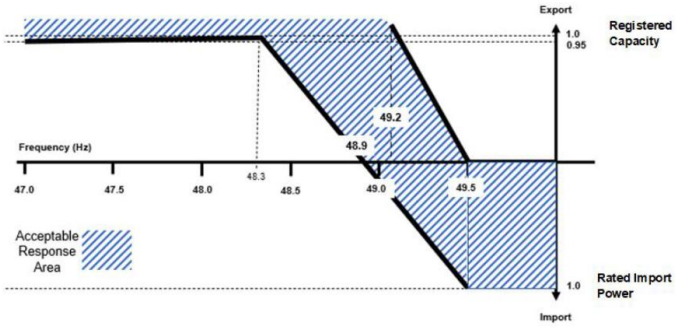
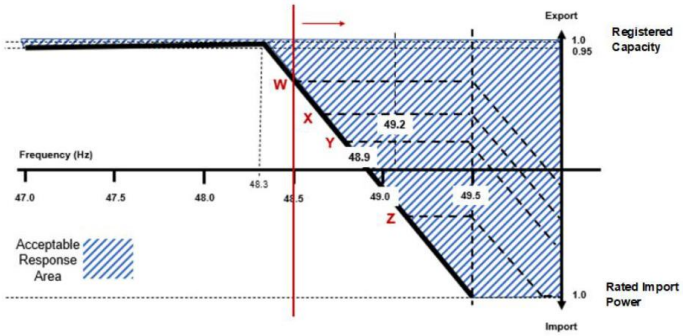
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.6.1	If a Voltage Management Unit is installed in a Customer's Installation between the Connection Point and the Micro-generator, it may result in the voltage at the Micro-generator side of the Voltage Management Unit remaining within the limits of the protection settings defined in Table 2 while the voltage at the Connection Point side of the unit might be outside the limits of the protection settings. This would negate the effect of the protection settings. Therefore, this connection arrangement is not acceptable and all Micro-generators connected to the DNO's LV Distribution Network under this EREC G98 shall be made on the Connection Point side of any Voltage Management Unit installed in a Customers' Installation.		P
7.7	**Earthing**		P
7.7.1	There shall be no direct connection between the Micro-generator current carrying conductors and earth with the following exception: For a Micro-generator that is connected via an Inverter (eg a PV array or fuel cell) it is permissible to connect one pole of the DC side of the Inverter to the DNO's earth terminal if the insulation between the AC and the DC sides of the Inverter meets the requirements for at least simple separation. The requirements for simple separation are those given in Section 5.3.3 of BS EN 60664-1 for basic insulation. In such cases the Installer shall take all reasonable precautions to ensure that the Micro-generating Plant will not impair the integrity of the DNO's Distribution Network and will not suffer unacceptable damage for all credible operating conditions, including faults on the DNO's Distribution Network.		P
7.7.2	Earthing of all exposed conductive parts shall comply with the requirements of BS 7671.		P
8	**COMMISSIONING, NOTIFICATION AND DECOMMISSIONING**		Info.
8.1	**General**		Info.
8.1.1	The installation shall be carried out by Installers who are competent and have sufficient skills and training (complete with recognised and approved qualifications relating to the fuels used and general electrical installations) to apply safe methods of work to install a Micro-generator in compliance with this EREC G98.	Must be taken under consideration for the installation.	Info.
	Notwithstanding the requirements of this EREC G98, the installation will be carried out to no lower a standard than that required in the Manufacturer's installation instructions.		Info.
8.2	**Commissioning**		Info.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
8.2.1	No parameter relating to the electrical connection and subject to type verification certification shall be modified unless previously agreed in writing between the DNO and the Customer or their agent. Customer access to such parameters shall be prevented.		Info.
8.2.2	As part of the on-site commissioning tests the Installer shall carry out a functional check of the loss of mains protection, for example by removing the supply to the Micro-generator during operation and checking that the Interface Protection operates to disconnect the Micro-generator from the DNO's Distribution Network. For three phase installations this test can be achieved by opening a three phase circuit breaker or isolator and confirming that the Micro-generator has shut down. Testing for the loss of a single phase is covered in the type testing of Inverters, see section 10.2.		Info.
8.3	**Notification of Commissioning**		Info.
8.3.1	In accordance with ESQCR and the HSE Certificate of Exemption (2008) (see Appendix 4) the Installer shall ensure that the DNO is advised of the intention to use the Micro-generator in parallel with the Distribution Network no later than 28 days (inclusive of the day of commissioning) after commissioning the Micro-generator. Notification that the Micro-generator has been commissioned is achieved by completing an Installation Document as per Appendix 3 Form B (Installation Document), which also includes the relevant details on the Micro-generator installation required by the DNO.		Info.
8.3.2	The Installer shall supply separate Installation Documents for each premises in which Micro-generators are installed under EREC G98. Documentation may be submitted via an agent acting on behalf of the Installer and may be submitted electronically.		Info.
8.4	**Notification of Changes**		Info.
8.4.1	If a Micro-generator requires modification the Manufacturer must re-submit the Type Test Verification Report prior to the modification being made and the Micro-generator being recommissioned.		Info.
8.4.2	The DNO shall be notified of any operational incidents or failures of a Micro-generator that affect its compliance with this EREC G98, without undue delay, after the occurrence of those incidents.		Info.
8.4.3	The DNO shall have the right to request that the Customer arrange to have compliance tests undertaken after any failure, modification or replacement of any equipment that may have an impact on the Micro-generator's compliance with this EREC G98.		Info.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
8.4.4	Where an existing Micro-generator installed under EREC G83 is substantially modified (eg a significant piece of equipment, such as an inverter, is replaced) then it will be necessary for that Micro-generator to be modified to be compliant with this EREC G98. Modifications to an existing Micro-generator which complies with the requirements of EREC G83 that are not considered to be substantial do not change the compliance requirements of that Micro-generator, ie it can remain compliant with EREC G83.		Info.
8.5	**Notification of Decommissioning**		Info.
8.5.1	The Customer shall notify the DNO about the permanent decommissioning of a Micro-generator by providing the information as detailed under Appendix 3 Form D. Documentation may be submitted by an agent acting on behalf of the Customer and may be submitted electronically.		Info.
9	**GENERAL TECHNICAL REQUIREMENTS**		P
9.1	**Frequency withstand**		P
9.1.1	The Micro-generator shall be capable of remaining connected to the Distribution Network and operating within the frequency ranges and time periods specified in Table 1 unless disconnection was triggered by rate-of-change-of-frequency-type loss of mains protection.		P
	Table 1 – Minimum time periods for which a Micro-generator has to be capable of operating within different frequency ranges without disconnecting from the Distribution Network 47.0 Hz – 47.5 Hz: 20 seconds 47.5 Hz – 48.5 Hz: 90 minutes 48.5 Hz -49.0 Hz: 90 minutes 49.0 Hz – 51.0 Hz: Unlimited 51.0 Hz – 51.5 Hz: 90 minutes 51.5 Hz – 52.0 Hz: 15 minutes	See appended table.	P
9.2	**Rate of Change of Frequency**		P
9.2.1	With regard to the rate of change of frequency withstand capability, a Micro-generator shall be capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1.0 Hzs^{-1} measured over 500 ms.	See appended table.	P
9.3	**Limited Frequency Sensitive Mode – Overfrequency**		P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
9.3.1	With regard to the Limited Frequency Sensitive Mode — Overfrequency (LFSMO), the Micro-generator shall be capable of reducing its Active Power output when the frequency rises above 50.4 Hz. The Droop shall be 10%. No intentional delay should be programmed to ensure that the initial delay is as short as possible with a maximum of 2 s.	See appended table.	P
9.3.2	The Micro-generator will continue to reduce power with rising frequency with a Droop of 10% until 52.0 Hz, at which point the Micro-generator should disconnect.		P
9.3.3	If the reduction in Active Power output is such that the Micro-generator reaches its minimum stable operating level, it shall continue to operate stably at this level.		P
9.3.4	Steady state operation below a Micro-generator's minimum stable operating level is not expected but if system frequency would cause operation below its minimum stable operating level then the Micro-generator shall be able to deliver an output of not less than the minimum stable operating level.		P
9.4	**Active Power Output**		P
9.4.1	The Micro-generator shall be capable of maintaining constant output at its Registered Capacity regardless of changes in frequency, except where the output follows the changes defined in the context of paragraphs 9.3.1 and 9.4.2.		P
9.4.2	The Micro-generator shall be capable of maintaining constant Active Power output at its Registered Capacity regardless of changes in frequency in the range 49.5 – 50.4 Hz. Below 49.5 Hz, the Active Power output should not drop by more than prorata with frequency, ie the maximum permitted requirement is 100% power at 49.5 Hz falling linearly to 95% power at 47.0 Hz as illustrated in Figure 3.  **Figure 3 – Change in Active Power output with falling frequency**	See appended table.	P
9.4.3	Micro-generating Plant that incorporates an Electricity Storage device when operating in an importing mode must meet the requirements (a) – (f) below:	Electricity Storage device.	P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
	(a) Be capable of automatically maintaining its Active Power output within the shaded operating region shown in Figure 4 until the stored energy has been depleted. The Electricity Storage device could initially be operating at any level of import between zero Active Power and the Rated Import Power within a system frequency range of 50 Hz and 49.5 Hz as shown in Figure 4. The Electricity Storage device is only required to reach its Registered Capacity if the Electricity Storage device has headroom and the ability to increase Active Power output. A typical value of the Droop would be 0.6% where this does not result in control system instability or plant difficulties. In all cases the Droop shall be between 0.6% and 1.2% and shall be agreed with the DNO. (b) Automatically respond in accordance with the characteristic of Figure 4 when the system frequency falls to 49.5 Hz and below. (c) The reduction in Active Power import (during an import mode of operation), and the transition to the final value of Active Power output shall be continuously and linearly proportional, as far as is practicable, to the reduction in frequency below 49.5 Hz. Active Power output must be provided increasingly with time as required by (d) below. (d) As much as possible of the proportional reduction in Active Power import must result from the frequency control device (or speed governor) action and must be achieved within 10 s of the time of the frequency decreases below 49.5 Hz. The Electricity Storage device shall be capable of initiating a power frequency response with an initial delay that is as short as possible. Delays that exceed 2 s shall be justified by the Manufacturer or Installer providing technical evidence to the DNO and in any event as much as possible of the proportional reduction in Active Power import shall be achieved within 10 s. This performance requirement is to be maintained when the Electricity Storage device makes the transition to an Active Power export mode of operation unless the energy store is depleted, in which case it shall be required to operate at zero Active Power output. (e) Where the Electricity Storage device is not capable of making a transition from import operation to export operation within 20 s of the frequency falling to 49.2 Hz, then it shall immediately reduce its Active Power import to zero. (f) If the Electricity Storage device has not achieved at least a zero Active Power import when the system frequency has reached 48.9 Hz, it shall be instantaneously tripped. Where an Electricity Storage device trips, it shall not reconnect to the system until the conditions of 9.6 (below) are met.		P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
	 **Figure 4 Active Power performance with falling frequency**		P
9.4.4	Where an Electricity Storage device was importing before the fall in frequency and has responded in accordance with the requirements of 9.4.3, its performance, once the system frequency starts to rise above the minimum reached, shall be in accordance with Figure 5 in respect of the Active Power output and Active Power import. For example, Figure 5, illustrates the four operating points W, X, Y and Z. If points W, X, Y and Z denotes the minimum frequency reached during a particular low system frequency event, as the system frequency starts to rise, the Active Power output of the Electricity Storage device should remain at a constant level (where the energy source has not been depleted) until 49.5 Hz is reached as denoted by the dashed blacklines. Once the system frequency has risen above 49.5 Hz the Electricity Storage device is permitted to reduce Active Power output so long as it is operating within the shaded area above 49.5 Hz shown in Figure 5, unless the Electricity Storage device has insufficient capability in which case it shall operate at zero Active Power.  **Figure 5 Active Power performance with increasing frequency**		P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
9.4.5	The Micro-generator shall be equipped with a logic interface (input port) in order to cease Active Power output within 5 s following an instruction being received from the DNO at the input port. 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 Micro-generator can operate normally. When the switch is opened the Micro-generator will reduce its Active Power output to zero within 5 s. The signal from the Micro-generator that is being switched can be either AC (maximum value 240 V) or DC (maximum value 110 V). The DNO may specify any additional requirements particularly regarding remote operation of this facility.		P
9.5	**Power Factor**		P
9.5.1	The power factor capability of the Micro-generator shall conform to EN 50549-1. When operating at Registered Capacity the Micro-generator shall operate 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 eg for power factor improvement.	See appended table.	P
9.6	**Automatic Connection**		P
9.6.1	Micro-generators shall conform to EN 50549-1 in respect of connection and starting to generate electric power. Connection, reconnection and starting to generate electrical power is only allowed after the voltage and frequency at the Connection Point is within the limits of the Interface Protection settings for a minimum of 20 s.		P
9.7	**Cyber Security**		P
9.7.1	Every Micro-generator and any associated equipment must be designed and operated appropriately to ensure cyber security. The Manufacturer or Installer shall consider all cyber security risks applicable to the Micro-Generator both in terms of the communication between any home energy management system etc and also in terms of interaction with any system of the Manufacturer for product management.		P
9.7.2	The Manufacturer or Installer shall provide information describing the high level cyber security approach, as well as the specific cyber security requirements complied with. The statement will make appropriate reference to the Micro-generator's compliance with		P
	• ETSI EN 303 645;		P
	• relevant aspects of PAS 1879 "Energy smart appliances – Demand side response operation – Code of practice;		P
	• relevant aspects of "Distributed Energy Resources – Cyber Security Connection Guidance" published by BEIS and the ENA;		P

<table>
<tr><th colspan="4">G98/2</th></tr>
<tr><th>Clause</th><th>Requirement - Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td></td><td>• Any other relevant standard that has been incorporated in the design of the Micro-Generator.</td><td></td><td>P</td></tr>
<tr><td>10</td><td colspan="2">INTERFACE PROTECTION</td><td>P</td></tr>
<tr><td>10.1</td><td colspan="2">General</td><td>P</td></tr>
<tr><td>10.1.1</td><td>The Micro-generator shall conform to the Interface Protection settings set out below (Table 2). Means shall be provided to protect the settings from unpermitted interference (eg via a password or seal).</td><td>Interface protection settings protected via a password.</td><td>P</td></tr>
<tr><td>10.1.2</td><td>The DNO is responsible under the Distribution Code for ensuring, by design, that the voltage and frequency at the Connection Point remains within statutory limits. The Interface Protection settings have been chosen to allow for voltage rise or drop within the Customer’s Installation and to allow the Micro-generator to continue to operate outside of the statutory frequency range as required by the EU Network Code on Requirements for Grid Connection of Generators.</td><td></td><td>P</td></tr>
<tr><td>10.1.3</td><td>Interface Protection shall be installed which disconnects the Micro-generator from the DNO’s Distribution Network when any parameter is outside of the settings shown in Table 2.
Table 2 – Interface Protection settings
<table>
<tr><th>Protection Function</th><th>Trip Setting</th><th>Time Delay Setting</th></tr>
<tr><td>U/V</td><td>Vφ-n† - 20% = 184 V</td><td>2.5 s</td></tr>
<tr><td>O/V stage 1</td><td>Vφ-n† +14% = 262.2 V</td><td>1.0 s</td></tr>
<tr><td>O/V stage 2</td><td>Vφ-n†+ 19% = 273.7 V3</td><td>0.5 s</td></tr>
<tr><td>U/F stage 1</td><td>47.5 Hz</td><td>20 s</td></tr>
<tr><td>U/F stage 2</td><td>47 Hz</td><td>0.5 s</td></tr>
<tr><td>O/F</td><td>52 Hz</td><td>0.5 s</td></tr>
<tr><td>LoM (RoCoF)</td><td>1.0 Hzs-1</td><td></td></tr>
</table>
† A value of 230 V phase to neutral</td><td>See appended table.</td><td>P</td></tr>
<tr><td>10.1.4</td><td>The total disconnection time for voltage and frequency protection, including the operating time of the disconnection device, shall be the time delay setting with a tolerance of, -0s + 0.5 s.</td><td></td><td>P</td></tr>
<tr><td>10.1.5</td><td>For the avoidance of doubt, where the Distribution Network voltage or frequency exceed the trip settings in Table 2, for less than the time delay setting, the Micro-generator should not disconnect from the Distribution Network.</td><td></td><td>P</td></tr>
<tr><td>10.1.6</td><td>Fully Type Tested Micro-generators shall have protection settings set during manufacture.</td><td></td><td>P</td></tr>
<tr><td>10.1.7</td><td>The Manufacturer shall establish a secure way of displaying the Interface Protection setting information in one of the following ways:</td><td></td><td>P</td></tr>
</table>

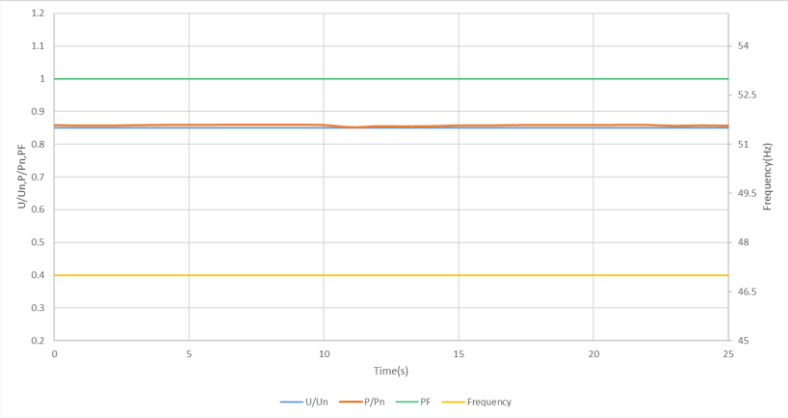
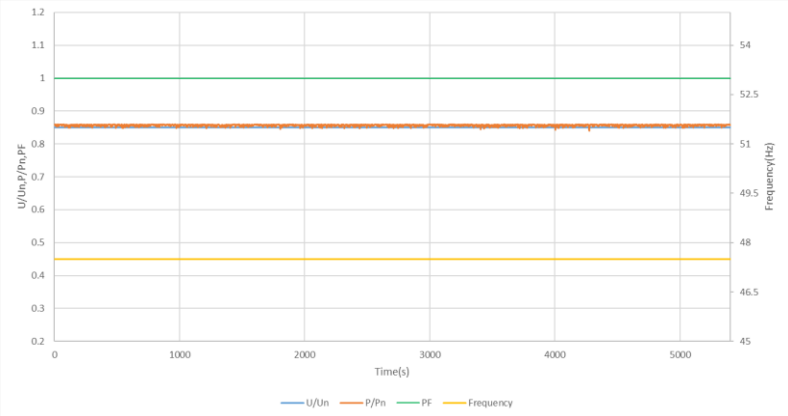
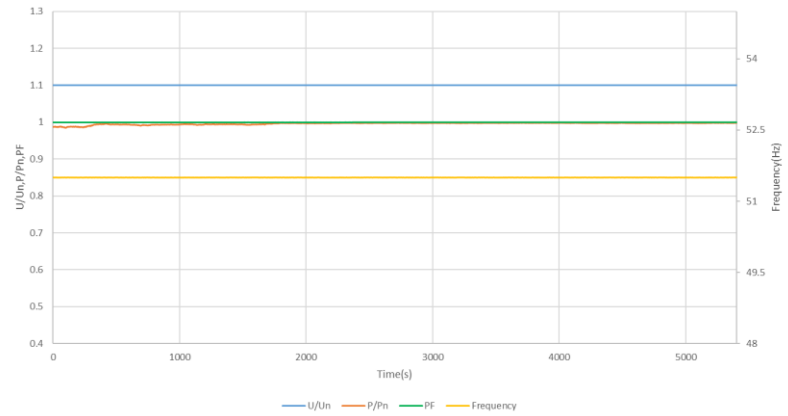
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
	• A display on a screen; • A display on a PC which can communicate with the Micro-generator and confirm that it is the correct Micro-generator by means of a serial number permanently fixed to the Micro-generator and visible on the PC screen at the same time as the settings; or • Display of all Interface Protection settings and nominal voltage and current outputs, alongside the serial number of the Micro-generator, permanently fixed to the Micro-generator.		P
10.1.8	The provision of loose documents, documents attached to the Micro-generator by cable ties etc, or provision of data on adhesive paper based products which are not likely to survive due to fading, or failure of the adhesive, for at least 20 years is not acceptable.		P
10.1.9	In response to a protection operation the Micro-generator shall be automatically disconnected from the DNO's Distribution Network. This disconnection must be achieved preferably by the separation of mechanical contacts or alternatively by the operation of a suitably rated solid state switching device.		P
10.1.10	The Interface Protection shall function correctly, ie operate within the required tolerance range as given in paragraph 10.1.4, across the expected range of ambient operating temperatures and other environmental factors.		P
10.1.11	Where a common protection system is used to provide the protection function for multiple Micro-generators the complete installation cannot be considered to comprise Fully Type Tested Micro-generators if the protection and connections are made up on site and so cannot be factory tested or Fully Type Tested. In accordance with Annex A1 or Annex A2 if the units or Micro-generators are specifically designed with plugs and sockets to be interconnected on site, then provided the assembly passes the function tests required in Appendix 3 Form C, the Micro-generator(s) can retain Fully Type Tested status.		N/A
10.1.12	Once the Micro-generator has been installed and commissioned the protection settings shall only be altered following written agreement between the DNO and the Customer or their agent.	Interface protection settings protected via a password and can't be change by user.	Info.
10.2	**Loss of Mains Protection**		P

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.2.1	Loss of mains protection shall be incorporated and tested as defined in the compliance type testing annex of this EREC G98. Active methods which use impedance measuring techniques by drawing current pulses from or injecting AC currents into the DNO's Distribution Network are not considered to be suitable. For Micro-generators which generate on more than one phase, the loss of mains protection should be able to detect the loss of a single phase of the supply network. This should be tested during type testing and recorded in the Type Test Verification Report as per Appendix 3 Form C.	See appended table.	P
10.3	**Frequency Drift and Step Change Stability Test**		P
10.3.1	Under normal operation of the Distribution Network, the frequency changes over time due to continuous unbalance of load and generation or can experience a step change due to the loss of a Distribution Network component which does not cause a loss of supply.		P
10.3.2	In order to ensure that such phenomena do not cause unnecessary tripping of Micro-generators, stability type tests shall be carried out.		P
10.3.3	The Rate of Change of Frequency (RoCoF) and Vector Shift values required for these tests are marginally less than the corresponding protection settings for RoCoF in Table 2 and vector shifts of up to 50º. Both stability tests shall be carried out in all cases.	See appended table.	P
10.3.4	The stability tests are to be carried out as per the table in Appendix 3 Form C of this document and the Micro-generator should remain connected during each and every test. The tests shall check that the Micro-generator remains stable and connected during the following scenarios: • RoCoF: 0.95 Hzs-1 from 49.0 Hz to 51.0 Hz on both rising and falling frequency; and • Vector shift: 50º plus from 49.5 Hz and 50º minus from 50.5 Hz.	See appended table.	P
11	**QUALITY OF SUPPLY**		P
11.1	The connection and operation of a Micro-generator in parallel with a DNO's Distribution Network shall not impair the quality of supply provided by the DNO to any Customers. In this respect the Micro-generator shall comply with: • EN 61000-3-2 Class A for harmonics; and • EN 61000-3-3 for voltage fluctuation and flicker with a d_{max} value of 4%.	See appended table.	P
11.2	**DC injection**		P
11.2.1	The upper limit for DC injection is 0.25% of AC current rating per phase.	See appended table.	P
11.3	**Electromagnetic Compatibility (EMC)**		P

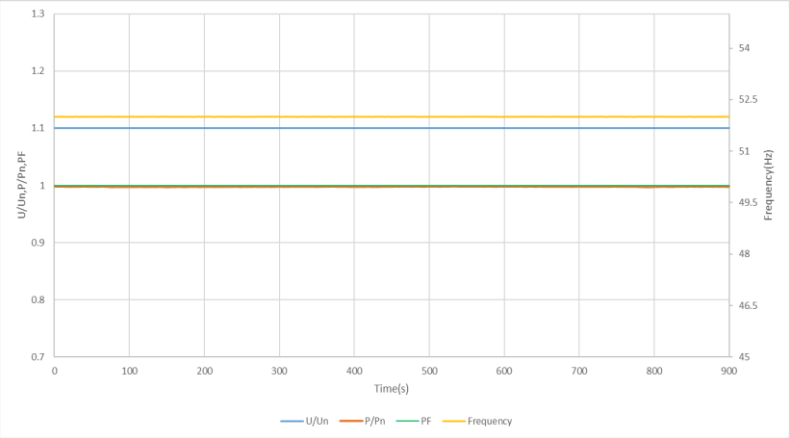
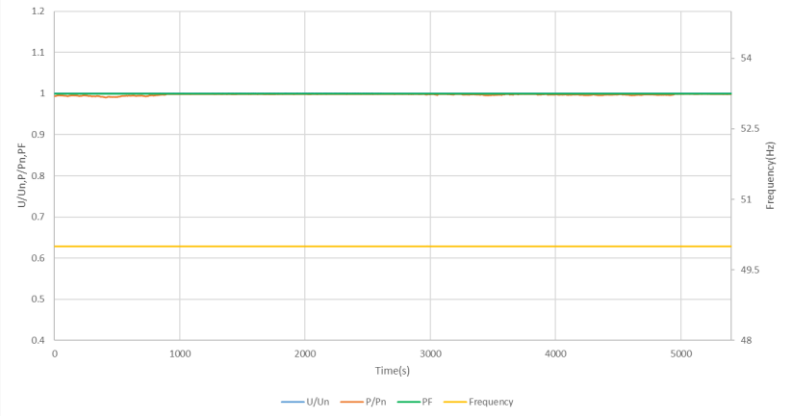
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.3.1	All equipment shall conform to the generic EMC standards: BS EN61000-6-3: Electromagnetic Compatibility, Generic Emission Standard; and BS EN61000-6-1: Electromagnetic Compatibility, Generic Immunity Standard	Refer to report number 6235605.53 issued by DEKRA	P
11.4	**Short Circuit Current Contribution**		P
11.4.1	Directly Coupled Micro-generators		N/A
	The Manufacturer shall establish the maximum short circuit current contribution from the Micro-generator and the conditions under which this exists. This shall be determined in accordance with Annex A.2.3.4.		N/A
	The Manufacturer shall establish the maximum short circuit current contribution from the Micro-generator and the conditions under which this exists. This shall be determined in accordance with Annex A.2.3.4.		N/A
11.4.2	Inverter Connected Micro-generators		P
	DNOs need to understand the contribution that Inverters make to system fault levels in order to determine that they can continue to safely operate their Distribution Networks without exceeding design fault levels for switchgear and other circuit components.		P
	As the output from an Inverter reduces to zero when a short circuit is applied to its terminals, a short circuit test does not represent the worst case scenario; in most cases the voltage will not collapse to zero for a Distribution Network fault.		P
	To address this issue a test, which ensures that at least 10% of nominal voltage remains and which allows the Micro-generator to feed into a load with an X to R ratio of 2.5, is specified as detailed in Annex A1.3.5.		P
APPENDIX 1	**EMERGING TECHNOLOGIES AND OTHER EXCEPTIONS**		N/A
APPENDIX 2	**CONNECTION PROCEDURE FLOW CHART**		Info.
APPENDIX 3	**MICRO-GENERATOR DOCUMENTATION**		P
APPENDIX 4	**RELAXATION OF COMMISSIONING NOTIFICATION TIMESCALES FOR MICRO-GENERATOR: HSE CERTIFICATE OF EXEMPTION (AUGUST 2008)**		N/A

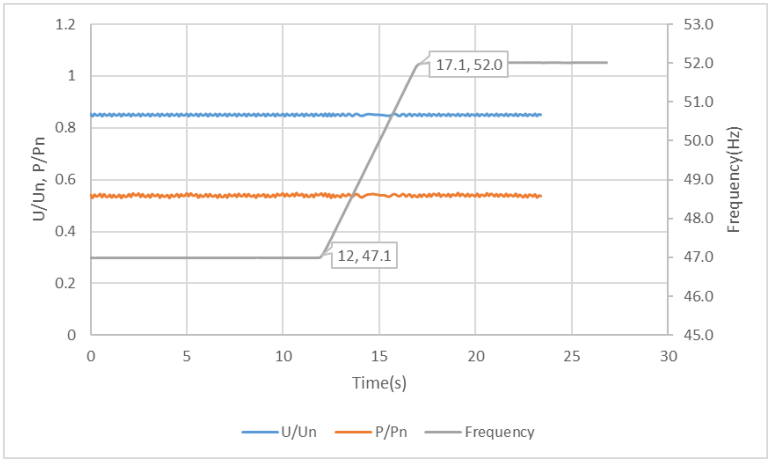
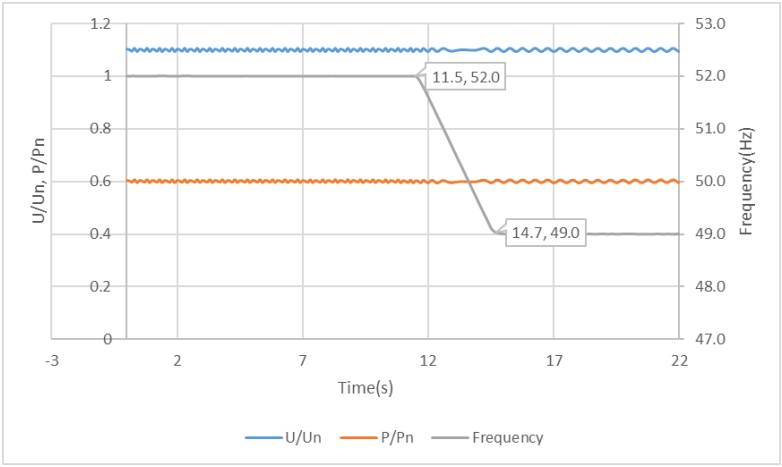
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Appendix 1: Type Verification Test Report

Form C: Type Test Verification Report	
1. Operating Range:	**P**
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 s	
Test 2 Voltage = 85% of nominal (195.5 V), Frequency = 47.5 Hz, Power Factor = 1, Period of test 90 minutes	
Test 3 Voltage = 110% of nominal (253 V), Frequency = 51.5 Hz, Power Factor = 1, Period of test 90 minutes	

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

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	

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict
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^{-1} as measured over a period of 500 ms.	 		

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model: AU3.6KESL-G3				**P**
Test 1:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
196.0	47.0	3087.8	0.999	30
Test 2:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
195.5	47.5	3085.1	0.999	5500
Test 3:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
253.4	51.5	3585.4	0.999	5500
Test 4:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
253.1	52.0	3591.8	0.999	900
Test 5:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (s)
230.5	50.0	3590.6	0.999	5500
Test 6:				
Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.5	47.0 Hz to 52.0 Hz	+1 Hzs^{-1}	5.1s	no trip
253.0	52.0 Hz to 49.0 Hz	-1 Hzs^{-1}	3.2s	no trip

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

2. Power Quality – Harmonics:						**P**
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).						
Model: AU3.6KESL-G3						
Micro-generator tested to BS EN 61000-3-2						
Micro-generator rating per phase (rpp)			3.6		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.			Single phase			
Harmonic	At 45-55% of **Registered Capacity**		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	0.023	--	0.019	--	1.080	
3	0.098	--	0.170	--	2.300	
4	0.010	--	0.008	--	0.430	
5	0.101	--	0.092	--	1.140	
6	0.005	--	0.005	--	0.300	
7	0.098	--	0.084	--	0.770	
8	0.004	--	0.004	--	0.230	
9	0.087	--	0.082	--	0.400	
10	0.003	--	0.003	--	0.184	
11	0.065	--	0.073	--	0.330	
12	0.003	--	0.003	--	0.153	
13	0.045	--	0.058	--	0.210	
14	0.004	--	0.003	--	0.131	
15	0.028	--	0.043	--	0.150	
16	0.003	--	0.003	--	0.115	
17	0.022	--	0.028	--	0.132	
18	0.002	--	0.002	--	0.102	
19	0.019	--	0.019	--	0.118	
20	0.001	--	0.002	--	0.092	
21	0.016	--	0.016	--	0.107	0.160
22	0.001	--	0.001	--	0.084	
23	0.014	--	0.014	--	0.098	0.147

G98/2						
Clause	Requirement - Test				Result - Remark	Verdict
24	0.001	--	0.001	--	0.077	
25	0.012	--	0.014	--	0.090	0.135
26	0.001	--	0.001	--	0.071	
27	0.010	--	0.013	--	0.083	0.124
28	0.001	--	0.001	--	0.066	
29	0.009	--	0.013	--	0.078	0.117
30	0.001	--	0.001	--	0.061	
31	0.008	--	0.012	--	0.073	0.109
32	0.001	--	0.001	--	0.058	
33	0.007	--	0.011	--	0.068	0.102
34	0.001	--	0.001	--	0.054	
35	0.007	--	0.010	--	0.064	0.096
36	0.001	--	0.001	--	0.051	
37	0.007	--	0.008	--	0.061	0.091
38	0.001	--	0.001	--	0.048	
39	0.007	--	0.007	--	0.058	0.087
40	0.001	--	0.001	--	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.						

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Clause	Requirement - Test	Result - Remark	Verdict

Model: AU3KESL-G3						
Micro-generator tested to BS EN 61000-3-2						
Micro-generator rating per phase (rpp)			3	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.			Single phase			
Harmonic	At 45-55% of **Registered Capacity**		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	0.020	--	0.022	--	1.080	
3	0.107	--	0.135	--	2.300	
4	0.008	--	0.009	--	0.430	
5	0.110	--	0.090	--	1.140	
6	0.006	--	0.005	--	0.300	
7	0.102	--	0.088	--	0.770	
8	0.005	--	0.004	--	0.230	
9	0.082	--	0.086	--	0.400	
10	0.004	--	0.004	--	0.184	
11	0.056	--	0.075	--	0.330	
12	0.003	--	0.003	--	0.153	
13	0.034	--	0.058	--	0.210	
14	0.002	--	0.003	--	0.131	
15	0.021	--	0.041	--	0.150	
16	0.002	--	0.002	--	0.115	
17	0.017	--	0.028	--	0.132	
18	0.002	--	0.002	--	0.102	
19	0.014	--	0.020	--	0.118	
20	0.001	--	0.002	--	0.092	
21	0.013	--	0.018	--	0.107	0.160
22	0.001	--	0.001	--	0.084	
23	0.014	--	0.016	--	0.098	0.147
24	0.001	--	0.001	--	0.077	
25	0.014	--	0.016	--	0.090	0.135
26	0.001	--	0.001	--	0.071	
27	0.013	--	0.015	--	0.083	0.124

G98/2						
Clause	Requirement - Test				Result - Remark	Verdict
28	0.001	--	0.001	--	0.066	
29	0.012	--	0.014	--	0.078	0.117
30	0.001	--	0.001	--	0.061	
31	0.011	--	0.012	--	0.073	0.109
32	0.001	--	0.001	--	0.058	
33	0.010	--	0.010	--	0.068	0.102
34	0.001	--	0.001	--	0.054	
35	0.008	--	0.009	--	0.064	0.096
36	0.001	--	0.001	--	0.051	
37	0.008	--	0.008	--	0.061	0.091
38	0.001	--	0.001	--	0.048	
39	0.007	--	0.006	--	0.058	0.087
40	0.001	--	0.001	--	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.						

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

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

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	2025-11-15	Test end date	2025-11-18
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		
Model:	AU3.6KESL-G3		

Single Phase

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	1.609%	1.574%	0	1.831%	1.784%	0	0.114	0.110
Normalised to standard impedance	1.609%	1.574%	0	1.831%	1.784%	0	0.114	0.110
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	0.4	Ω	Xl	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A #	Ω	Xl	N/A #	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

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

system. Delete as appropriate.

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

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	2025-11-15	Test end date	2025-11-18
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		
Model:	AU3KESL-G3		

Single Phase

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.961%	0.914%	0	1.389%	1.364%	0	0.115	0.112
Normalised to standard impedance	0.961%	0.914%	0	1.389%	1.364%	0	0.115	0.112
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	0.4	Ω	Xl	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A #	Ω	Xl	N/A #	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.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

4. Power quality – DC injection:			**P**
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%.			
Model: AU3.6KESL-G3			
Single Phase			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.009	0.008	0.012
as % of rated AC current	0.06%	0.05%	0.07%
Limit	0.25%	0.25%	0.25%



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model: AU3KESL-G3			
Single Phase			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.010	0.018	0.030
as % of rated AC current	0.07%	0.13%	0.23%
Limit	0.25%	0.25%	0.25%



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

5. Power Factor:			**P**
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.			
Model: AU3.6KESL-G3			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.999	0.999	0.999
Power Factor Limit	>0.95	>0.95	>0.95
Model: AU3KESL-G2			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.999	0.999	0.999
Power Factor Limit	>0.95	>0.95	>0.95

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

6. Protection – Frequency tests: **P**

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.

Model: AU3.6KESL-G3

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	47.49 Hz	20.09 s	47.7 Hz 30 s	No trip
U/F stage 2	47.0 Hz	0.5 s	47.00 Hz	0.590 s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0 Hz	0.5 s	52.02 Hz	0.585 s	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 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.

7. Protection – Voltage tests: **P**

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.

Model: AU3.6KESL-G3

Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V	0.8 pu (184 V)	2.5 s	184.0 V	2.59 s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0 s	261.7 V	1.09 s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	273.2 V	0.545 s	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.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

8. Protection – Loss of Mains test:	**P**

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.

For test condition A, EUT output = 100 % P_n, test condition B, EUT output = 50 % to 66 % P_n, and test condition C, EUT output = 25 % to 33 % P_n.

Model: AU3.6KESL-G3

For **Inverter**s 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 0.5s**	171 ms	161 ms	222 ms	161 ms	155 ms	220 ms

No.	P_{EUT} a) (% of EUT rating)	Reactive load (% of Q_L)	P_{AC} b) (% of nominal)	Q_{AC} c) (% of nominal)	Run-on time (ms)	P_{EUT} (kW)	Actual Q_f	V_{DC} d)	Remarks e)
1	100	100	0	0	233	3.62	1.00	356	Test A at BL
2	66	66	0	0	206	2.25	1.00	287	Test B at BL
3	33	33	0	0	209	1.06	1.00	200	Test C at BL
4	100	100	-5	-5	215	3.61	0.97	356	Test A at IB
5	100	100	-5	0	222	3.60	1.00	356	Test A at IB
6	100	100	-5	+5	228	3.65	1.02	356	Test A at IB
7	100	100	0	-5	232	3.61	0.98	356	Test A at IB
8	100	100	0	+5	228	3.60	1.01	356	Test A at IB
9	100	100	+5	-5	225	3.65	1.02	356	Test A at IB
10	100	100	+5	0	220	3.65	0.97	356	Test A at IB
11	100	100	+5	+5	217	3.60	1.00	356	Test A at IB
12	66	66	0	-5	161	2.28	0.97	287	Test B at IB
13	66	66	0	-4	173	2.25	0.98	287	Test B at IB
14	66	66	0	-3	176	2.20	0.99	287	Test B at IB
15	66	66	0	-2	187	2.23	0.99	287	Test B at IB
16	66	66	0	-1	200	2.25	1.00	287	Test B at IB
17	66	66	0	+1	196	2.26	1.00	287	Test B at IB
18	66	66	0	+2	179	2.20	1.01	287	Test B at IB
19	66	66	0	+3	174	2.25	1.01	287	Test B at IB
20	66	66	0	+4	166	2.26	1.02	287	Test B at IB
21	66	66	0	+5	155	2.20	1.02	287	Test B at IB
22	33	33	0	-5	171	1.00	0.97	200	Test C at IB

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

23	33	33	0	-4	189	1.05	0.98	200	Test C at IB
24	33	33	0	-3	197	1.03	0.98	200	Test C at IB
25	33	33	0	-2	201	1.06	0.99	200	Test C at IB
26	33	33	0	-1	207	1.02	1.00	200	Test C at IB
27	33	33	0	+1	207	1.05	1.00	200	Test C at IB
28	33	33	0	+2	199	1.00	1.01	200	Test C at IB
29	33	33	0	+3	190	1.06	1.01	200	Test C at IB
30	33	33	0	+4	182	1.07	1.02	200	Test C at IB
31	33	33	0	+5	161	1.05	1.02	200	Test C at IB

Note:

[a)] P_{EUT}: EUT output power.

[b)] P_{ac}: Active power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

[c)] Q_{ac}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

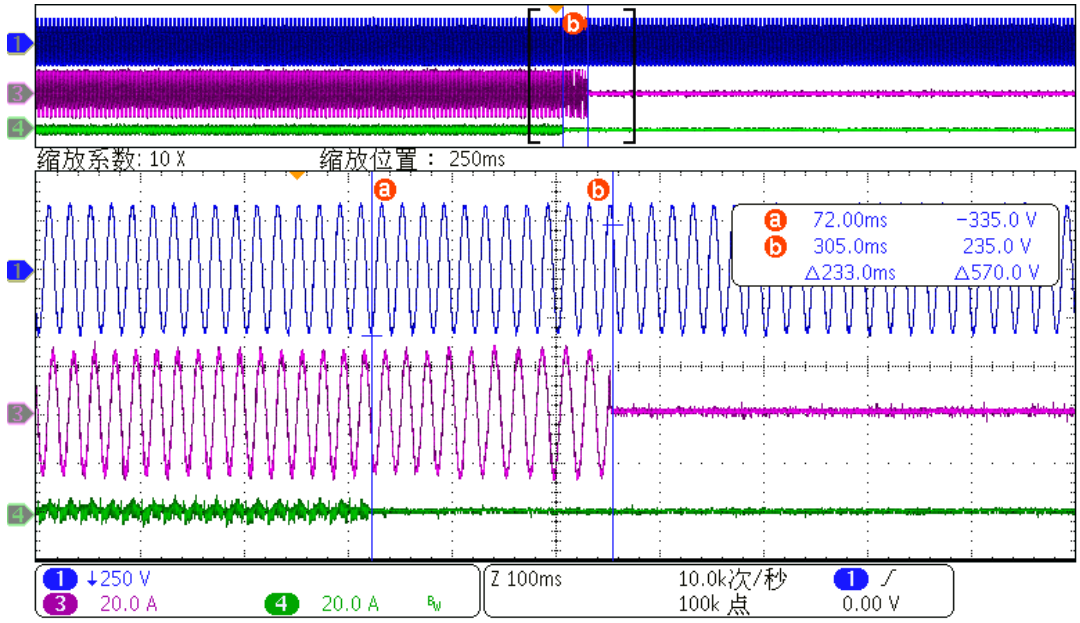
[d)] For test condition A, > 75 % of rated input voltage range used, for test condition B, 50 % of rated input voltage range, ±10 % used, for test condition C, < 20 % of rated input voltage range used. Based on EUT rated input operating range. For example, if range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

[e)] BL: Balance condition, IB: Imbalance condition.

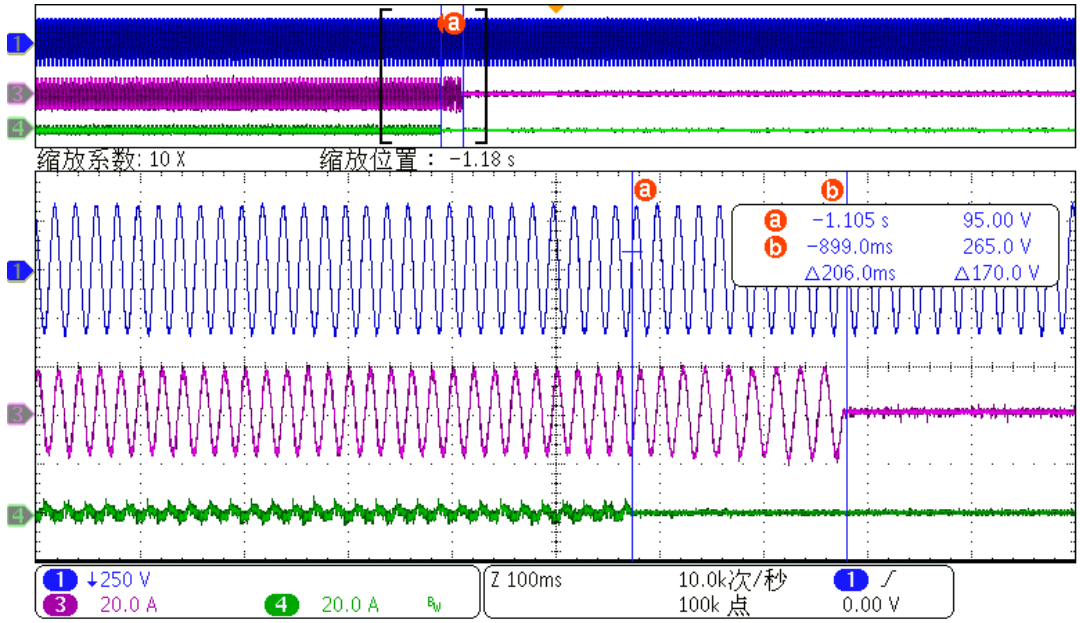
If the device requires additional shut down time (beyond 0.5 s but less than 1 s) then this should be stated on this form.

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 100% nominal power

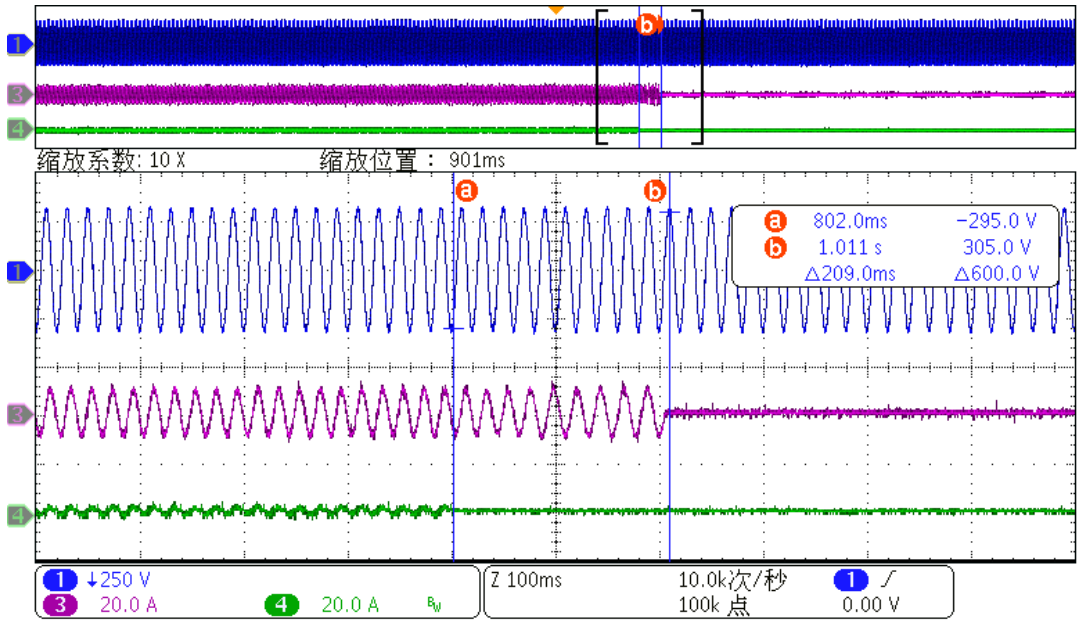


Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 66% nominal power



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 33% nominal power



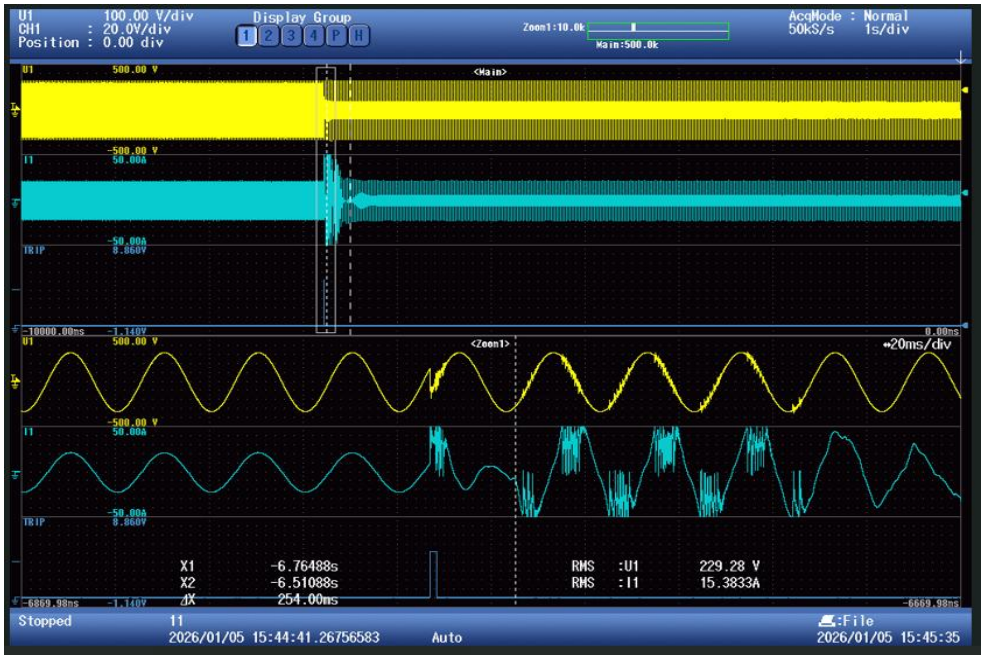
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Protection – Frequency change, Vector Shift Stability test:			**P**
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.			
Model: AU3.6KESL-G3			
	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
Positive Vector Shift			



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

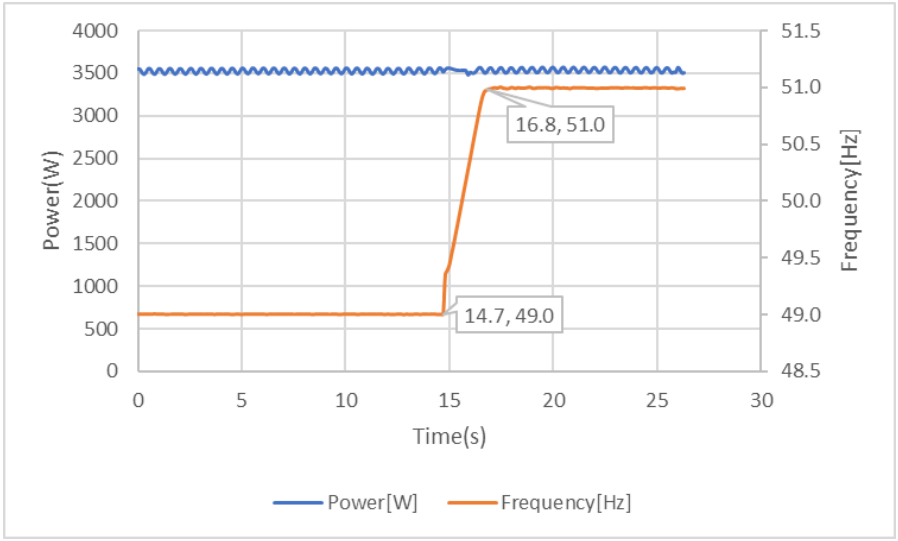
Negative Vector Shift



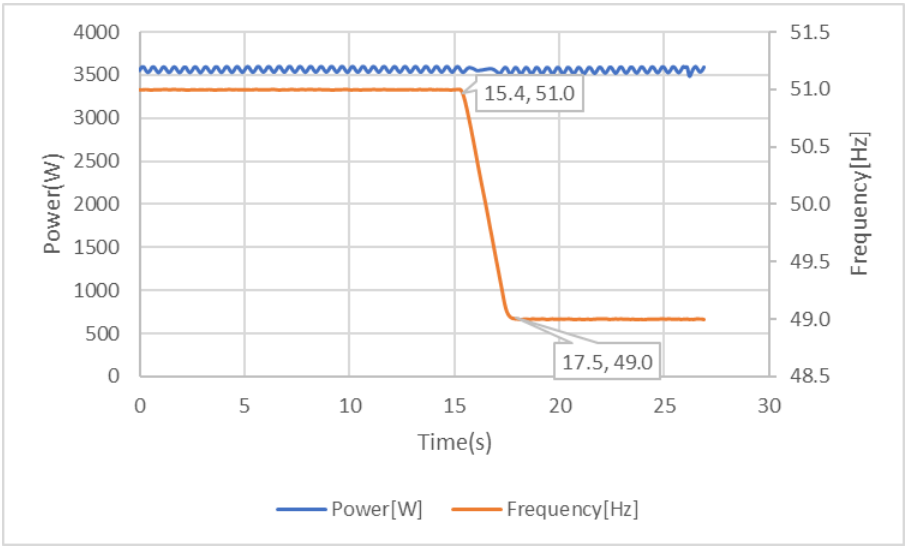
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Protection – Frequency change, RoCoF Stability test:			**P**
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.			
Model: AU3.6KESL-G3			
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

ROCOF – From 49.0 Hz to 51.0 Hz



ROCOF – From 51.0 Hz to 49.0 Hz



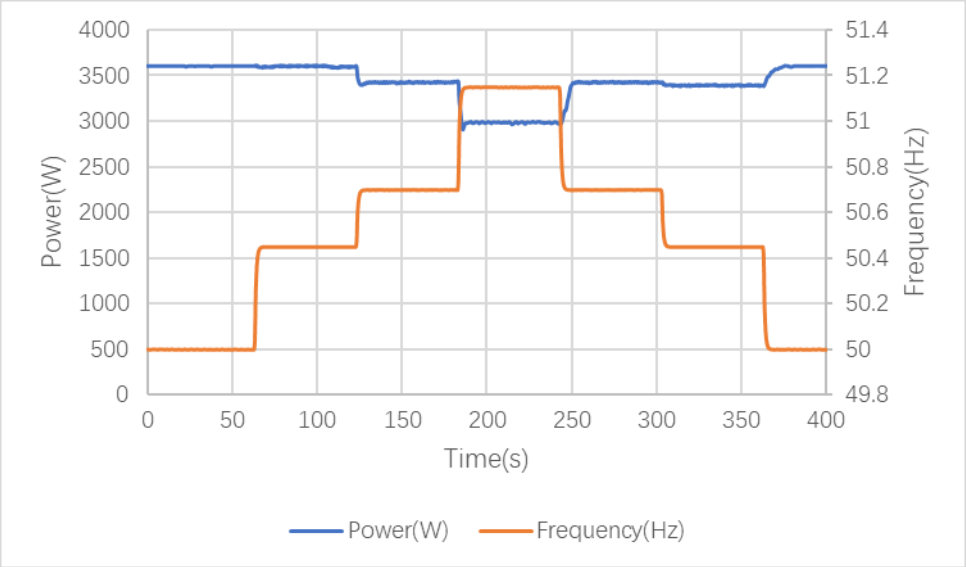
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

9. Limited Frequency Sensitive Mode – Over frequency test:					**P**
This test should be carried out in accordance with A.1.2.9. 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.1.2.9.					
Model: AU3.6KESL-G3					
Alternatively, simulation results should be noted below:					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	3610.01	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	3573.58	50.45	9.88%		-
Step c) 50.70 Hz ±0.10 Hz	3428.48	50.70	11.90%		-
Step d) 51.15 Hz ±0.05 Hz	2999.71	51.15	8.85%		-
Step e) 50.70 Hz ±0.10 Hz	3412.98	50.70	10.96%		-
Step f) 50.45 Hz ±0.05 Hz	3571.21	50.45	9.28%		-
Step g) 50.00 Hz ±0.01 Hz	3610.18	50.00	-		-
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient
Step a) 50.00 Hz ±0.01 Hz	1804.8	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	1762.1	50.45	8.59%		-
Step c) 50.70 Hz ±0.10 Hz	1569.2	50.70	9.20%		-
Step d) 51.15 Hz ±0.05 Hz	1264.9	51.15	10.02%		-
Step e) 50.70 Hz ±0.10 Hz	1558.1	50.70	8.78%		-
Step f) 50.45 Hz ±0.05 Hz	1744.1	50.45	9.02%		-
Step g) 50.00 Hz ±0.01 Hz	1840.4	50.00	-		-
The frequency at each step should be maintained for at least one minute and the Active Power reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.3. The Droop should be determined from the measurements between 50.4 Hz and 51.15 Hz. The allowed tolerance for the frequency measurement shall be ± 0.05 Hz. The allowed tolerance for Active Power output measurement shall be ±10% of the required change in Active Power. The resulting overall tolerance range for a nominal 10% Droop is +2.8% and – 1.5%, ie a Droop less than 12.8% and greater than 8.5%.					

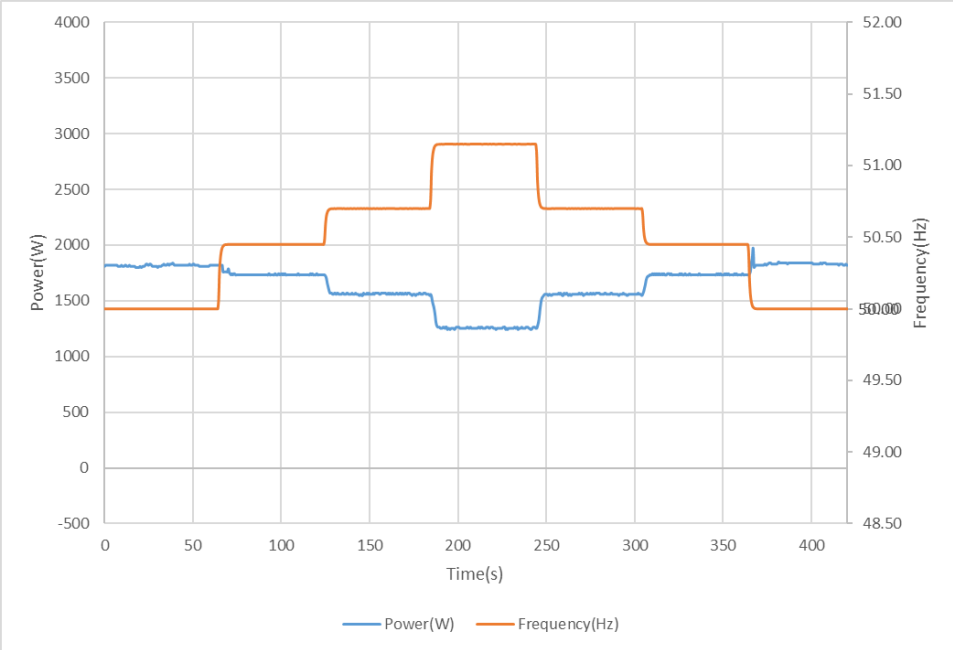
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Test chart

100%Pn



50%Pn



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

10. Power output with falling frequency test (For PV Inverter):			**P**
This test should be carried out in accordance with A.1.2.7.			
Model: AU3.6KESL-G3			
Test sequence	Measured **Active Power** Output (W)	Frequency (Hz)	Primary power source
Test a) 50 Hz ± 0.01 Hz	3595.15	50.00	Photovoltaic array simulator
Test b) Point between 49.5 Hz and 49.6 Hz	3596.14	49.59	Photovoltaic array simulator
Test c) Point between 47.5 Hz and 47.6 Hz	3543.71	47.59	Photovoltaic array simulator

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

The test is regarded as passed if:
• the Micro-generator does not disconnect from the network at the operating points a) to c) when the network frequency is changed and
• the Micro-generator does not reduce output energy at point b) and
• the power reduction at point c) is less than or equal to the allowed power reduction according to paragraph 9.4.2 (Figure 3).

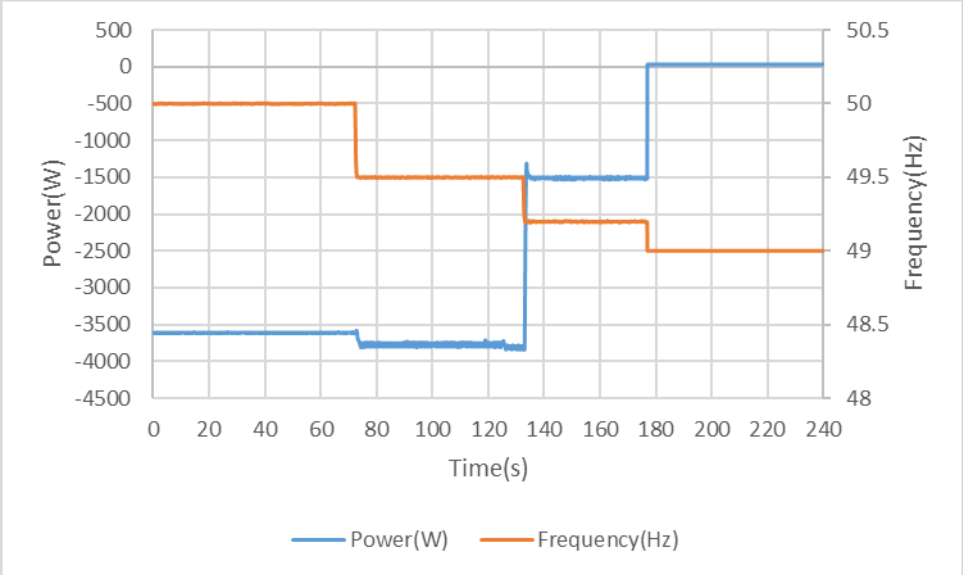
The following data shall be documented:
• variation of the network frequency with time;
• the measured Active Power with time.

11. Power output with falling frequency test (For Electricity Storage Device)				
This test should be carried out in accordance with clause 9.4.3 and A.1.2.8.				
Model: AU3.6KESL-G3				
Test 1: 50 Hz to 49.0 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3610	50.0	-	AC grid / Storage Battery
49.5	-3699	49.5	-	AC grid / Storage Battery
49.2	-1520	49.2	1.03%	AC grid / Storage Battery
49.0	-32.1	49.0	1.01%	AC grid / Storage Battery
Test 2: 50 Hz to 48.8 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-3601	50.0	-	AC grid / Storage Battery
49.5	-3776	49.5	1.03%	AC grid / Storage Battery
49.2	-1510	49.2	0.99%	AC grid / Storage Battery
49.0	32.40	49.0	0.99%	AC grid / Storage Battery

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

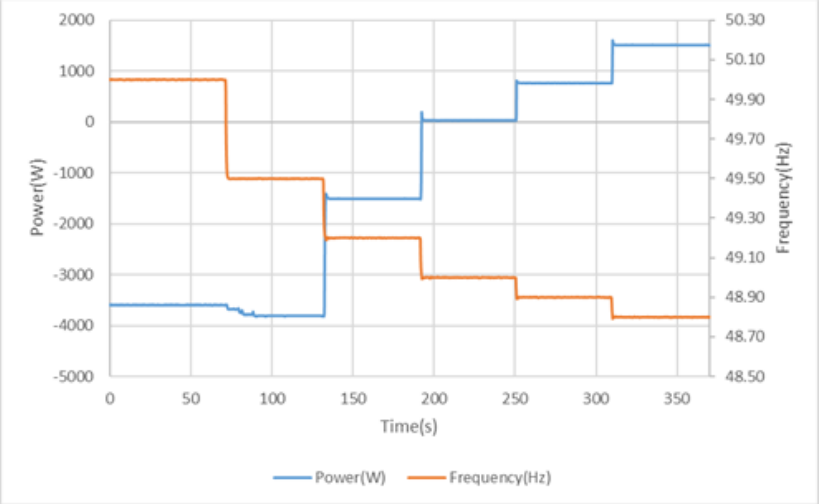
48.9	764	48.9	0.99%	AC grid / Storage Battery
48.8	1510	48.8	-	AC grid / Storage Battery
Test 3: 50 Hz to 49.0 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-1450	50.0	-	AC grid / Storage Battery
49.5	-1480	49.5	-	AC grid / Storage Battery
49.2	672	49.2	1.02%	AC grid / Storage Battery
49.0	2190	49.0	0.99%	AC grid / Storage Battery
Test 4: 50 Hz to 48.8 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-1440	50.0	-	AC grid / Storage Battery
49.5	-1530	49.5	-	AC grid / Storage Battery
49.2	583	49.2	1.07%	AC grid / Storage Battery
49.0	2100	49.0	1.02%	AC grid / Storage Battery
48.9	2890	48.9	1.00%	AC grid / Storage Battery
48.8	3540	48.8	1.01%	AC grid / Storage Battery

Chart:
Test1:

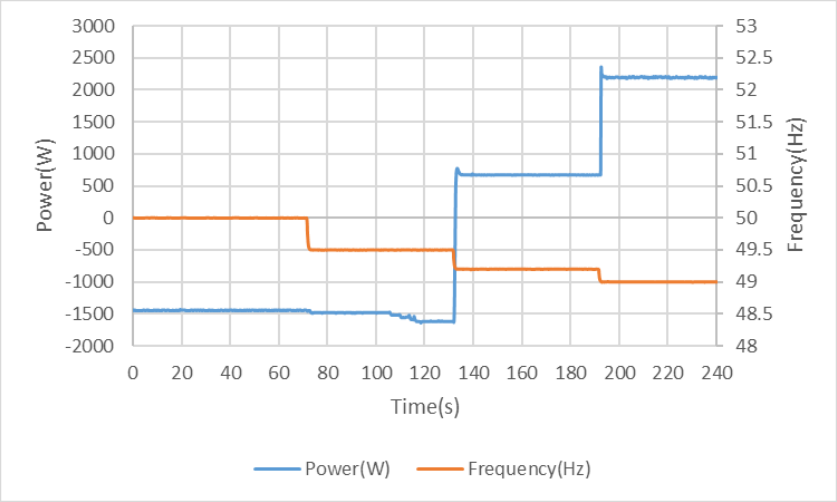


G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

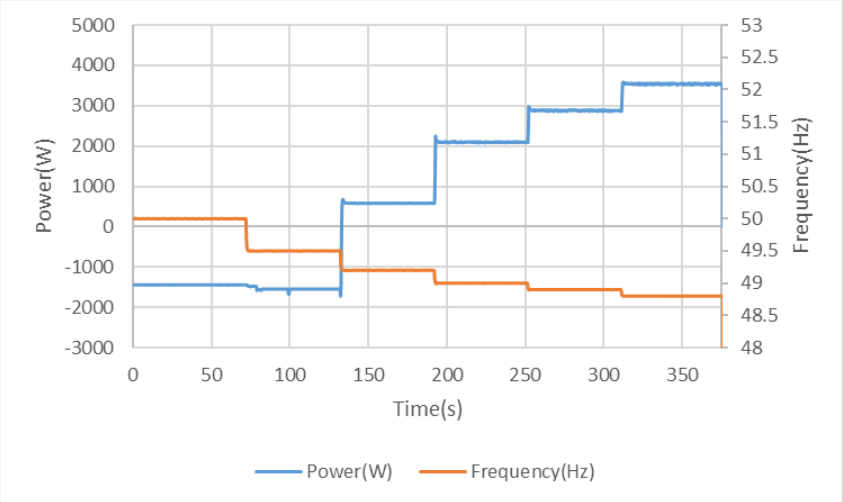
Test2:



Test3:



Test4:



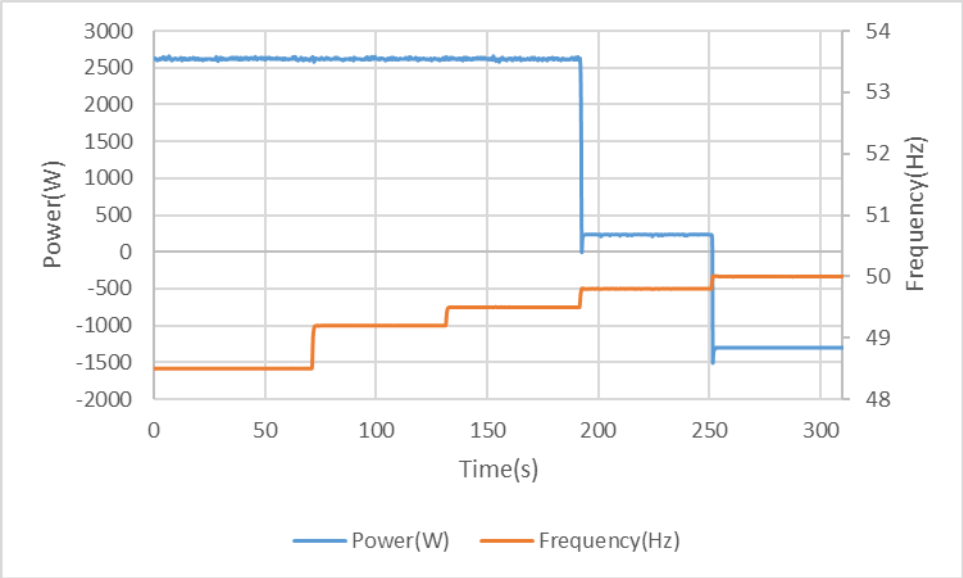
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

12. Power output with increasing frequency test (For Electricity Storage Device)				
This test should be carried out in accordance with clause 9.4.4 and A.7.1.7				
Model: AU3.6KESL-G3				
Test 1: 48.5 Hz to 50.0 Hz, from **75%** $P_{rated\text{-}export}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	2650	48.5	-	AC grid / Storage Battery
49.2	2650	49.2	-	AC grid / Storage Battery
49.5	2650	49.5	-	AC grid / Storage Battery
49.8	251	49.8	0.90%	AC grid / Storage Battery
50.0	-1250	50.0	0.92%	AC grid / Storage Battery
Test 2: 48.5 Hz to 50.0 Hz, from 50% Prated-export				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	1730	48.5	-	AC grid / Storage Battery
49.2	1730	49.2	-	AC grid / Storage Battery
49.5	1730	49.5	-	AC grid / Storage Battery
49.8	-632	49.8	0.91%	AC grid / Storage Battery
50.0	-2200	50.0	0.92%	AC grid / Storage Battery
Test 3: 48.5 Hz to 50.0 Hz, from **25%** $P_{rated\text{-}export}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	951	48.5	-	AC grid / Storage Battery
49.2	950	49.2	-	AC grid / Storage Battery
49.5	950	49.5	-	AC grid / Storage Battery
49.8	-1410	49.8	0.91%	AC grid / Storage Battery
50.0	-2990	50.0	0.91%	AC grid / Storage Battery
Test 4: 48.5 Hz to 50.0 Hz, from **33%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
48.5	-1220	48.5	-	AC grid / Storage Battery
49.2	-1240	49.2	-	AC grid / Storage Battery
49.5	-1230	49.5	-	AC grid / Storage

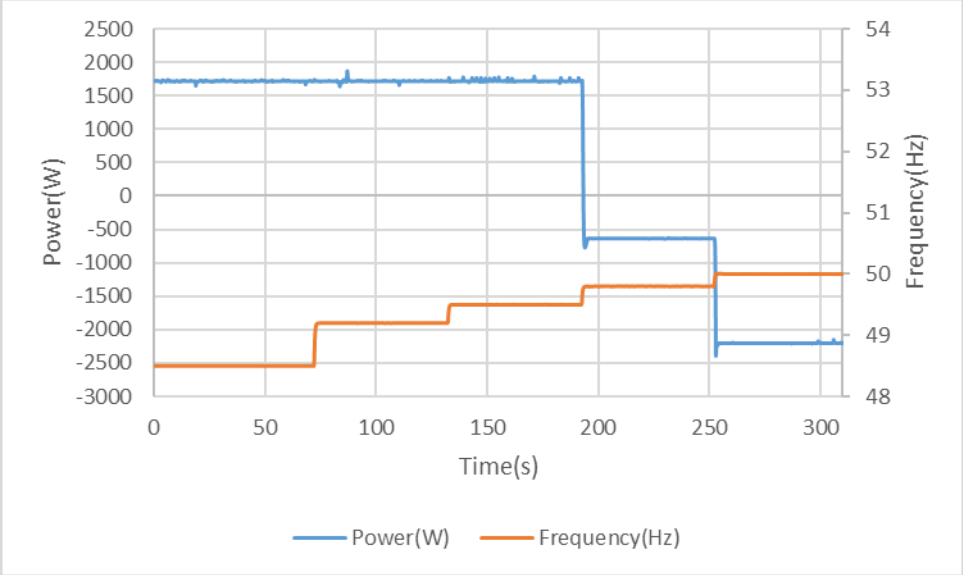
G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

				Battery
49.8	-3210	49.8	1.09%	AC grid / Storage Battery
50.0	-3820	50.0	1.38%	AC grid / Storage Battery

Chart:
Test1:

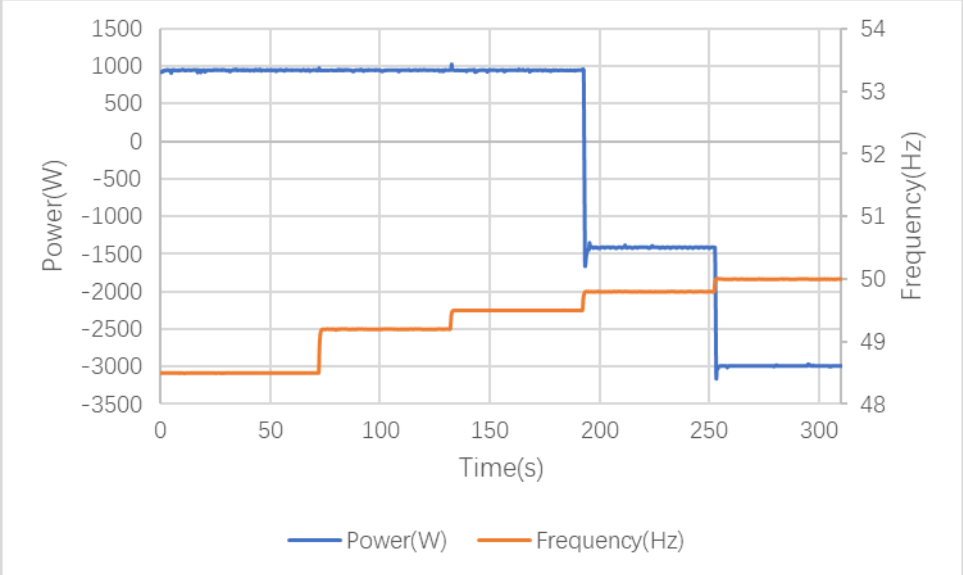


Test2:

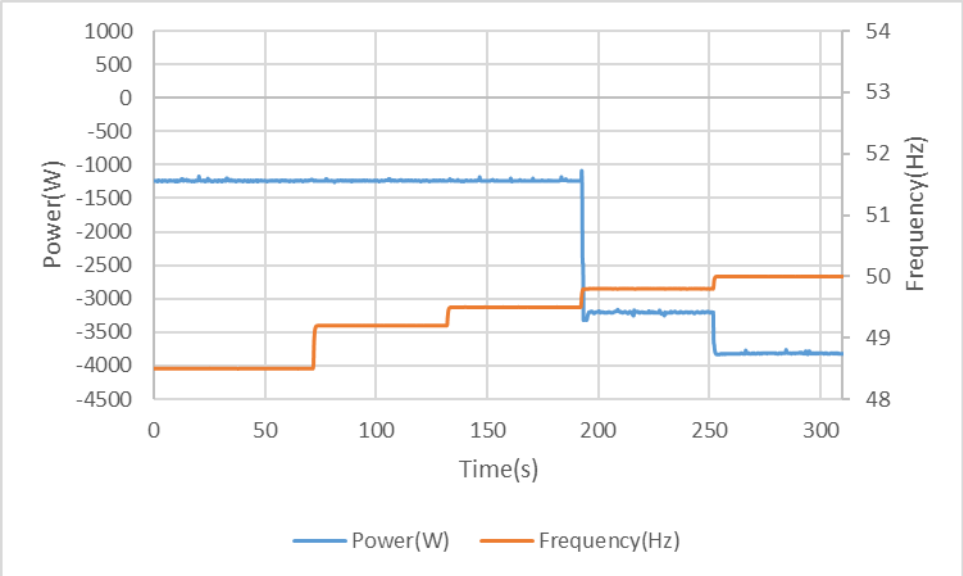


G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Test3:



Test4:



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

13. Re-connection timer					**P**
Model: AU3.6KESL-G3					
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 10.1.			
30 s	45.6 s	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 **Micro-generator** does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
Measured reconnection time		43.92 s	43.92 s	43.38 s	43.35 s

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Reconnection – U < 1.16 p.u. (266.2 V)



Reconnection – U > 0.78 p.u. (180.0 V)



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

Reconnection – F > 47.4 Hz



Reconnection – F < 52.1 Hz



G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

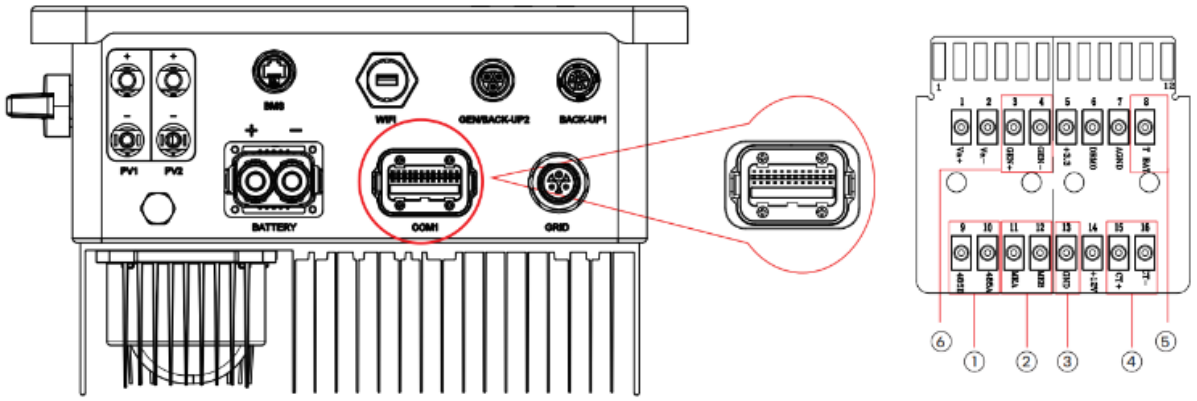
14. Fault level contribution:					**P**
These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (**Inverter** connected) and Annex A2 A.2.3.4 (Synchronous). Please complete each entry, even if the fault contribution is zero.					
Model: AU3.6KESL-G3					
For machines with electro-magnetic output			For **Inverter** output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	N/A	20ms	104	28.27
Initial Value of aperiodic current	A	N/A	100ms	67	28.27
Initial symmetrical short-circuit current*	I_k	N/A	250ms	67	0.08
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	68	0.05
Reactance/Resistance Ratio of source*	$^X/_R$	N/A	Time to trip	0.19	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.					

G98/2			
Clause	Requirement - Test	Result - Remark	Verdict

15. 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)	Yes
16. Self-Monitoring solid state switching: No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (**Inverter** connected).	
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.	N/A
17. 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, Manufacturer's declaration provided.
Additional comments.	

An external emergency stop switch is required.The pins 6 and 7 need to be connected to the normally open contacts of the emergency switch. When the switch is turned on,the power generation module will reduce its active power to zero immediately .

2.Communication line end connector



Pin	1	2	3&5	4	6
Function	BMS 485	METER 485	External NTC of Battery	GRID CT	GEN+/-

Appendix 2: Photo documentation

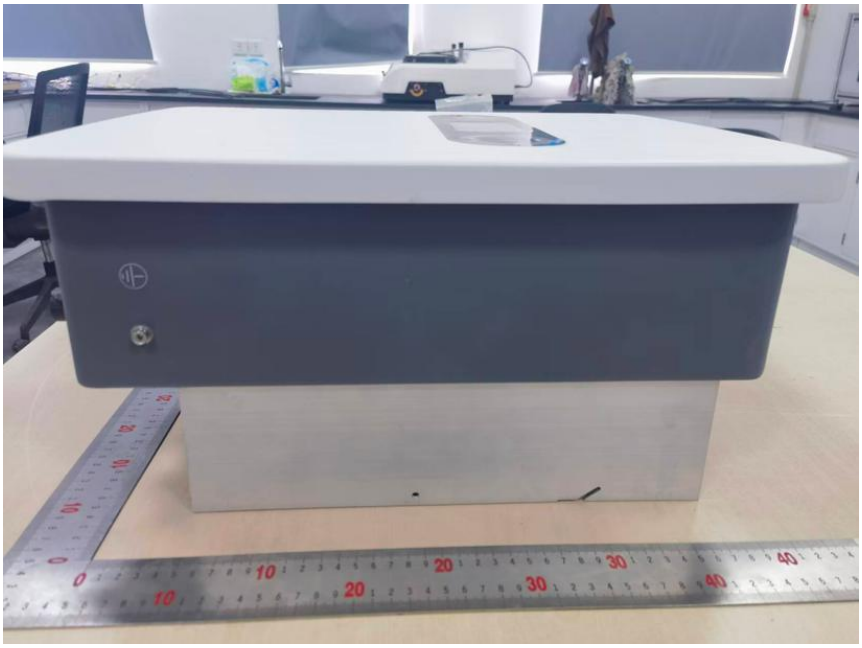
Enclosure – Front View



Enclosure – Rear View



Enclosure – Side view (Right)



Enclosure – Side view (Left)



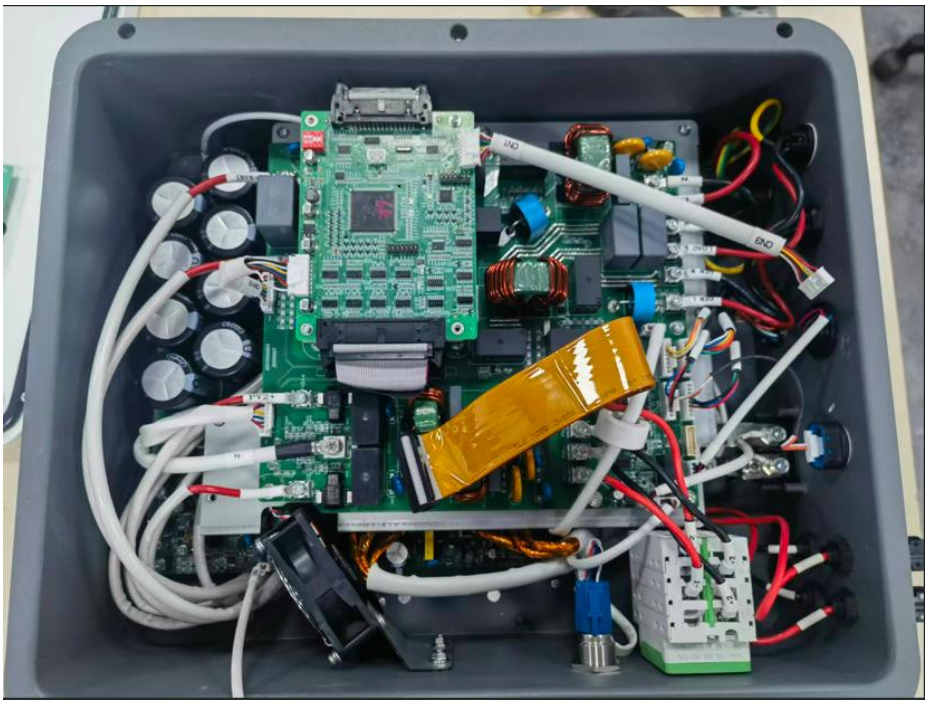
Enclosure – Bottom view

Enclosure – Top view


Upper cover – Rear view



Enclosure – inside view



--- End of test report---

CERTIFICATE OF CONFORMITY

Issued to:	NINGBO AUSTA SOLAR TECH CO.,LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
For the product:	Hybrid Inverter
Trade name:	AUSTA&OSDA
Type/Model:	AU4KESL-G3, AU5KESL-G3, AU6KESL-G3
Ratings:	See Annex
Manufactured by:	NINGBO AUSTA SOLAR TECH CO.,LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Factory:	AUSTA(JIAXING) SOLAR TECH CO.,LTD. No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China
Requirements:	Engineering Recommendation G99 Issue 2:2025 (G99/2:2025) (Requirements for Type A Generating Module)

Type of product certification scheme: Type 1a (Type approval)

This Test Certificate is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6252420.50V1.1.

The examination has been carried out on one single specimen of the product. The Attestation does not include an assessment of the manufacturer's production. Conformity of this production with the specimen tested by DEKRA is not the responsibility of DEKRA.

This Test Certificate expires at the latest on 24 June 2031 or expires upon withdrawal of one of the above mentioned standards.

Shanghai, 24 June 2026 Certificate Number: 6252420.01COC V1.1

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

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PCA-141

DEKRA Testing and Certification (Shanghai) Ltd.
No.250, Jiangchangsan Road, Jing'an District, Shanghai, 200436 People's Republic of China
T +86 21 6056 7600 F +86 21 6056 7555 www.dekra-product-safety.com

Annex to 6252420.01COC V1.1

Ratings of the test product:

Model	AU4KESL-G3	AU5KESL-G3	AU6KESL-G3
PV input:			
Max input voltage (Vdc)	500		
MPPT voltage range (Vdc)	150 – 425		
Start-up voltage (Vdc)	125		
Max input current (A)	18 / 18		
Max short-circuits current (A)	23 / 23		
No. of MPPT trace paths	2		
Strings Per MPPT Tracker	1/1		
AC input (from grid):			
Rated voltage (Vac)	L / N / PE. 220/230/240		
Max. current (A)	34.8	43.5	43.5
Max. power (VA)	8000	10000	10000
Rated frequency (Hz)	50 / 60		
AC output (to grid):			
Rated power (W)	4000	5000	6000
Max. apparent power (VA)	4400	5500	6600
Rated current (A)	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 220/230/240		
Rated frequency (Hz)	50 / 60		
Power factor	0.8 leading …0.8 lagging		
EPS output:			
Rated power (W)	4000	5000	6000
Max. current (A)	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 230		
Rated frequency (Hz)	50 / 60		
Battery:			
Battery type	Lead-acid or Li-ion		
Voltage range (Vdc)	40 - 60		
Max. charge / discharge current (A)	100	120	135
General Data			
Topology	Transformerless		
Protective class	Class I		
Ingress protection (IP) rating	IP66		
Operating temperature	-40 to 60°C (>45°C derating)		
Altitude (m)	3000		
Dimension (W x H x D)	384 x 450 x 226 mm		
Weight	18 kg		
Software version:	DSP: Ver 1.0.0 ARM: Ver 1.0.0		

---------END-------

CERTIFICATE OF CONFORMITY

Issued to:	NINGBO AUSTA SOLAR TECH CO., LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
For the product:	Hybrid Inverter
Trade name:	AUSTA&OSDA
Type/Model:	AU3KESL-G3, AU3.6KESL-G3, AU4KESL-G3, AU5KESL-G3, AU6KESL-G3
Ratings:	See Annex
Manufactured by:	NINGBO AUSTA SOLAR TECH CO., LTD. 3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Factory:	AUSTA(JIAXING) SOLAR TECH CO.,LTD. No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China
Requirements:	Engineering Recommendation G100 Issue 2 – Amendment 2: 2023

Type of product certification scheme: Type 1a (Type approval)

This Test Certificate is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6252420.51V1.1

The examination has been carried out on one single specimen of the product. The certificate does not include an assessment of the manufacturer's production. Conformity of his production with the specimen tested by DEKRA is not the responsibility of DEKRA.

This Test Certificate expires at the latest on 24 June 2031 or expires upon withdrawal of one of the above mentioned standards.

Shanghai, 24 June 2026 Certificate Number: 6252420.02COC V1.1

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

IAS ACCREDITED Product Certification Agency

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DEKRA Testing and Certification (Shanghai) Ltd.
No.250, Jiangchangsan Road, Jing'an District, Shanghai, 200436 People's Republic of China
T +86 21 6056 7600 F +86 21 6056 7555 www.dekra-product-safety.com

Annex

Document no. : 6252420.02COC V1.1

Ratings of the test product:

Model	AU3KESL -G3	AU3.6KESL -G3	AU4KESL -G3	AU5KESL -G3	AU6KESL -G3
PV input:					
Max input voltage (Vdc)	500				
MPPT voltage range (Vdc)	150 – 425				
Start-up voltage (Vdc)	125				
Max input current (A)	18	18 / 18			
Max short-circuits current (A)	23	23 / 23			
No. of MPPT trace paths	1	2			
Strings Per MPPT Tracker	1	1/1			
AC input (from grid):					
Rated voltage (Vac)	L / N / PE. 220/230/240				
Max. current (A)	26.1	31.3	34.8	43.5	43.5
Max. power (VA)	6000	7200	8000	10000	10000
Rated frequency (Hz)	50 / 60				
AC output (to grid):					
Rated power (W)	3000	3600	4000	5000	6000
Max. apparent power (VA)	3300	3600	4400	5500	6600
Rated current (A)	13	16	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 220/230/240				
Rated frequency (Hz)	50 / 60				
Power factor	0.8 leading …0.8 lagging				
EPS output:					
Rated power (W)	3000	3600	4000	5000	6000
Max. current (A)	13	15.7	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 230				
Rated frequency (Hz)	50 / 60				
Battery:					
Battery type	Lead-acid or Li-ion				
Voltage range (Vdc)	40 - 60				
Max. charge / discharge current (A)	75	90	100	120	135
General Data					
Topology	Transformerless				
Protective class	Class I				
Ingress protection (IP) rating	IP66				
Operating temperature	-40 to 60°C (>45°C derating)				
Altitude (m)	3000				
Dimension (W x H x D)	384 x 450 x 226 mm				
Weight	18 kg				

Annex

Document no. : 6252420.02COC V1.1

CLS Designation	Converter with Single-Phase Smart Meter
Manufacturer name	NINGBO AUSTA SOLAR TECH CO.,LTD.
Address	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
CLS information:	
Converter	AU3KESL-G3, AU3.6KESL-G3, AU4KESL-G3, AU5KESL-G3,AU6KESL-G3;
Single-Phase Smart Meter	DDSU666-Q (Zhejiang Chint Electrics Co., Ltd.)

-End-

TEST REPORT
Engineering Recommendation G99/2
Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

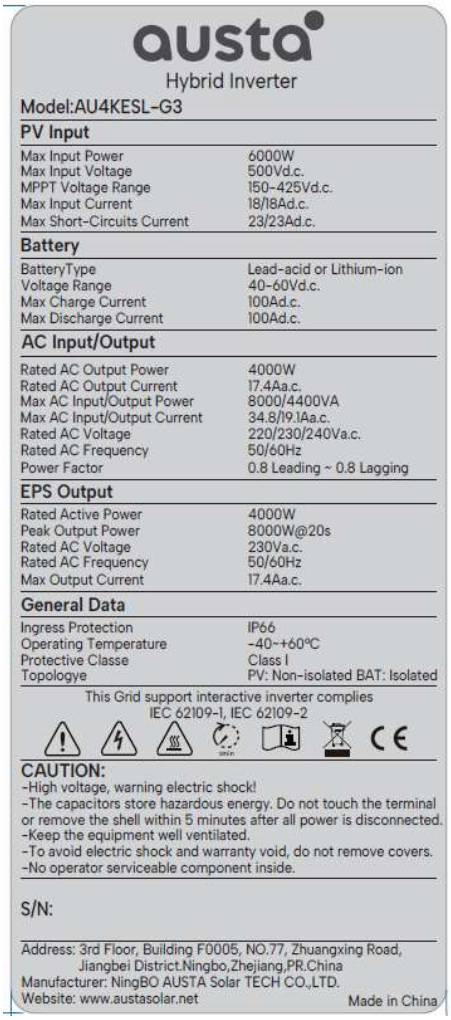
Report	
Report Number. ..... :	6252420.50V1.1
Date of issue..... :	2026-06-17
Total number of pages ..... :	111pages
Testing Laboratory ..... :	DEKRA Testing and Certification (Shanghai) Ltd.
Address ..... :	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China
Applicant's name ..... :	NINGBO AUSTA SOLAR TECH CO.,LTD.
Address ..... :	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Test specification:	
Standard ..... :	Engineering Recommendation G99 Issue 2: 2025 (G99/2:2025) (Requirements for Type A Generating Module)
Test procedure ..... :	Type test
Non-standard test method..... :	N/A
Test Report Form No..... :	G99/2_V1.0
Test Report Form(s) Originator ..... :	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF..... :	Dated 2025-10
Test item description ..... :	Hybrid Inverter
Trade Mark ..... :	AUSTA&OSDA
Manufacturer ..... :	Same as applicant
Model/Type reference ..... :	AU4KESL-G3, AU5KESL-G3, AU6KESL-G3;
Ratings ..... :	See ratings of products on page 9

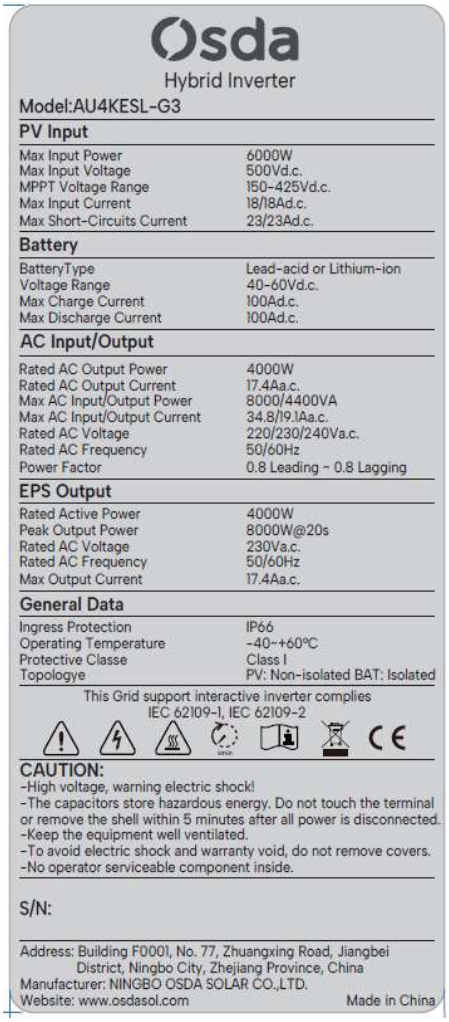
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ **Testing Laboratory:**	DEKRA Testing and Certification (Shanghai) Ltd.	
Testing location/ address ..... :	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China	
Tested by (name, function, signature) ..... :	Yuan Chen (ENG)	Yuan Chen
Approved by (name, function, signature) .. :	Sandy Qian (REW)	Sandy Qian
☐ ~~**Testing procedure: TMP/CTF Stage 1:**~~		
~~**Testing location/ address ..... :**~~		
~~**Tested by (name, function, signature) ..... :**~~		
~~**Approved by (name, function, signature) .. :**~~		
☐ ~~**Testing procedure: WMT/CTF Stage 2:**~~		
~~**Testing location/ address ..... :**~~		
~~**Tested by (name + signature)..... :**~~		
~~**Witnessed by (name, function, signature) . :**~~		
~~**Approved by (name, function, signature) .. :**~~		
☐ ~~**Testing procedure: SMT/CTF Stage 3 or 4:**~~		
~~**Testing location/ address ..... :**~~		
~~**Tested by (name, function, signature) ..... :**~~		
~~**Witnessed by (name, function, signature) . :**~~		
~~**Approved by (name, function, signature) .. :**~~		
~~**Supervised by (name, function, signature) :**~~		

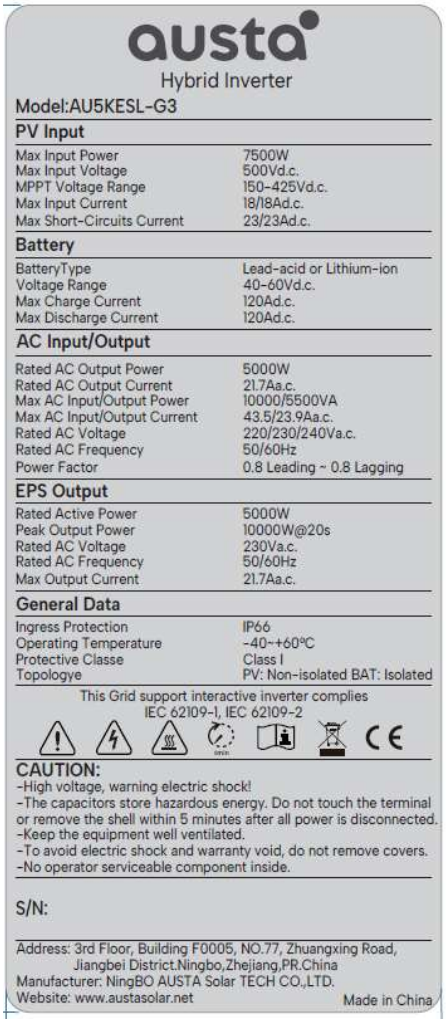
List of Attachments (including a total number of pages in each attachment):	
Appendix 1: A2-3 Compliance Verification Report –Tests for Type A Inverter Connected Power Generating Modules (38 pages) Appendix 2: Photo Documentation (4 pages)	
Summary of testing:	
Tests performed (name of test and test clause):	**Testing location:**
Full applicable clauses test according to standards: Engineering Recommendation G99 Issue 2: 2025	DEKRA Testing and Certification (Shanghai) Ltd.. No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China

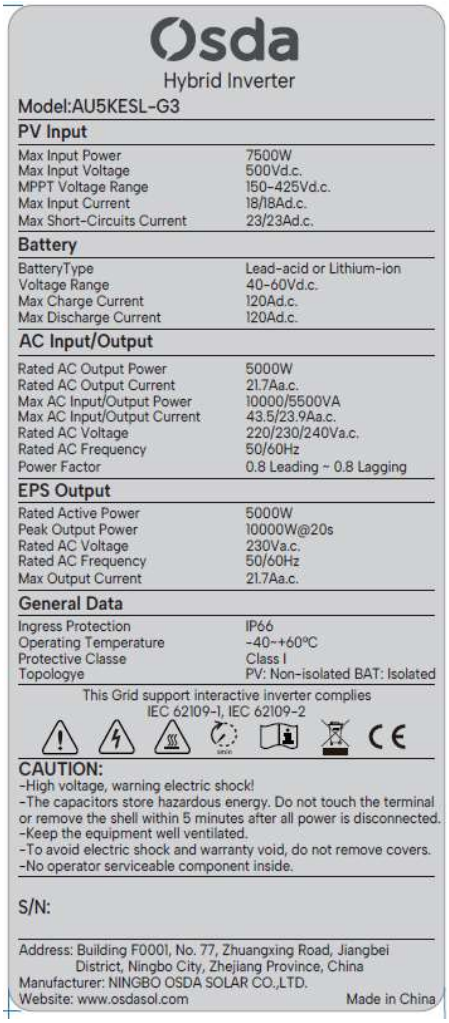
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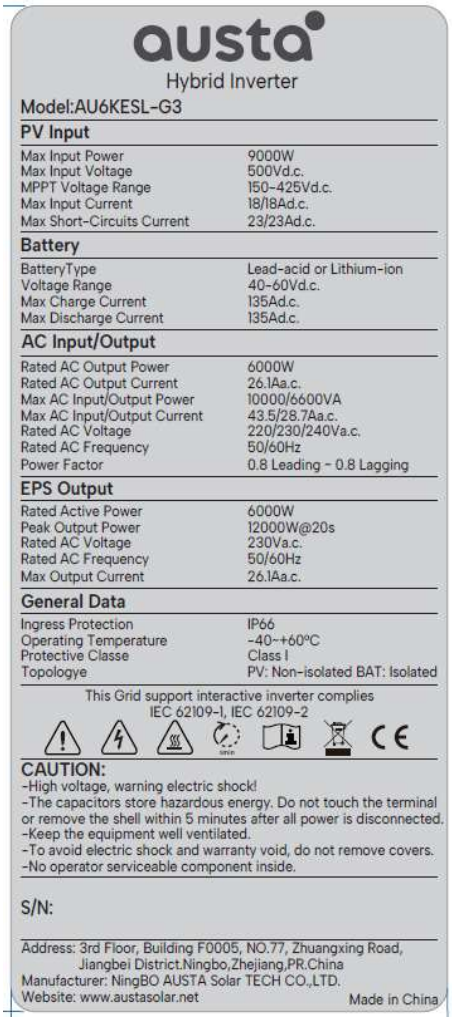
"The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective certification body' s that own these marks".






austa
Hybrid Inverter
Model:AU5KESL-G3
PV Input
Max Input Power 7500W
Max Input Voltage 500Vd.c.
MPPT Voltage Range 150-425Vd.c.
Max Input Current 18/18Ad.c.
Max Short-Circuits Current 23/23Ad.c.
Battery
BatteryType Lead-acid or Lithium-ion
Voltage Range 40-60Vd.c.
Max Charge Current 120Ad.c.
Max Discharge Current 120Ad.c.
AC Input/Output
Rated AC Output Power 5000W
Rated AC Output Current 21.7Aa.c.
Max AC Input/Output Power 10000/5500VA
Max AC Input/Output Current 43.5/23.9Aa.c.
Rated AC Voltage 220/230/240Va.c.
Rated AC Frequency 50/60Hz
Power Factor 0.8 Leading ~ 0.8 Lagging
EPS Output
Rated Active Power 5000W
Peak Output Power 10000W@20s
Rated AC Voltage 230Va.c.
Rated AC Frequency 50/60Hz
Max Output Current 21.7Aa.c.
General Data
Ingress Protection IP66
Operating Temperature -40~+60℃
Protective Classe Class I
Topologye PV: Non-isolated BAT: Isolated
This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2
CE
CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.
S/N:
Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net
Made in China


Osda
Hybrid Inverter
Model:AU5KESL-G3
PV Input
Max Input Power 7500W
Max Input Voltage 500Vd.c.
MPPT Voltage Range 150-425Vd.c.
Max Input Current 18/18Ad.c.
Max Short-Circuits Current 23/23Ad.c.
Battery
BatteryType Lead-acid or Lithium-ion
Voltage Range 40-60Vd.c.
Max Charge Current 120Ad.c.
Max Discharge Current 120Ad.c.
AC Input/Output
Rated AC Output Power 5000W
Rated AC Output Current 21.7Aa.c.
Max AC Input/Output Power 10000/5500VA
Max AC Input/Output Current 43.5/23.9Aa.c.
Rated AC Voltage 220/230/240Va.c.
Rated AC Frequency 50/60Hz
Power Factor 0.8 Leading ~ 0.8 Lagging
EPS Output
Rated Active Power 5000W
Peak Output Power 10000W@20s
Rated AC Voltage 230Va.c.
Rated AC Frequency 50/60Hz
Max Output Current 21.7Aa.c.
General Data
Ingress Protection IP66
Operating Temperature -40~+60℃
Protective Classe Class I
Topologye PV: Non-isolated BAT: Isolated
This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2
CE
CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.
S/N:
Address: Building F0001, No. 77, Zhuangxing Road, Jiangbei District, Ningbo City, Zhejiang Province, China
Manufacturer: NINGBO OSDA SOLAR CO.,LTD.
Website: www.osdasol.com
Made in China


austa
Hybrid Inverter
Model:AU6KESL-G3

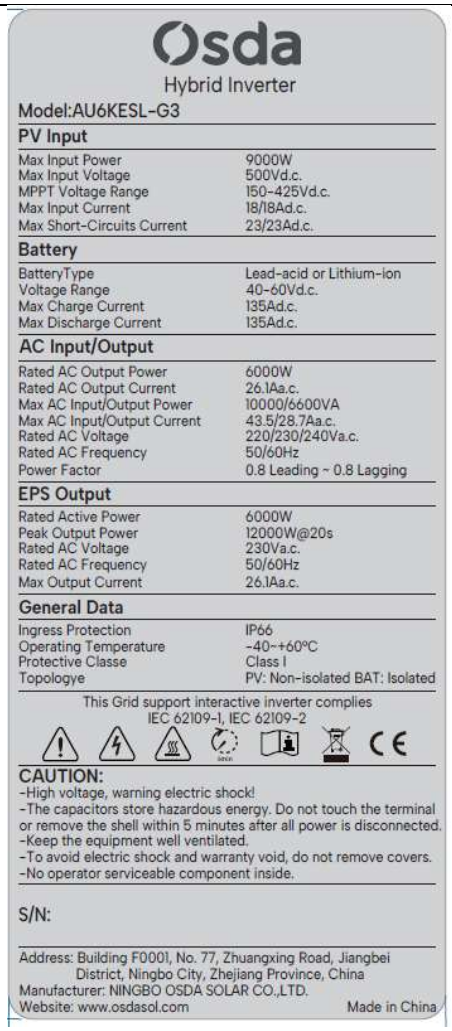
PV Input	
Max Input Power	9000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.
Battery	
BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	135Ad.c.
Max Discharge Current	135Ad.c.
AC Input/Output	
Rated AC Output Power	6000W
Rated AC Output Current	26.1Aa.c.
Max AC Input/Output Power	10000/6600VA
Max AC Input/Output Current	43.5/28.7Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging
EPS Output	
Rated Active Power	6000W
Peak Output Power	12000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	26.1Aa.c.
General Data	
Ingress Protection	IP66
Operating Temperature	-40~+60°C
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies IEC 62109-1, IEC 62109-2

CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.

S/N:

Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net Made in China


Osda
Hybrid Inverter
Model:AU6KESL-G3

PV Input	
Max Input Power	9000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.
Battery	
BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	135Ad.c.
Max Discharge Current	135Ad.c.
AC Input/Output	
Rated AC Output Power	6000W
Rated AC Output Current	26.1Aa.c.
Max AC Input/Output Power	10000/6600VA
Max AC Input/Output Current	43.5/28.7Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging
EPS Output	
Rated Active Power	6000W
Peak Output Power	12000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	26.1Aa.c.
General Data	
Ingress Protection	IP66
Operating Temperature	-40~+60°C
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies IEC 62109-1, IEC 62109-2

CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.

S/N:

Address: Building F0001, No. 77, Zhuangxing Road, Jiangbei District, Ningbo City, Zhejiang Province, China
Manufacturer: NINGBO OSDA SOLAR CO.,LTD.
Website: www.osdasol.com Made in China

As Great Britain public Low Voltage Distribution Networks grid code G99 required, only 230 Vac (phase to neutral conductor voltage) / 50Hz output setting was verified in this test report.

Test item particulars:	
Equipment mobility ..... :	movable hand-held stationary fixed transportable for building-in
Connection to the mains ..... :	pluggable equipment direct plug-in permanent connection for building-in
Environmental category ..... :	outdoor indoor unconditional indoor conditional
Over voltage category Mains ..... :	OVC I OVC II OVC III OVC IV
Over voltage category PV ..... :	OVC I OVC II OVC III OVC IV
Mains supply tolerance (%) ..... :	-90% / +110%
Tested for power systems ..... :	TN
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	Class I Class II Class III Not classified
Mass of equipment (kg) ..... :	See model list
Pollution degree ..... :	Outside PD3; Inside PD2
IP protection class ..... :	IP66
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
- this clause is information reference for installation .... :	Info.
Testing:	
Date of receipt of test item ..... :	2025-10-22 (samples provided by applicant)
Date (s) of performance of tests ..... :	2025-12-10 to 2025-12-25

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
The measurement result is considered in conformance with the requirement if it is within the prescribed limit. It is not necessary to account the uncertainty associated with the measurement result.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.
This report is not used for social proof function in China market.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Name and address of factory (ies):

AUSTA(JIAXING) SOLAR TECH CO.,LTD.
No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China

General product information:

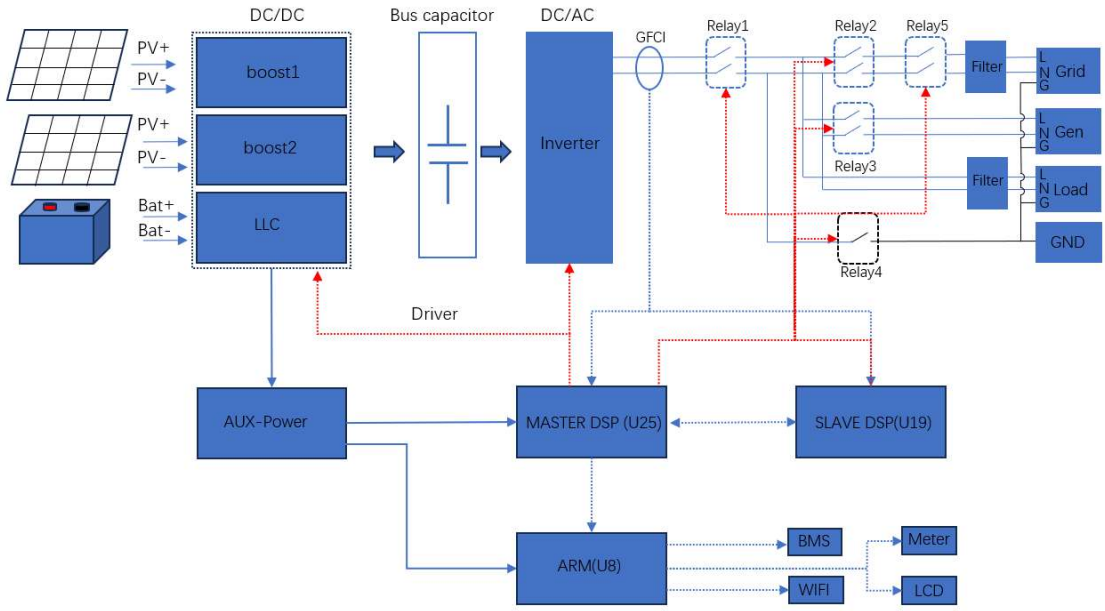
This product is a single-phase Hybrid inverter, which converts the DC voltage of solar panels into three - phase AC voltage and connects to the low-voltage grid to achieve power generation function. It can also control and dispatch power between grid, battery and back up. Inverter can dispatch AC power from grid to back up side, and also rectify AC power into DC power to charge the battery. The power flow between inverter and battery is bi-directional DC power. The specific dispatch mode and power flow direction is controlled by end user via inverter screen settings or APP settings.

There is an auxiliary power supply inside the product. The product can generate full power up to ambient temperature 45°C. When the temperature exceeds 45°C, the output power derates linearly until maximum ambient temperature 60°C.

The relay4 between phase N and GND shall be in the open position in final use.

The product does not provide galvanic separation between the PV input and AC output circuit (Non-isolation or transformerless type).

Block Diagram



The product was tested on:

If no special state, the tests were performed on model AU6KESL-G3.

Hardware version:

Control	Input / Output	Power	LLC	ARM	LCD
31700000805	31700000806	31700000804	31700000803	31700000801	31700000802

Software version:

DSP: Ver 1.0.0

ARM: Ver 1.0.0

Ratings of products:

Model	AU4KESL-G3	AU5KESL-G3	AU6KESL-G3
PV input:			
Max input voltage (Vdc)	500		
MPPT voltage range (Vdc)	150 – 425		
Start-up voltage (Vdc)	125		
Max input current (A)	18 / 18		
Max short-circuits current (A)	23 / 23		
No. of MPPT trace paths	2		
Strings Per MPPT Tracker	1/1		
AC input (from grid):			
Rated voltage (Vac)	L / N / PE. 220/230/240		
Max. current (A)	34.8	43.5	43.5
Max. power (VA)	8000	10000	10000
Rated frequency (Hz)	50 / 60		
AC output (to grid):			
Rated power (W)	4000	5000	6000
Max. apparent power (VA)	4400	5500	6600
Rated current (A)	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 220/230/240		
Rated frequency (Hz)	50 / 60		
Power factor	0.8 leading …0.8 lagging		
EPS output:			
Rated power (W)	4000	5000	6000
Max. current (A)	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 230		
Rated frequency (Hz)	50 / 60		
Battery:			
Battery type	Lead-acid or Li-ion		
Voltage range (Vdc)	40 - 60		
Max. charge / discharge current (A)	100	120	135
General Data			
Topology	Transformerless		
Protective class	Class I		
Ingress protection (IP) rating	IP66		
Operating temperature	-40 to 60°C (>45°C derating)		
Altitude (m)	3000		
Dimension (W x H x D)	384 x 450 x 226 mm		
Weight	18 kg		

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6	**CONNECTION APPLICATION**		-
6.1	**General**		-
6.1.1	This document describes the processes that shall be adopted for both connection of a single Power Generating Module and installations that comprise of a number of Power Generating Modules.		Info.
6.1.2	Type A Power Generating Module(s) ≤ 16A per phase and EREC G98 compliant	Type A Power Generating Module(s) > 16A.	N/A
6.1.2.1	A connection procedure to facilitate the connection and operation of Fully Type Tested Power Generating Modules with aggregate Registered Capacity of less than or equal to 16 A per phase in parallel with public Low Voltage Distribution Network is given in EREC G98 and is not considered further in this document. These are referred to as micro-generators.		N/A
6.1.3	Power Park Modules		P
6.1.3.1	Where an installation comprises a single Generating Unit, the application process, technical and commissioning requirements are based on the Registered Capacity of that Generating Unit. Where an installation comprises multiple Generating Units the application process, technical and commissioning requirements will generally be based on the Registered Capacity of each Power Park Module, and also on the extent to which each Power Park Module is Type Tested.		P
6.1.3.2	Where a new Generating Unit is connected to an existing installation the treatment of the addition will depend on the EREC under which the existing installation was connected. If the existing installation was connected under EREC G59 or EREC G83 then the new Generating Unit will be treated as a separate Power Park Module and managed for compliance with this EREC G99 as a separate Power Generating Module. If, however, the existing installation was completed in compliance with EREC G98 or EREC G99, then the new Power Park Module must be added to the aggregate capacity of the complete installation which shall be used to determine which EREC is applicable.		P
6.1.4	Synchronous Power Generating Modules		N/A
6.1.4.1	Where an installation comprises a single Synchronous Power Generating Module or multiple Synchronous Power Generating Modules, the application process, technical and commissioning requirements are based on the Registered Capacity of each Synchronous Power Generating Module.	Not Synchronous Power Generating Modules.	N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.1.4.2	Where one or more new Synchronous Power Generating Module(s) is to be connected to an existing installation then each new Power Generating Module will be treated as a separate Synchronous Power Generating Module. Only the new Power Generating Module will be required to meet the requirements of this EREC G99 or EREC G98 if applicable. However, note that if the aggregated capacity of all the Power Generating Modules in the Power Generating Facility (ie the Registered Capacity of the Power Generating Facility) reaches the threshold for large as defined in the Grid Code (ie 10 MW in the north of Scotland; 30 MW in the south of Scotland, 100 MW in England and Wales), then the Generator will have to ensure compliance with relevant parts of the Grid Code. Similarly if the Registered Capacity of a Power Generating Facility in England and Wales is 50 MW or more, the Generator will have to comply with paragraphs 6.4.4 and 13.8.		N/A
6.1.5	Illustrative examples		Info.
6.1.5.1	Table 6.1 is provided to illustrate some of the connection scenarios and the EREC requirements.		Info.
6.1.5.2	In respect of Table 6.1 the aggregate Registered Capacity of all the Power Generating Modules in the Power Generating Facility will be taken into account when the DNO considers the effect of the connection on the Distribution Network.		Info.
6.1.6	Interaction with the ISOP		N/A
6.1.6.1	It should be noted that if the aggregate Registered Capacity of all Power Generating Module (synchronous together with asynchronous) on one or more sites in common ownership is >50 MW, then the Generator becomes licensable.		N/A
6.1.6.2	Generators with an agreement with the ISOP may be required to comply with applicable requirements of the Grid Code. Where Grid Code requirements apply, it is the Generator's responsibility to comply with the relevant parts of both the Distribution Code and Grid Code.		N/A
6.1.6.3	In the case where the Generator has a Bilateral Embedded Generation Agreement (BEGA) with the ISOP, the Generator shall demonstrate compliance with this EREC G99 to the DNO, and any additional Grid Code compliance requirements shall be demonstrated by the Generator to the ISOP. In these cases the Generator will make the Generator's interim and final PGMD, and/or the Generator's FON, available to the ISOP on request. The ISOP may seek confirmation from the DNO of the compliance status of the Power Generating Module as recorded on the Generator's PGMD.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.1.6.4	In some cases the Grid Code requirements may be different to those in Sections 12-13 of this EREC G99. In these cases the DNO and the ISOP may agree to apply the Grid Code requirements in substitution for the G99 requirements. In these cases, the DNO will record these exceptions in the Connection Agreement, and the compliance with those requirements will be assessed by the ISOP.		N/A
6.1.6.5	In the case of an embedded large power station, the ISOP will be responsible for confirming the Generator's compliance with all Grid Code requirements. In general this will mean that the requirements of Sections 12-13, 17, 18 and parts of Section 19 of this EREC G99 will be superseded by the equivalent requirements in the Grid Code. The DNO will remain responsible for ensuring the Generator's compliance with the remaining parts of this EREC G99.		N/A
6.1.6.6	See also section 6.2.4.6 regarding the issuing of FONs		N/A
6.2	**Application for Connection**		P
6.2.1	Information about the Power Generating Module(s) is needed by the DNO so that it can assess the effect that a Power Generating Facility may have on the Distribution Network. This document details the parameters to be supplied by a Generator wishing to connect Power Generating Module(s) that do not comply with EREC G98 to a Distribution Network. This document also enables the DNO to request more detailed information if required.		P
6.2.2	Small Generation Installation procedures		N/A
6.2.2.1	Where, typically in a domestic, or similarly small Low Voltage installation, the Generator wishes to install one or more small Generating Units where the Intrinsic Design Capacity of all existing and intended Generating Units is not greater than 32 A per phase, the provisions of the appropriate Small Generation Installation procedure can be followed provided that the Generator's Installation meets the appropriate conditions set out below. Different connection procedures apply depending on the exact capacities and capabilities of the Generating Units and control equipment installed, as summarised in the table below:		N/A

Application Procedure	All individual **Intrinsic Design Capacities**	All individual **Registered Capacities**	Aggregate of **Registered Capacities**	EREC G100 limitation scheme required?
EREC G98	-[10]	≤ 16 A	≤ 16 A	No
EREC G99 SGI-1	≤ 32 A	≤ 16 A	≤ 16 A	No
EREC G99 SGI-2	≤ 32 A	≤ 16 A	≤ 32 A	16 A
EREC G99 SGI-3	≤ 32 A	≤ 32 A	≤ 60 A	32 A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.2.2.2	Small Generation Installation Procedure-1 (a) This procedure SGI-1 applies where the following conditions are met: 1. The new and existing Generating Units are located in a single Generator's Installation; 2. All of the Generating Units (including Electricity Storage devices) are connected via EREC G98 or G99 Fully Type Tested inverters;11 3. The Intrinsic Design Capacity of each Generating Unit is no more than 32 A; 4. Any Generating Unit with an Intrinsic Design Capacity of greater than16 A has its Registered Capacity limited to 16 A; and 5. The total aggregate Registered Capacities of all Generating Units (including Electricity Storage devices) is no more than 16 A per phase; (b) If all the conditions above are satisfied, the Generator can install and commission all the Power Generating Modules and shall submit notification in the format as shown in Form A3-3 (Annex A.1). Note that the DNO may provide a method of submitting this information electronically on line etc. (c) If the Generator wishes to increase the Active Power output of one or more Generating Units comprising the Power Generating Module from its current Registered Capacity such that condition 4 above is no longer satisfied, ie to change or remove the limitation on output, an application in a format as shown in Form A1-1 or Form A1-2 (as applicable and included in Annex A.1) shall be submitted to the DNO.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.2.2.3	Small Generation Installation Procedure-2. (a) This procedure SGI-2 applies where the Generator wishes to install one or more Generating Units and the following conditions, which are essentially the conditions that were applicable for the “Integrated Micro Generation and Storage” procedure in previous versions of EREC G99, are met: 1. The new and existing Generating Units are located in a single Generator’s Installation; 2. All of the Generating Units (including Electricity Storage devices) are connected via EREC G98 or G99 Fully Type Tested inverters;12 3. The Intrinsic Design Capacity of each new and existing Generating Unit is no more than 32A per phase; 4. The Registered Capacity of each new and existing Generating Unit is no more than 16A per phase; 5. The total aggregate Registered Capacities of all the Generating Units (including Electricity Storage devices) is less than 32 A per phase; and 6. An EREC G100 Fully Type Tested export limitation scheme is present that limits the export from the Generator’s Installation to the Distribution Network to no more than 16 A per phase. (b) If all the conditions above are satisfied, the Generator should complete an application in a format as shown in Form A1-2 (Annex A.1). Note that the DNO may provide a method of submitting this information electronically on line etc. (c) The DNO will assess the application. No Power Generating Modules should be installed or commissioned before this DNO assessment is complete and the Generator has been advised of the outcome of this assessment. The DNO will provide the results of the assessment within 10 working days of receiving the application in (b) above. Given the lower limit of Registered Capacities allowed in this procedure SGI-2 compared to that of SGI-3, the DNO will generally apply less complex checks than in procedure SGI-3. (d) The planned commissioning date stated on the application form shall be between 10 working days and 3 months from the date that the application is submitted to the Distribution Network Operator. Confirmation of the		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	commissioning of each Power Generating Module shall be made no later than 28 days after commissioning (where tests and checks are not witnessed in accordance with 16.3.1). Confirmation shall be provided in a format as shown in Form A3-2 (Annex A.3). (e) If, at (c) above, the DNO determines that further analysis is required before a connection offer can be made, the DNO will confirm this. This confirmation ends the SGI-2 process for this application which will then be progressed in line with the DNO's standard application process. No Power Generating Modules should be installed or commissioned before the standard application process completes.		

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.2.2.4	Small Generation Installation Procedure-3. (a) This procedure SGI-3 applies where the following conditions are met: 1. The new and existing Generating Units are located in a single Generator's Installation; 2. All of the Generating Units (including Electricity Storage devices) are connected via EREC G98 or EREC G99 Fully Type Tested inverters;-13 3. The Intrinsic Design Capacity of each new and existing Generating Unit is no more than 32 A. 4. The total aggregate Registered Capacities of all the Generating Units (including Electricity Storage devices) is less than 60 A per phase; and 5. An EREC G100 Fully Type Tested export limitation scheme is present that limits the export from the Generator's Installation to the Distribution Network to 32 A per phase. 6. Condition 5 above can be waived if the aggregate of the Registered Capacities of the Power Generating Units is no more than 32 A. (b) If all the conditions above are satisfied, the Generator should submit an application in a format as shown in Form A1-2 (Annex A.1). Note that the DNO may provide a method of submitting this information electronically on line etc. (c) The DNO will make an initial assessment of the application. No Power Generating Modules should be installed or commissioned before this initial DNO assessment is complete and the Generator has been advised of the outcome of this initial assessment. The DNO will confirm within 10 working days of the submission whether it is necessary for the DNO to undertake site specific analysis of the application, taking into account the Intrinsic Design Capacities, the aggregated Registered Capacities of the Generating Units and the local network conditions. Where the DNO has identified there is a need for further analysis, no further submission of information is required, but installation and commissioning must not proceed until the DNO has established if it is necessary to upgrade the network, and whether such work may be chargeable to the Generator, if the Generator wishes to go ahead with the installation. (d) The planned commissioning date stated on the application form shall be between 10 working days and 3 months from the date that the application is submitted to the DNO. Confirmation of the commissioning of each Power Generating Module shall be made no later than 28 days after commissioning (where tests and checks are not witnessed in accordance with 16.3.1).		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	Confirmation shall be provided in a format as shown in Form A3-2 (Annex A.3).		
6.2.3	Power Generating Facilities which include Type A Power Generating Modules		P
6.2.3.1	For Type A Power Generating Modules the compliance, testing and commissioning requirements are detailed in Section 16 of this EREC G99.	Type A Power Generating Modules.	P
6.2.3.2	The Generator should apply to the local DNO for connection using the DNO's Standard Application Form (available from the DNO's website). On receipt of the application, the DNO will assess whether any Distribution Network studies are required and whether there is a requirement to witness the commissioning tests. In some cases studies to assess the impact on the Distribution Network may need to be undertaken before a firm quotation can be provided to the Generator. On acceptance of the quote, any works at the connection site and any associated facilitating works will need to be completed before the Power Generating Module can be commissioned. On successful completion of the commissioning tests, the DNO will sanction permanent energisation of the Power Generating Module in accordance with Section 16 of this EREC G99.		P
6.2.4	Power Generating Facilities which include Type B, Type C or Type D Power Generating Modules	Type A Power Generating Modules	N/A
6.2.4.1	The connection process is similar to that described in paragraph 6.2.2 above, although detailed system studies will almost certainly be required and consequently the Generator might need to provide additional information. The information should be provided using the Standard Application Form (generally available from the DNO's website). The data that will generally be required is defined in the Distribution Code, Data Registration Code (DDRC), Schedules 5a, 5b and 5c.		N/A
6.2.4.2	For Type B and Type C Power Generating Modules the compliance, testing and commissioning requirements are detailed in Sections 17 and 18 respectively of this EREC G99. On successful completion of a Type B or Type C Power Generating Module Document the DNO will issue a Final Operational Notification to the Generator.		N/A
6.2.4.3	For a Type D Generating Unit, once all the relevant documents have been provided to the DNO to its satisfaction, the DNO will issue an Energisation Operational Notification to the Generator followed by an Interim Operational Notification and a Final Operational Notification. This staged process is described further in Section 19 of this EREC G99.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
6.2.4.4	Generators who own Type B and Type C Power Generating Modules do not have permanent rights to operate their Power Generating Modules without a valid Final Operational Notification which will be issued by the DNO following completion of the commissioning tests and process, refer to paragraphs 17.4.3 and 18.4.3.		N/A
6.2.4.5	Generators who own Type D Power Generating Modules do not have rights to operate their Power Generating Modules without either: (a) a valid Final Operational Notification, refer to paragraph 19.5.4; (b) an Interim Operational Notification, refer to paragraph 19.3.6; or (c) a Limited Operational Notification, refer to paragraph 19.6.4.1.		N/A
6.3	**System Analysis for Connection Design Type A, Type B, Type C and Type D**		Info.
6.4	**Provision of Information**		Info.
7	**CONNECTION ARRANGEMENTS**		P
7.1	**Operating Modes**		P
7.1.1	Power Generating Modules may be designed for one of three operating modes. These are termed long-term parallel operation, infrequent short-term parallel operation and switched alternative-only operation. In the case that a Power Generating Module is designed to switch between these modes of operation, it must be designed to comply with the requirements for each mode.	Long-Term Parallel Operation.	P
7.1.2	Equipment other than Generating Units (eg traction loads, lift motors etc) may act as a short term source of energy, and inject electrical energy into the Customer's Installation when they operate in a regenerative mode. In general EREC G99 will not apply as there will be no need to make any specific design accommodation for such equipment as it is unlikely that they will support any possible power island for a significant length of time. Where such equipment can act as a source of electrical energy for more than a few seconds (say typically 20 s), the DNO will advise the Customer if the Customer's Installation requires any special consideration such as reverse power protection on a case by case basis.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.1.3	In general the technical requirements in EREC G99 will not apply for non-controllable storage technology such as synchronous compensators and synchronous flywheels. This is because there will be no need to make any specific design accommodation for such equipment as it is unlikely that they will support any possible power island for a significant length of time. Where such equipment can act as a source of electrical energy for more than a few seconds (say typically 20 s), the DNO will advise the Customer if the Customer's Installation requires any special consideration, such as reverse power protection or short circuit current contribution assessment, on a case by case basis.		N/A
7.2	**Long-Term Parallel Operation**		P
7.2.1	This refers to the frequent or long-term operation of Power Generating Modules in parallel with the Distribution Network. Unless otherwise stated, all sections in this EREC G99 are applicable to this mode of operation.		P
7.3	**Infrequent Short-Term Parallel Operation**		N/A
7.4	**Switched Alternative-Only Operation**		N/A
7.5	**Phase Balance of Type A Power Generating Module output at LV**		P
7.5.1	Connection of single phase Power Generating Modules may require Distribution Network reinforcement and extension before commissioning for technical reasons (such as voltage issues and unacceptable phase imbalance) depending on the point of connection and Distribution Network design.		N/A
7.5.2	A solution to these voltage issues and phase imbalance issues may be to utilise 3-phase Power Generating Modules or to use multiple single phase Power Generating Modules connected across three phases.	Single-phase grid-connected PV inverter.	N/A
7.5.3	Where single phase Power Generating Modules are being used the Generator should design the installation on a maximum unbalance output of 16 A between the highest and lowest phase.		N/A
7.5.4	In order to illustrate this requirement examples of acceptable and unacceptable connections have been given in Annex A.5.		Info.
7.6	**Type A Power Generating Module capacity for single and split LV phase supplies**		P
7.6.1	The maximum aggregate capacity of Power Generating Modules that can be connected to a single-phase supply is 17 kW. The maximum aggregate capacity of Power Generating Modules that can be connected to a split single-phase supply is 34 kW.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.6.2	There is no requirement to provide intertripping between single phase Inverters where these are installed on multi-phase supplies up to a limit of 17 kW per phase (subject to balance of site output as per Section 7.5). A single phase 17 kW connection may result in an imbalance of up to 17 kW following a Distribution Network or Power Generating Module outage. However, the connection design should result in imbalance under normal operation to be below 16 A between phases as noted above.		N/A
7.6.3	Power Generating Facilities with a capacity above 17 kW per phase are expected to comprise three phase units. The requirement to disconnect all phases following a fault in the Generator's Installation or a Distribution Network outage applies to three phase the Power Generating Modules only and will be tested as part of the compliance testing of the Power Generating Module. In some parts of the country where provision of three phase networks is costly then the DNO may be able to provide a solution using single or spilt phase networks for Power Generating Facilities above the normal limits as set out above.		P
7.7	**Voltage Management Units in Generator's premises**		P
7.7.1	Voltage Management Units are becoming more popular and use various methods, in most cases, to reduce the voltage supplied from the DNO's Distribution Network before it is used by the Generator. In some cases where the DNO's Distribution Network voltage is low they may increase the voltage supplied to the Generator. Some technologies are only designed to reduce voltage and cannot increase the voltage.		Info.
7.7.2	The use of such equipment has the advantage to the Generator of running appliances at a lower voltage and in some cases this can reduce the energy consumption of the appliance. Some appliances when running at a lower voltage will result in higher current consumption as the device needs to take the same amount of energy from the system to carry out its task.		Info.
7.7.3	If a Voltage Management Unit is installed between the Connection Point and the Power Generating Module in a Generators Installation, it may result in the voltage at the Generator side of the Voltage Management Unit remaining within the limits of the protection settings defined in Table 10.1 while the voltage at the Connection Point side of the unit might be outside the limits of the protection settings. This would negate the effect of the protection settings. Therefore, this connection arrangement is not acceptable and all Power Generating Modules connected to the DNO's LV Distribution Network under this Engineering Recommendation must be made on the Connection Point side of any Voltage Management Unit installed in a Generator's Installation.		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
7.7.4	Generators should note that the overvoltage setting defined in Table 10.1 is 4% above the maximum voltage allowed for the voltage from the DNO's Distribution Network under the ESQCR and that provided they have designed their installation correctly there should be very little nuisance tripping of the Power Generating Module. Frequent nuisance tripping of a Power Generating Module may be due to a fault in the Generator's Installation or the operation of the DNO's Distribution Network at too high a voltage. Generators should satisfy themselves that their installation has been designed correctly and all Power Generating Modules are operating correctly before contacting the DNO if nuisance tripping continues. Under no circumstances should they resort to the use of Voltage Management Units installed between the Connection Point and the Power Generating Module.		P
7.8	Power Generating Module Sharing System		N/A
7.8.1	This section describes the additional requirements where a Generator provides Active Power to two or more independent Customers connected at Low Voltage via equipment designed to share the power generated by Power Generating Module(s) under a sharing arrangement.		N/A
7.8.2	In such a sharing arrangement the Power Generating Module(s) are connected to each separate Customers' Installation and power flow through these connections is arranged such that output from the Power Generating Module(s) is shared between them.		N/A
7.8.3	The owner of the Power Generating Module is, for the purposes of this EREC G99, the Generator. The Generator need not have a direct electrical connection to the DNO's Distribution Network. In some cases the connection will only be via the relevant Customers' Installations. In all cases the Generator shall have a suitable contract with the DNO for the installation and operation of the Power Generating Module.		N/A
7.8.4	All Customers served by a Power Generating Module sharing arrangement must be connected to the same section of the DNO's Distribution Network (ie supplied via a single set of Low Voltage fuses at the DNO's substation or equivalent) and also have the same earthing arrangements (eg all be PME or all be SNE). Normally all the Customers' Installations will be within a single building. Any use of a sharing arrangement outside of a single building must be specifically agreed with the DNO.		N/A
7.8.5	Where Power Generating Module output sharing is intended, the following requirements apply:		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.8.5.1	The Generator is responsible for ensuring compliance with all the relevant requirements of this EREC G99, including specifically the requirements of this section 7.8.5.		N/A
7.8.5.2	The equipment/installation shall be designed and constructed such that all protection in each Customers' Installation and the Generator's Installation will operate correctly by design for faults anywhere on the Generator's Installation and Customers' Installations. Such protection shall also comply with the requirements of BS 7671. Particular attention should be paid to ensure that all parts of the Customer's Installation and the Generator's Installation that are within the protection zone of the DNO's cut-out fuse are adequately protected.		N/A
7.8.5.3	The equipment/installation shall be designed such that no Active Power can flow from any Customer's Installation towards the Power Generating Module, ie to prevent Active Power flowing from one Customer's Installation to another or from one Customer's Installation to the Generator's Installation. This restriction does not include any Active Power flow that is used purely for maintaining the equipment implementing the sharing arrangement in an operational state when the Power Generating Module is generating insufficient Active Power, ie the sharing arrangement equipment's parasitic demand: for example that required by a PV sharing arrangement in its quiescent state at night.		N/A
7.8.5.4	An exception to section 7.8.5.3 is allowed where the Generator has incorporated Electricity Storage into the Power Generating Module. In this case the Generator will arrange, and demonstrate, that the Active Power flow into the Electricity Storage component matches the aggregate Active Power flowing from the Generator's Installation and all the relevant Customer's Installations at all times. Under these circumstances all Active Power flows between the components of the sharing arrangement and the Customers' Installations shall be in the same direction, ie towards the Electricity Storage component. If there is a mismatch in aggregate flows or direction the charging of the Electricity Storage shall cease immediately and an alarm raised.		N/A
7.8.5.5	If a Customer's Installation becomes de-energized from the DNO's Distribution Network the equipment shall detect this condition and disconnect the Power Generating Module from that Customer's Installation.		N/A
7.8.5.6	Synchronizing facilities shall be in place and synchronising checks carried out that check for correct phasing each and every time a Customer's Installation is to be connected to the Generator's Installation. The detection of incorrect phasing shall trigger an alarm.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.8.5.7	In situations where the power sharing arrangement results in export of Active Power from the Customers' Installations to the DNO's Distribution Network, the exported Active Power flows to the DNO's Distribution Network shall be arranged to be balanced between the relevant Customers' Connection Points. The characteristics of the distribution of exported Active Power shall be specified in the application, and the export per phase per Customer must not exceed 32A.		N/A
7.8.5.8	All communication channels, ie those between the components of the equipment used to implement the sharing arrangement, and between those components and any part of Customers' Installations, shall be actively monitored, and failure of communication channels shall lead to the appropriate failsafe action, ie disconnection of the Power Generating Module from the relevant Customer's Installation or the complete shut down of the Power Generating Module as appropriate, together with triggering an alarm.		N/A
7.8.5.9	If any of the following are detected: (a) An Active Power flow from any Customer's Installation towards the Power Generating Module (apart from the parasitic demand referred to in 7.8.5.3 above); (b) A mismatch between the aggregate Active Power flow from the Generator's Installations to the Customers' Installation and to any Electricity Storage component of the Power Generating Module as described in section 7.8 5.4; (c) An out of phase condition, as described in section 7.8.5.6; or (d) A failure of any communication channel as described in section 7.8.5.8 an alarm shall be raised and communicated to the Generator.		N/A
7.8.5.10	Earthing arrangements shall be in accordance with BS 7671.		N/A
7.8.5.11	The Power Generating Module sharing arrangement shall be capable of being switched off by the Generator and disconnected via lockable isolation devices from all Customers' Installations.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
7.8.5.12	In addition to the requirements of Section 14 ownership and operational boundaries, and the means of isolation of the Power Generating Module(s) and the connections between the Generator's Installation and the Customer's Installation, shall be clear for every Customer, the Generator, the DNO and for any operator of the network in a shared building. Appropriate labels shall be affixed at each Customer's service position. A single line diagram of the overall installations shall be posted in the Generator's Installation and at each Customer's service position. As well as the standard signage requirements of section 14.2 the following provisions shall apply: (a) The generation sharing equipment itself should be clearly labelled. (b) There should be a specific warning label affixed at each Customer's metering position, each Customer's consumer unit. These labels shall make it clear that the equipment is supplied from more than one source of energy. (c) Depending on the Manufacturer's instructions and installation design additional labels may be required to identify generation sharing neutral connections and any current transformers installed for the generation sharing installation. (d) Where there is more than one set of generation sharing equipment within the installation, cross-referencing shall be used on relevant labels to identify which generation sharing equipment supplies each Customer.		N/A
8	**EARTHING**		P
8.1	**General**		P
8.1.1	The earthing arrangements of the Power Generating Module shall satisfy the requirements of DPC4 of the Distribution Code.		P

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Clause	Requirement - Test	Result - Remark	Verdict
8.1.2	The figures included in section 8 are summarised here:		P

Connection Voltage	Operating Mode	Typical Installation Type	Figure
HV	OM4	Industrial/commercial HV generation	8.1
HV	OM1	Industrial/commercial HV generation	8.2
HV	OM2	Industrial/commercial HV generation	8.3
HV	OM2	Industrial/commercial HV generation	8.4
HV	OM2	Industrial/commercial LV generation in HV system	8.5
HV	OM2	Industrial/commercial	8.6
LV	OM4	Industrial/commercial	8.7
LV	OM1	Industrial/commercial	8.8
LV	OM2	Industrial/commercial	8.9
LV	OM2	Industrial/commercial non-synchronous generation	8.10
LV	OM2	Industrial/commercial single phase non-synchronous generation	8.11
LV	OM1	Domestic single phase non-synchronous	8.12
LV	OM2	Domestic single phase non-synchronous – all Demand islanded	8.13
LV	OM2	Domestic single phase non-synchronous – only essential Demand islanded	8.14
LV	OM3	Industrial/commercial	8.15

8.2	**Power Generating Modules with a Connection Point at HV**		N/A
8.3	**Power Generating Modules with a Connection Point at LV**		P
8.3.1	LV Distribution Networks are always solidly earthed, and the majority are multiple earthed. Design practice for protective multiple earthing is detailed in the Energy Networks Association publications including Engineering Recommendation G12, and in the references contained in those publications.		P
8.3.2	The winding configuration and method of earthing connection shall be agreed with the DNO.		P
8.3.3	In addition, where the Power Generation Facility's Connection Point is at Low Voltage the following shall apply: Where an earthing terminal is provided by the DNO it may be used by a Power Generation Facility for earthing the Power Generating Module, provided the DNO earth connection is of adequate capacity.		P
9	**NETWORK CONNECTION DESIGN AND OPERATION**		P
9.1	**General Criteria**		P
9.1.1	As outlined in Section 5, DNOs have to meet certain statutory and Distribution Licence obligations when designing and operating their Distribution Networks. These obligations will influence the options for connecting Power Generating Modules.		P

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Clause	Requirement - Test	Result - Remark	Verdict
9.1.2	The technical and design criteria to be applied in the design of the Distribution Network and Power Generating Module connection are detailed in this document and DPC 4 of the Distribution Code. The criteria are based upon the performance requirements of the Distribution Network necessary to meet the above obligations.		P
9.1.3	The Distribution Network, and any Power Generating Module connection to that network, shall be designed:		P
	(a) to comply with the obligations (to include security, frequency and voltage; voltage disturbances and harmonic distortion; auto reclosing and single phase protection operation).		P
	(b) according to design principles in relation to Distribution Network's plant and equipment, earthing, voltage regulation and control, and protection as outlined in DPC4, subject to any Modification to which the DNO may reasonably consent.		P
9.1.4	Power Generating Modules should meet a set of technical requirements in relation to its performance with respect to frequency and voltage, control capabilities, protection coordination requirements, Phase (Voltage) Unbalance requirements, neutral earthing provisions, islanding and Black Start Capability as applicable. The technical connection requirements in this chapter are common to all Power Generating Modules.		P
9.1.5	In addition requirements for Type A Power Generating Modules are detailed in Section 11. Requirements for Type B Power Generating Modules are detailed in Section 12. Requirements for Type C and Type D Power Generating Modules are detailed in Section 13.	Type A Power Generating Modules fulfil with Section 11.	P
9.1.6	The Reactive Power and voltage control requirements are given in Section 11, Section 12 and Section 13 for Type A Power Generating Modules, Type B Power Generating Modules, and Type C and Type D Power Generating Modules respectively. They are summarised in Table D.4 for information.		P
9.1.7	Every Power Generating Module and any associated equipment must be designed and operated appropriately to comply with cyber security requirements. The Generator shall consider all cyber security risks applicable to the Power Generating Module in terms of the communication between any energy management system etc and also in terms of interaction with any system of the Manufacturer for product management.	Compliance of cyber security is responsible for client and evaluated by manufacturer.	P

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Clause	Requirement - Test	Result - Remark	Verdict
9.1.8	The Generator shall provide information describing the high level cyber security approach, as well as the specific cyber security requirements complied with. The statement will make appropriate reference to the Power Generating Facilities compliance with: • ETSI EN 303 645; • relevant aspects of PAS 1879 “Energy smart appliances – Demand side response operation – Code of practice”; • relevant aspects of “Distributed Energy Resources – Cyber Security Connection Guidance” published by BEIS and the ENA; • Any other relevant standard that has been incorporated in the design of the Power Generating Module.		P
9.2	**Network Connection Design for Power Generating Modules**		P
9.3	**Step Voltage Change and Rapid Voltage Change**		P
9.4	**Power Quality**		P
9.4.1	Introduction		P
9.4.1.1	The connection and operation of Power Generating Modules may cause Phase (Voltage) Unbalance and/or a distortion of the Distribution Network voltage waveform resulting in voltage fluctuations and harmonics.		P
9.4.2	Flicker		P
9.4.2.1	Where the input motive power of the Power Generating Module may vary rapidly, causing corresponding changes in the output power, flicker may result. The operation of a Power Generating Module including synchronisation, run-up and desynchronisation shall not result in flicker that breaches the limits for flicker that is non-compliant with EREC P28.		P
9.4.2.2	The supply impedance of the Distribution Network needs to be considered to ensure that the emissions produced by the Power Generating Module do not cause a problem on the Distribution Network.		P
9.4.2.3	For Power Generating Modules up to 17 kW per phase or 50 kW three phase voltage step change and flicker measurements as required by BS EN 61000-3-11 shall be made and recorded in the test declaration form A2-1 or form A2-3 as applicable for the Power Generating Module. The DNO will use these declared figures to calculate the required maximum supply impedance required for the connection to comply with EREC P28. This calculation may show that the voltage fluctuations will be greater than those permitted and hence reinforcement of the Distribution Network may be required before the Power Generating Module can be connected. Detailed testing requirements are described in Annex A.7.		P

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Clause	Requirement - Test	Result - Remark	Verdict
9.4.3	Harmonic Emissions		P
9.4.3.1	Harmonic currents produced within the Generator's system and modification of the harmonic impedance caused by the addition of the Generator's installation may cause excessive harmonic voltage distortion in the Distribution Network. The Generator's Installation must be designed and operated to comply with the planning criteria for harmonic voltage distortion as specified in EREC G5. EREC G5, like all planning standards referenced in this recommendation, is applicable at the time of connection of additional equipment to a Generator's Installation.		P
9.4.3.2	For Power Generating Modules of up to 17 kW per phase or 50 kW three phase harmonic measurements as required by BS EN 61000-3-12 shall be made and recorded in the test declaration form A2-1 or form A2-3 as applicable for the Power Generating Module. The DNO will use these declared figures to calculate the required maximum supply impedance required for the connection to comply with BS EN 61000-3-12 and will use this data in their design of the connection for the Power Generating Module. This standard requires a minimum ratio between source fault level and the size of the Power Generating Module, and connections in some cases may require the installation of a transformer between 2 and 4 times the rating of the Power Generating Module in order to accept the connection to a DNO's Distribution Network. Detailed testing requirements are described in Annex A.7		P
9.4.3.3	Where the Power Generating Module is connected via a long cable circuit the likelihood of a resonant condition is greatly increased, especially at 132 kV. This arises from the reaction of the transformer inductance with the cable capacitance. Resonance is likely in the low multiples of the fundamental frequency (8th-11th harmonic). The resonant frequency is also a function of the Total System fault level. If there is the possibility that this can change significantly eg by the connection of another Power Generating Module then a full harmonic study should be carried out.		N/A
9.4.4	Voltage imbalance		P

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Clause	Requirement - Test	Result - Remark	Verdict
9.4.4.1	EREC P29 is a planning standard which provides limits for voltage unbalance caused by uneven loading of three phase supply systems. Power Generating Modules should be capable of performing satisfactorily under the conditions it defines. The existing voltage unbalance on an urban Distribution Network rarely exceeds 0.5% but higher levels, in excess of 1%, may be experienced at times of high load and when outages occur at voltage levels above 11 kV. 1% may exist continuously due to unbalance of the system impedance (common on remote rural networks). In addition, account can be taken of the neutralising effect of rotating plant, particularly at 11 kV and below. BS EN 50160 contains details of the variations and disturbances to the voltage which shall be taken into account in selecting equipment from an appropriate specification for installation on or connected to the Distribution Network.		P
9.4.4.2	The level of voltage unbalance at the Point Of Common Coupling should be no greater than 1.3% for systems with a nominal voltage below 33 kV, or 1% for other systems with a nominal voltage no greater than 132 kV. Overall, voltage unbalance should not exceed 2% when assessed over any one minute period. EREC P29, like all planning standards, is applicable at the time of connection.		P
9.4.4.3	For Power Generating Facilities of 50 kW or less Section 7.5 of this document specifies maximum unbalance of Power Generating Modules. Where these requirements are met then no further action is required by the Generator.		P
9.4.5	Power Factor correction equipment is sometimes used with Power Park Modules to decrease Reactive Power flows on the Distribution Network. Where the Power Factor correction equipment is of a fixed output, stable operating conditions in the event of loss of the DNO supply are extremely unlikely to be maintained, and therefore no special protective actions are required in addition to the standard protection specified in this document.		P
9.4.6	DC Injection		P
9.4.6.1	The effects of, and therefore limits for, DC currents injected into the Distribution Network is an area currently under investigation. Until these investigations are concluded the limit for DC injection is less than 0.25% of the AC rating per Power Generating Module.	See appended table.	P
9.4.6.2	The main source of these emissions are from transformer-less Inverters. Where necessary DC emission requirements can be satisfied by installing a transformer on the AC side of an Inverter.		P
9.5	**System Stability**		P

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Clause	Requirement - Test	Result - Remark	Verdict
9.5.1	Instability in Distribution Networks may result in unacceptable quality of supply and tripping of Generator's plant. In severe cases, instability may cascade across the Distribution Network, resulting in widespread tripping and loss of demand and generation. There is also a risk of damage to plant.		P
9.5.2	In general, System Stability is an important consideration in the design of Power Generating Module connections to the Distribution Network at 33 kV and above. Stability considerations may also be appropriate for some Power Generating Module connections at lower voltages. The risks of instability generally increase as Power Generating Module capacity increases relative to the fault level infeed from the Distribution Network at the Connection Point.		P
9.5.3	System Stability may be classified into several forms, according firstly to the main system variable in which instability can be observed, and secondly to the size of the system disturbance. In Distribution Networks, the forms of stability of interest are rotor angle stability and voltage stability.		P
9.5.3.1	Rotor angle stability refers to the ability of synchronous machines in an interconnected system to remain in Synchronism after the system is subjected to a disturbance.		N/A
9.5.3.2	Voltage stability refers to the ability of a system to maintain acceptable voltages throughout the system after being subjected to a disturbance.		P
9.5.3.3	Both rotor angle stability and voltage stability can be further classified according to the size of the disturbance.		P
9.5.3.4	Small-disturbance stability refers to the ability of a system to maintain stability after being subjected to small disturbances such as small changes in load, operating points of Power Generating Modules, transformer tap-changing or other normal switching events.		P
9.5.3.5	Large-disturbance stability refers to the ability of a system to maintain stability after being subjected to large disturbances such as short-circuit faults or sudden loss of circuits or Power Generating Modules.		P
9.5.3.6	Traditionally, large-disturbance rotor angle stability (also referred to as transient stability) has been the form of stability predominantly of interest in Distribution Networks with synchronous machines. However, it should be noted that the other forms of stability may also be important and may require consideration in some cases.		N/A
9.5.4	It is recommended that a Power Generating Module and its connection to the Distribution Network be designed to maintain stability of the Distribution Network for a defined range of initial operating conditions and a defined set of system disturbances.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
9.5.4.1	The range of initial operating conditions should be based on those which are reasonably likely to occur over a year of operation. Variables to consider include system loads, system voltages, system outages and configurations, and Power Generating Module operating conditions.		P
9.5.4.2	The system disturbances for which stability should be maintained should be selected on the basis that they have a reasonably high probability of occurrence. It is recommended that these include short-circuit faults on single Distribution Network circuits (such as transformers, overhead lines and cables) and busbars, that are quickly cleared by main protection.		P
9.5.5	With the system in its normal operating state, it is desirable that all Power Generation Modules remain connected and stable for any of the following credible fault outages; i. any one single circuit overhead line, transformer feeder or cable circuit, independent of length, ii. any one transformer or reactor, iii. any single section of busbar at or nearest the point of connection where busbar protection with a total clearance time of less than 200ms is installed, iv. if demand is to be secured under a second circuit outage as required by EREC P2, fault outages (a) or (b), overlapping with any pre-existing first circuit outage, usually for maintenance purposes. In this case the combination of circuit outages considered should be that causing the most onerous conditions for System Stability, taking account of the slowest combination of main protection, circuit breaker operating times and strength of the connections to the system remaining after the faulty circuit or circuits have been disconnected.		P
9.5.6	It should be noted that it is impractical and uneconomical to design for stability in all circumstances. This may include double circuit fault outages and faults that are cleared by slow protection. Power Generating Modules that become unstable following system disturbances shall be disconnected as soon as possible to reduce the risk of plant damage and disturbance to the system.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
9.5.7	Various measures may be used, where reasonably practicable, to prevent or mitigate system instability. These may include Distribution Network and Power Generating Module solutions, such as: (a) improved fault clearance times by means of faster protection; (b) improved performance of Power Generating Module control systems (excitation and governor/prime mover control systems; Power System Stabilisers to improve damping); (c) improved system voltage support (provision from either Power Generating Module or Distribution Network plant); (d) reduced plant reactance's (if possible); (e) installation of protection to identify pole-slipping; (f) increased fault level infeed. In determining mitigation measures which are reasonably practicable, due consideration should be given to the cost of implementing the measures and the benefits to the Distribution Network and Generators in terms of reduced risk of system instability.		P
9.6	**Island Mode**		P
9.6.1	There are two specific instances of island mode to be considered: (a) where the Generator wishes to deliberately move from the long-term parallel mode of operation to the situation where the Generator's Power Generating Module(s) is arranged to supply just the load presented by the Customer's Installation, with the Customer's Installation disconnected from the DNO's Distribution Network; or (b) where one or more Power Generating Modules, belonging to one or more Generators, support an isolated part of the DNO's Distribution Network, maintaining supplies to other Customers of the DNO.		P
9.6.2	Customer's Installation Island		P
9.6.2.1	Wherever a Generator's Power Generating Module runs in parallel with the DNO's Distribution Network for more than 5 minutes per month, the design of the Power Generating Module and the Customer's Installation must meet the requirements for long-term parallel operation and comply with all the appropriate requirements of this EREC G99.		P
9.6.2.2	Where a Generator intends to operate the Power Generating Module so that it supplies just the Customer's Installation, it is the Generator's responsibility to ensure the safety of the Customer's Installation in respect of electrical and general safety.		P

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Clause	Requirement - Test	Result - Remark	Verdict
9.6.2.3	The arrangements of Figures 8.6 (HV) and 8.9 (LV) will generally be appropriate for earthing and switching arrangements. Exact designs of Customer's Installations will vary, but the functional requirements of these figures should be implemented.		P
9.6.2.4	It is the Generator's responsibility to ensure appropriate and safe synchronisation to, and disconnection from, the DNO's Distribution Network, respecting the requirements of EREC P28 on voltage disturbances on the DNO's Distribution Network.		P
9.6.3	DNO's Distribution Network Island		P
9.6.3.1	A fault or planned outage, which results in the disconnection of a Power Generating Module, together with an associated section of Distribution Network, from the remainder of the Total System, creates the potential for island mode operation. It will be necessary for the DNO to decide, dependent on local network conditions, if it is desirable for the Generators to continue to generate onto the islanded DNO's Distribution Network. The key potential advantage of operating in island mode is to maintain continuity of supply to the portion of the Distribution Network containing the Power Generating Module. The principles discussed in this section generally also apply where Power Generating Modules on a Generator's site is designed to maintain supplies to that site in the event of a failure of the DNO supply.		P
9.6.3.2	When considering whether Power Generating Modules can be permitted to operate in island mode,10 detailed studies need to be undertaken to ensure that the islanded system will remain stable and comply with all statutory obligations and relevant planning standards when separated from the remainder of the Total System. Before operation in island mode can be allowed, a contractual agreement between the DNO and Generator shall be in place and the legal liabilities associated with such operation shall be carefully considered by the DNO and the Generator. Consideration should be given to the following areas: (a) load flows, voltage regulation, frequency regulation, voltage unbalance, voltage flicker and harmonic voltage distortion; (b) earthing arrangements; (c) short circuit currents and the adequacy of protection arrangements; (d) System Stability; (e) re-synchronisation to the Total System; (f) safety of personnel.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
9.6.3.3	Suitable equipment will need to be installed to detect that an island situation has occurred and an intertripping scheme is preferred to provide absolute discrimination at the time of the event. Confirmation that a section of Distribution Network is operating in island mode, and has been disconnected from the Total System, will need to be transmitted to the Power Generating Module(s) protection and control schemes.		P
9.6.3.4	The ESQCR requires that supplies to Customers are maintained within statutory limits at all times ie when they are supplied normally and when operating in island mode. Detailed system studies including the capability of the Power Generating Module and its control / protections systems will be required to determine the capability of the Power Generating Module to meet these requirements immediately as the island is created and for the duration of the island mode operation.		P
9.6.3.5	The ESQCR also require that Distribution Networks are earthed at all times. Generators, who are not permitted to operate their installations and plant with an earthed star-point when in parallel with the Distribution Network, shall provide an earthing transformer or switched star-point earth for the purpose of maintaining an earth on the system when islanding occurs. The design of the earthing system that will exist during island mode operation should be carefully considered to ensure statutory obligations are met and that safety of the Distribution Network to all users is maintained. Further details are provided in Section 8		P
9.6.3.6	Detailed consideration shall be given to ensure that protection arrangements are adequate to satisfactorily clear the full range of potential faults within the islanded system taking into account the reduced fault currents and potential longer clearance times that are likely to be associated with an islanded system.		P
9.6.3.7	Switchgear shall be rated to withstand the voltages which may exist across open contacts under islanded conditions. The DNO may require interlocking and isolation of its circuit breaker(s) to prevent out of phase voltages occurring across the open contacts of its switchgear. Intertripping or interlocking should be agreed between the DNO and the Generator where appropriate.		P
9.6.3.8	It will generally not be permissible to interrupt supplies to DNO Customers for the purposes of re-synchronisation. The design of the islanded system shall ensure that synchronising facilities are provided at the point of isolation between the islanded network and the DNO supply. Specific arrangements for this should be agreed and recorded in the Connection Agreement with the DNO. If no facilities exist for the subsequent re-synchronisation with the rest of the DNO's Distribution Network then the Generator will, under DNO instruction, ensure that the Power Generating Module is disconnected for re-synchronisation.		P
9.7	**Fault Contributions and Switchgear Considerations**		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10	**PROTECTION**		P
10.1	**General**		P
10.1.1	The main function of the protection systems and settings described in this document is to prevent the Power Generating Module supporting an islanded section of the Distribution Network when it would or could pose a hazard to the Distribution Network or Customers connected to it. The settings recognize the need to avoid nuisance tripping and therefore require a two stage approach where practicable, ie to have a long time delay for smaller excursions that may be experienced during normal Distribution Network operation, to avoid nuisance tripping, but with a faster trip, where possible, for greater excursions.		P
10.1.2	In accordance with established practice it is for the Generator to install, own and maintain this protection. The Generator can therefore determine the approach, ie per Power Generating Module or per installation, and where in the installation the protection is sited.		P
10.1.3	Where a common protection system is used to provide the protection function for multiple Power Generating Modules the complete installation cannot be considered to comprise Fully Type Tested Power Generating Modules if the protection and connections are made up on site and so cannot be factory tested or Type Tested. If the units or Power Generating Modules are specifically designed to be interconnected on site via plugs and sockets, then provided the assembly passes the function tests required in Annex A.2 (Form A2-4), the Power Generating Modules can retain Type Tested status.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.1.4	Type Tested Interface Protection shall have protection settings set during manufacture. An Interface Protection device or relay can only be considered Type Tested if: (a) The frequency and LoM protection settings are factory set in firmware by the Manufacturer to those in Table 10.1 and cannot be changed outside the factory (except as provided by (e) below). (b) The voltage protection settings are factory set to those in Table 10.1 and can be changed by agreement with the DNO and by personnel specifically instructed by the Generator to make this change. (c) The access by the personnel specifically instructed shall be controlled by a password, pin or a physical switch that has the facility to be sealed. (d) Any Interface Protection device functionality other than the voltage protection settings (eg such as any auto reclosing functionality) can only be changed by personnel specifically empowered to do so by the Generator. (e) Any changes to device firmware etc, where Type Tested status is to be retained, outside of the original factory environment shall be undertaken by personnel specifically empowered and equipped for that task by the Manufacturer.		P
10.1.5	Once the Power Generating Modules has been installed and commissioned the protection settings shall only be altered following written agreement between the DNO and the Generator.		P
10.1.6	In exceptional circumstances additional protection may be required by the DNO to protect the Distribution Network and its Customers from the Power Generating Module.		P
10.1.7	Note that where the Generator installs an Export Limiting Scheme in accordance with EREC G100 the installation will also need to comply with the requirements of that EREC.		P
10.2	**Co-ordinating with DNO's Distribution Network's Existing Protection**		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.2.1	It will be necessary for the protection associated with Power Generating Modules to co-ordinate with the Protection associated with the DNO's Distribution Network as follows: (a) For Power Generating Modules directly connected to the DNO's Distribution Network the Power Generating Module must meet the target clearance times for fault current interchange with the DNO's Distribution Network in order to reduce to a minimum the impact on the DNO's Distribution Network of faults on circuits owned by the Generator. The DNO will ensure that the DNO protection settings meet its own target clearance times. The target clearance times are measured from fault current inception to arc extinction and will be specified by the DNO to meet the requirements of the relevant part of the Distribution Network. (b) The settings of any protection controlling a circuit breaker or the operating values of any automatic switching device at any point of connection with the DNO's Distribution Network, as well as the Generator's maintenance and testing regime, shall be agreed between the DNO and the Generator in writing during the connection consultation process.		P
	It will be necessary for the Power Generating Module protection to co-ordinate with any auto-reclose policy specified by the DNO. In particular the Power Generating Module protection should detect a loss of mains situation and disconnect the Power Generating Module in a time shorter than any auto reclose dead time. This should include an allowance for circuit breaker operation and generally a minimum of 0.5 s should be allowed for this. For auto-reclosers set with a dead time of 3 s, this implies a maximum Interface Protection response time of 2.5 s. Where auto-reclosers have a dead time of less than 3 s, there may be a need to reduce the operating time of the Interface Protection. For Type Tested Power Park Modules no changes are required to the operating times irrespective of the auto-reclose times. In all other cases where the auto-recloser dead time is less than 3 s the Generator will need to agree site-specific Interface Protection settings with the DNO.		P
10.2.2	Specific protection required for Power Generating Modules		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	In addition to any protection installed by the Generator to meet his own requirements and statutory obligations on him, the Generator must install protection to achieve the following objectives: (a) For all Power Generating Modules: i. To disconnect the Power Generating Module from the system when a system abnormality occurs that results in an unacceptable deviation of the frequency or voltage at the Connection Point, recognizing the requirements to ride through faults as detailed in Sections 12.3 and 13.4; ii. To ensure the automatic disconnection of the Power Generating Module, or where there is constant supervision of an installation, the operation of an alarm with an audio and visual indication, in the event of any failure of supplies to the protective equipment that would inhibit its correct operation.		P
	(b) For polyphase Power Generating Modules: i. To inhibit connection of Power Generating Modules to the system unless all phases of the DNO's Distribution Network are present and within the agreed ranges of protection settings; ii. To disconnect the Power Generating Module from the system in the event of the loss of one or more phases of the DNO's Distribution Network;		P
	(c) For single phase Power Generating Modules: i. To inhibit connection of Power Generating Modules to the system unless that phase of the DNO's Distribution Network is present and within the agreed ranges of protection settings; ii. To disconnect the Power Generating Module from the system in the event of the loss of that phase of the DNO's Distribution Network;		N/A
10.3	**Protection Requirements**		P
10.3.1	Suitable protection arrangements and settings will depend upon the particular Generator installation and the requirements of the DNO's Distribution Network. These individual requirements must be ascertained in discussions with the DNO. To achieve the objectives above, the protection must include the detection of: • Under Voltage (1 stage); • Over Voltage (2 stage); • Under Frequency (2 stage); • Over Frequency (1 stage); • Loss of Mains (LoM).		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	The LoM protection will depend for its operation on the detection of some suitable parameter, for example, rate of change of frequency (RoCoF), or unbalanced voltages. More details on LoM protection are given in Section 10.4.		P
10.3.2	The protective equipment, provided by the Generator, to meet the requirements of this section must be installed in a suitable location that affords visual inspection of the protection settings and trip indicators and is secure from interference by unauthorised personnel.		P
10.3.3	Installation of automatic reconnection systems for Type B, Type C and Type D shall be subject to prior authorisation by the DNO. Unless Generators of Type D Power Generating Modules have prior authorisation from the DNO for the installation of automatic reconnection systems, they must obtain authorisation from the DNO, or NETSO as applicable, prior to synchronisation.	Type A Power Generating Modules.	N/A
10.3.4	The frequency and voltage at the DNO's side of the supply terminals at the Connection Point must be within the frequency and voltage ranges of the Interface Protection as listed in paragraph 10.6.7 for at least 20 s before the Power Generating Module is allowed to automatically reconnect to the DNO's Distribution Network. There is in general no maximum admissible ramp rate for Active Power output on connecting or reconnecting, although it is a requirement to state the assumed maximum ramp rate for the Power Generating Module as part of the application for connection.		P
10.3.5	If automatic resetting of the protective equipment is used, there must be a time delay to ensure that healthy supply conditions exist for a minimum continuous period of 20 s. Reset times may need to be co-ordinated where more than one Power Generating Module is connected to the same feeder. The automatic reset must be inhibited for faults on the Generator's Installation.		P
10.3.6	Protection equipment is required to function correctly within the environment in which it is placed and shall satisfy the following standards: • BS EN 61000 (Electromagnetic Standards); • BS EN 60255 (Electrical Relays); • BS EN 61810 (Electrical Elementary Relays); • BS EN 60947 (Low Voltage Switchgear and Control gear); • BS EN 61869 (Instrument Transformers; Additional requirements for current transformers). • Where these standards have more than one part, the requirements of all such parts shall be satisfied, so far as they are applicable.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.3.7	Protection equipment and protection functions may be installed within, or form part of the Power Generating Module control equipment as long as: (a) the control equipment satisfies all the requirements of Section 10 including the relevant standards specified in paragraph 10.3.6; (b) the Power Generating Module shuts down in a controlled and safe manner should there be an equipment failure that affects both the protection and control functionality, for example a power supply failure or microprocessor failure; and (c) (c) the equipment is designed and installed so that protection calibration and functional tests can be carried out easily and safely using secondary injection techniques (ie using separate Low Voltage test equipment).		P
10.3.8	The health of protection tripping and/or auxiliary supplies must be monitored such that any failure of these supplies is either brought to the immediate attention of the Generator via an automatic alarm that is monitored by the Generator in real time, or the failure of the protection tripping and/or auxiliary supplies causes the Power Generation Module to be tripped, and reconnection prevented before restoration of the protection tripping and/or auxiliary supplies that have been lost.		P
10.4	**Loss of Mains (LoM)**		P
10.4.1	To achieve the objectives of Section 10.1.1, in addition to protection installed by the Generator for his own purposes, the Generator must install protection to achieve (amongst other things) disconnection of the Power Generating Module from the Distribution Network in the event of loss of one or more phases of the DNOs supply.		P
10.4.2	LoM protection is required for all Type A, Type B and Type C Power Generating Modules. For Type D Power Generating Modules the DNO will advise if LoM protection is required. The requirements of paragraph 10.6.2 apply to LoM protection for all Power Generating Modules.		P
10.4.3	A problem can arise for Generators who operate a Power Generating Module in parallel with the Distribution Network prior to a failure of the network supply because if their Power Generating Module continues to operate in some manner, even for a relatively short period of time, there is a risk that when the network supply is restored the Power Generating Module will be out of Synchronism with the Total System and suffer damage. LoM protection can be employed to disconnect the Power Generating Module immediately after the supply is lost, thereby avoiding damage to the Power Generating Module.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.4.4	Where the amount of Distribution Network load that the Power Generating Module will attempt to pick up following a fault on the Distribution Network is significantly more than its capability the Power Generating Module will rapidly disconnect, or stall. However, depending on the exact conditions at the time of the Distribution Network failure, there may or may not be a sufficient change of load on the Power Generating Module to be able to reliably detect the failure. The Distribution Network failure may result in one of the following load conditions being experienced by the Power Generating Module: (a) The load may slightly increase or reduce, but remain within the capability of the Power Generating Module. There may even be no change of load; (b) The load may increase above the capability of the prime mover, in which case the Power Generating Module will slow down, even though the alternator may maintain voltage and current within its capacity. This condition of speed/frequency reduction can be easily detected; or (c) The load may increase to several times the capability of the Power Generating Module, in which case the following easily detectable conditions will occur: • Overload and accompanying speed/frequency reduction • Over current and under voltage on the alternator		P
10.4.5	Conditions (b) and (c) are easily detected by the under and over voltage and frequency protection required in this document. However, condition (a) presents most difficulty, particularly if the load change is extremely small and therefore there is a possibility that part of the Distribution Network supply being supplied by the Power Generating Module will be out of Synchronism with the Total System. LoM protection is designed to detect these conditions.		P
10.4.6	LoM signals can also be provided by means of intertripping signals from circuit breakers that have operated in response to the Distribution Network fault.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.4.7	The LoM protection can utilise one or a combination of the passive protection principles such as reverse Active Power flow, reverse Reactive Power and rate of change of frequency (RoCoF). Alternatively, active methods such as reactive export error detection or frequency shifting may be employed. These may be arranged to trip the interface circuit breaker at the DNO Generator interface, thus, leaving the Power Generating Module available to satisfy the load requirements of the site or the Power Generating Module circuit breaker can be tripped, leaving the breaker at the interface closed and ready to resume supply when the Distribution Network supply is restored. The most appropriate arrangement is subject to agreement between the DNO and Generator.	See appended table.	P
10.4.8	Protection based on measurement of reverse flow of Active Power or Reactive Power can be used when circumstances permit and must be set to suit the Power Generating Module rating, the site load conditions and requirements for Reactive Power.		P
10.4.9	Where the Power Generating Facility capacity is such that the site will always import power from the Distribution Network, a reverse power relay may be used to detect failure of the supply. It will usually be appropriate to monitor all three phases for reverse power.		P
10.4.10	However, where the Power Generating Facilities normal mode of operation is to export power, it is not possible to use a reverse power relay and consequently failure of the supply cannot be detected by measurement of reverse power flow. The protection should then be specifically designed to detect loss of the mains connection using techniques to detect the rate of change of frequency and/or Power Factor. All these techniques are susceptible to Distribution Network conditions and the changes that occur without islanding taking place. These relays must be set to prevent islanding but with the best possible immunity to unwanted nuisance operation.		P
10.4.11	RoCoF relays use a measurement of the period of the mains voltage cycle. The RoCoF technique measures the rate of change in frequency caused by any difference between prime mover power and electrical output power of the Power Generating Module over a number of cycles. RoCoF relays should normally ignore the slow changes but respond to relatively rapid changes of frequency which occur when the Power Generating Module becomes disconnected from the Total System. The voltage vector shift technique is not an acceptable loss of mains protection.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.4.12	Should spurious tripping present a nuisance to the Generator, the cause must be jointly sought with the DNO. Raising settings on any relay to avoid spurious operation may reduce a relay's capability to detect islanding and it is important to evaluate fully such changes. Annex D.2 provides some guidance for assessments, which assume that during a short period of islanding the trapped load is unchanged. In some circumstances it may be necessary to employ a different technique, or a combination of techniques to satisfy the conflicting requirements of safety and avoidance of nuisance tripping. In those cases where the DNO requires LoM protection this must be provided by a means not susceptible to spurious or nuisance tripping, eg intertripping.		P
10.4.13	For a radial or simple Distribution Network controlled by circuit breakers that would clearly disconnect the entire circuit and associated Power Generating Module, for a LoM event an intertripping scheme can be easy to design and install. For meshed or ring Distribution Networks, it can be difficult to define which circuit breakers may need to be incorporated in an intertripping scheme to detect a LoM event and the inherent risks associated with a complex system should be considered alongside those associated with a using simple, but potentially less discriminatory LoM relay.		P
10.4.14	It is the responsibility of the Generator to incorporate what they believe to be the most appropriate technique or combination of techniques to detect a LoM event in his protection systems. This will be based on knowledge of the Power Generating Module, site and network load conditions. The DNO will assist in the decision making process by providing information on the Distribution Network and its loads. The settings applied must be biased to ensure detection of islanding under all practical operating conditions.		P
10.5	**Additional DNO Protection**		P
10.5.1	Following the DNO connection study, the risk presented to the Distribution Network by the connection of a Power Generating Module may require additional protection to be installed and may include the detection of: • Neutral Voltage Displacement (NVD); • Over Current; • Earth Fault; • Reverse Power.		P
10.5.2	Neutral Voltage Displacement (NVD) Protection		N/A
10.6	**Protection Settings**		P
10.6.1	The following notes aim to explain the settings requirements as given in Section 10.6.7 below.		P
10.6.2	Loss of Mains	See appended table.	P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	A LoM protection of the RoCoF type will generally be appropriate for Type A, Type B and Type C Power Generating Modules, but this type of LoM protection must not be installed for Power Generating Facilities at or above 50 MW. In those cases where the DNO requires LoM protection this must be provided by a means not susceptible to spurious or nuisance tripping, eg intertripping.		P
10.6.3	Under Voltage	See appended table.	P
	In order to help maintain Total System Stability, the protection settings aim to facilitate transmission fault ride through capability (as required in Sections 12.3 and 13.3 below). The overall aim is to ensure that Power Generating Module is not disconnected from the Distribution Network unless there is material disturbance on the Distribution Network, as disconnecting generation unnecessarily will tend to make an under voltage situation worse. To maximize the transmission fault ride through capability a single undervoltage setting of - 20% with a time delay of 2.5 s should be applied.		P
10.6.4	Over Voltage	See appended table.	P
	Over voltages are potentially more dangerous than under voltages and hence the acceptable excursions from the norm are smaller and time delays shorter, a 2-Stage over voltage protection6 is to be applied as follows: • Stage 1 (LV) should have a setting of +14% (ie the LV statutory upper voltage limit of +10%, with a further 4% permitted for voltage rise internal to the Generator's Installation and measurement errors), with a time delay of 1.0 s (to avoid nuisance tripping for short duration excursions); • Stage 2 (LV) should have a setting of +19% with a time delay of 0.5 s (ie recognising the need to disconnect quickly for a material excursion);		P
	• Stage 1 (HV) should have a setting of +10% with a time delay of 1.0 s (ie the HV statutory upper voltage limit of +6%, with a further 4% permitted for voltage rise internal to the Generator's Installation and measurement errors), with a time delay of 1.0 s to avoid nuisance tripping for short duration excursions); • Stage 2 (HV) should have a setting of +13% with a time delay of 0.5 s (ie recognising the need to disconnect quickly for a material excursion).		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	To achieve high utilisation and Distribution Network efficiency, it is common for the HV Distribution Network to be normally operated near to the upper statutory voltage limits. The presence of Power Generating Module within such Distribution Network may increase the risk of the statutory limit being exceeded, eg when the Distribution Network is operating abnormally. In such cases the DNO may specify additional over voltage protection at the Power Generating Module Connection Point. This protection will typically have an operating time delay long enough to permit the correction of transient over voltages by automatic tap-changers.		N/A
10.6.5	Over Frequency		P
	Power Generating Modules are required to stay connected to the Total System for frequencies up to 52 Hz for up to 15 minutes so as to provide the necessary regulation to control the Total System frequency to a satisfactory level. In order to prevent the unnecessary disconnection of a large volume of smaller Power Generating Module for all LV and HV connected Power Generating Module a single stage protection is to be applied that has a time delay of 0.5 s and a setting of 52 Hz. If the frequency rises to or above 52 Hz as the result of an undetected islanding condition, the Power Generating Module will be disconnected with a delay of 0.5 s plus circuit breaker operating time.	See appended table.	P
10.6.6	Under Frequency		P
	All Power Generating Facilities are required to maintain connection unless the Total System frequency falls below 47.5 Hz for 20 s or below 47 Hz. For all LV and HV connected Power Generating Module, the following 2-stage under frequency protection should be applied: • Stage 1 should have a setting of 47.5 Hz with a time delay of 20 s; • Stage 2 should have a setting of 47.0 Hz with a time delay of 0.5 s;	See appended table.	P
10.6.7	Protection Settings		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.6.7.1	**Table 10.1 Settings for Long-Term Parallel Operation**		P

Protection Function	Type A, Type B and Type C Power Generating Modules				Type D Power Generating Modules and Power Generating Facilities with a Registered Capacity > 50 MW	
	LV Protection(1)		HV Protection(1)			
	Trip Setting	Time Delay Setting	Trip Setting	Time Delay Setting	Trip Setting	Time Delay Setting
U/V	Vφ-n† -20%	2.5 s*	Vφ-φ‡ -20%	2.5 s*	Vφ-φ‡ -20%	2.5 s*
O/V st 1	Vφ-n† + 14%	1.0 s	Vφ-φ‡ + 10%	1.0 s	Vφ-φ‡ + 10%	1.0 s
O/V st 2	Vφ-n†+ 19%$	0.5 s	Vφ-φ‡ + 13%	0.5 s		
U/F st 1	47.5 Hz	20 s	47.5 Hz	20 s	47.5 Hz	20 s
U/F st 2	47.0 Hz	0.5 s	47.0 Hz	0.5 s	47.0 Hz	0.5 s
O/F	52.0 Hz	0.5 s	52.0 Hz	0.5 s	52.0 Hz	0.5 s
LoM (RoCoF)#	1 Hzs^{-1} time delay 0.5 s		1 Hzs^{-1} time delay 0.5 s		Intertripping expected	

	(1) HV and LV Protection settings are to be applied according to the voltage at which the voltage related protection reference is measuring, eg: • If the EREC G99 protection takes its voltage reference from an LV source then LV settings shall be applied. Where a private non standard LV network exists the settings shall be calculated from HV settings values as indicated by Section 10.6.14; • If the EREC G99 protection takes its voltage reference from an HV source then HV settings shall be applied. †A value of 230 V shall be used in all cases for Power Generating Facilities connected to a DNO's LV Distribution Network ie the U/V LV trip setting is 184 V, the O/V stage 1 setting is 262.2 V and the O/V stage 2 setting is 273.7 V. ‡A value to suit the nominal voltage of the HV Connection Point. * Might need to be reduced if auto-reclose times are <3 s. (see 10.2.1). # Intertripping may be considered as an alternative to the use of a LoM relay. $ For voltages greater than 230 V +19% which are present for periods of<0.5 s the Power Generating Module is permitted to reduce/cease exporting in order to protect the Power Generating Module.		P

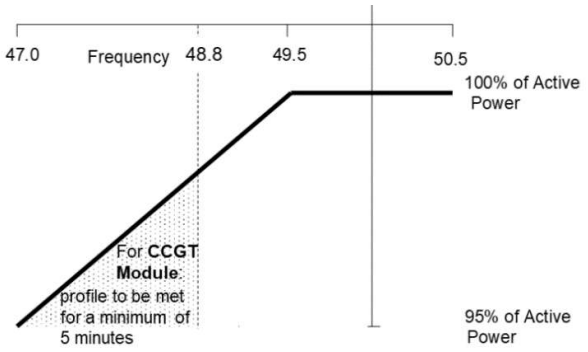
<table>
<tr><th colspan="4">G99/2</th></tr>
<tr><th>Clause</th><th>Requirement - Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td></td><td>The required RoCoF protection requirement is expressed in Hertz per second (Hzs^{-1}). The time delay should begin when the measured RoCoF exceeds the threshold expressed in Hzs^{-1}. The time delay should be reset if measured RoCoF falls below that threshold. The relay must not trip unless the measured rate remains above the threshold expressed in Hzs^{-1} continuously for 500 ms. Setting the number of cycles on the relay used to calculate the RoCoF is not an acceptable implementation of the time delay since the relay would trip in less than 500 ms if the system RoCoF was significantly higher than the threshold.</td><td></td><td>P</td></tr>
<tr><td></td><td>(2) Note that the times in the table are the time delays to be set on the appropriate relays. Total protection operating time from condition detection to circuit breaker opening will be of the order of 100 ms longer than the time delay settings in the above table with most circuit breakers, slower operation is acceptable in some cases.</td><td></td><td>P</td></tr>
<tr><td></td><td>The Manufacturer must ensure that the Interface Protection in a Type Tested Power Generating Module is capable of measuring voltage to an accuracy of ±1.5% of the nominal value and of measuring frequency to ± 0.2% of the nominal value across its operating range of voltage, frequency and temperature.</td><td></td><td>P</td></tr>
<tr><td>10.6.7.2</td><td>Table 10.2 – Settings for Infrequent Short-Term Parallel Operation
<table>
<tr><th rowspan="2">Protection Function</th><th colspan="4">Type A, Type B and Type C Power Generating Module</th></tr>
<tr><th colspan="2">LV Protection</th><th colspan="2">HV Protection</th></tr>
<tr><th>Trip Setting</th><th>Time Delay Setting</th><th>Trip Setting</th><th>Time Delay Setting</th></tr>
<tr><td>U/V</td><td>Vφ-n† -10%</td><td>0.5 s</td><td>Vφ-φ‡ -6%</td><td>0.5 s</td></tr>
<tr><td>O/V</td><td>Vφ-n† + 14%</td><td>0.5 s</td><td>Vφ-φ‡ + 6%</td><td>0.5 s</td></tr>
<tr><td>U/F</td><td>49.5 Hz</td><td>0.5 s</td><td>49.5 Hz</td><td>0.5 s</td></tr>
<tr><td>O/F</td><td>50.5 Hz</td><td>0.5 s</td><td>50.5 Hz</td><td>0.5 s</td></tr>
</table>
†A value of 230 V shall be used in all cases for Power Generating Facilities connected to a DNO's LV Distribution Network (ie the U/V LV trip setting is 207 V and the O/V trip setting is 262.2 V).
‡A value to suit the voltage of the HV Connection Point.</td><td>Long-Term Parallel Operation.</td><td>N/A</td></tr>
<tr><td>10.6.8</td><td>Over and Under voltage protection must operate independently for all three phases in all cases.</td><td></td><td>P</td></tr>
<tr><td>10.6.9</td><td>The settings in Table 10.1 should generally be applied to all Power Generating Modules. In exceptional circumstances Generators have the option to agree alternative settings with the DNO if there are valid justifications in that the Power Generating Module may become unstable or suffer damage with the settings specified in Table 10.1. The agreed settings should be recorded in the Connection Agreement.</td><td></td><td>P</td></tr>
</table>

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
10.6.10	Once the settings of relays have been agreed between the Generator and the DNO they must not be altered without the written agreement of the DNO. Any revised settings should be recorded again in the amended Connection Agreement.		P
10.6.11	The under/over voltage and frequency protection may be duplicated to protect the Power Generating Module when operating in island mode although different settings may be required.		P
10.6.12	For LV connected Power Generating Modules the voltage settings will be based on the 230 V nominal system voltage. In some cases Power Generating Modules may be connected to LV systems with non-standard operating voltages. Paragraph 10.6.14 details how suitable settings can be calculated based upon the HV connected settings in Table 10.1. Note that Power Generating Modules with non-standard LV protection settings need to be agreed by the DNO on a case by case basis.		P
10.6.13	Where an installation contains Power Factor correction equipment which has a variable susceptance controlled to meet the Reactive Power demands, the probability of sustained generation is increased. For LV installations, additional protective equipment provided by the Generator, is required as in the case of self-excited asynchronous machines.	No such equipment used.	N/A
10.6.14	Non-Standard private LV networks calculation of appropriate protection settings		N/A
10.6.15	The Generator shall provide a means of displaying the protection settings so that they can be inspected if required by the DNO to confirm that the correct settings have been applied. The Manufacturer needs to establish a secure way of displaying the settings in one of the following ways: (a) A display on a screen which can be read; (b) A display on an electronic device which can communicate with the Power Generating Module and confirm that it is the correct device by means of a Identification number / name permanently fixed to the device and visible on the electronic device screen at the same time as the settings; (c) Display of all settings including nominal voltage and current outputs, alongside the identification number / name of the device, permanently fixed to the Power Generating Module.		P

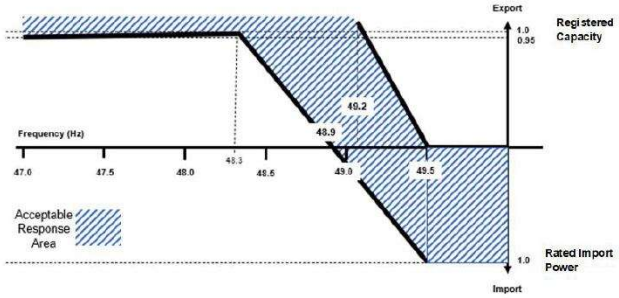
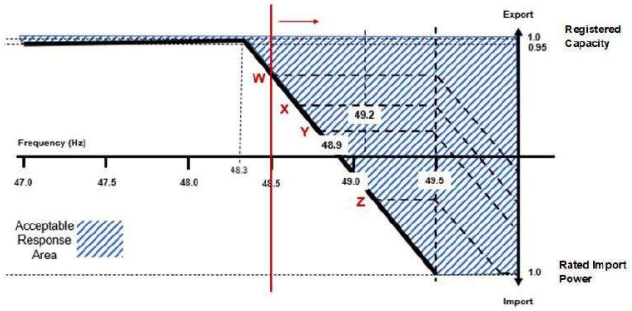
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	The provision of loose documents, documents attached by cable ties etc., a statement that the device conforms with a standard, or provision of data on adhesive paper based products which are not likely to survive due to fading, or failure of the adhesive, for at least 20 years is not acceptable. The protection arrangements (including changes to protection arrangements) for individual schemes will be agreed between the Generator and the DNO in accordance with this document.		P
10.6.16	Whilst the protection schemes and settings for internal electrical faults should mitigate any damage to the Power Generating Module they must not jeopardise the performance of a Power Generating Module, in line with the requirements set out in this EREC.		P
10.6.17	The Generator shall organise its protection and control devices in accordance with the following priority ranking (from highest to lowest) for Type B, Type C and Type D Power Generating Modules: (a) network and Power Generating Module protection; (b) synthetic inertia, if applicable; (c) frequency control (Active Power adjustment -if any); (d) power restriction (if any); and (e) power gradient constraint (if any).	Type A Power Generating Module.	N/A
10.6.18	For the avoidance of doubt where an internal fault on the Power Generating Module occurs during any significant event on the Total System, the Power Generating Module's internal protection should trip the module to ensure safety and minimise damage to the Power Generating Module.		P
10.7	**Typical Protection Application Diagrams**		Info.
10.7.1	This Section provides some typical protection application diagrams in relation to parallel operation of Power Generating Modules within DNO Distribution Networks. The diagrams only relate to DNO requirements in respect of the connection to the Distribution Network and do not necessarily cover the safety of the Generator's Installation. The diagrams are intended to illustrate typical installations.		Info.
11	**TYPE A POWER GENERATING MODULE TECHNICAL REQUIREMENTS**		P
11.1	Power Generating Module Performance and Control Requirements – General		P
11.1.1	The requirements of this Section 11 do not apply in full to: (a) Power Generation Facilities that are designed and installed for infrequent short-term parallel operation only; or (b) Electricity Storage Power Generation Modules within the Power Generating Facility commissioned before 01 September 2022.		Info.

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.1.2	The Active Power output of a Power Generating Module should not be affected by voltage changes within the statutory limits declared by the DNO in accordance with the ESQCR.		P
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.		P
11.1.3.1	By default the DNO 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 Power Generating Module that is being switched can be either AC (maximum value 240 V) or DC (maximum value 110 V). If the DNO wishes to make use of the facility to cease Active Power output the DNO will agree with the Generator how the communication path is to be achieved.		P
11.1.4	Each item of a Power Generating Module and its associated control equipment must be designed for stable operation in parallel with the Distribution Network.		P
11.1.5	When operating at rated power 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.		P
11.1.6	As part of the connection application process the Generator shall agree with the DNO the set points of the control scheme for voltage control, Power Factor control or Reactive Power control as appropriate. These settings, and any changes to these settings, shall be agreed with the DNO and recorded in the Connection Agreement. The information to be provided is detailed in Schedule 5a and Schedule 5b of the Data Registration Code.		P
11.1.7	Load flow and System Stability studies may be necessary to determine any output constraints or post fault actions necessary for n-1 fault conditions and credible n-2 conditions (where n-1 and n-2 conditions are the first and second outage conditions as, for example, specified in EREC P2) involving a mixture of fault and planned outages. The Connection Agreement should include details of the relevant outage conditions. It may be necessary under these fault conditions, where the combination of Power Generating Module output, load and through flow levels leads to circuit overloading, to rapidly disconnect or constrain the Power Generating Module.		P
11.2	**Frequency response**		P

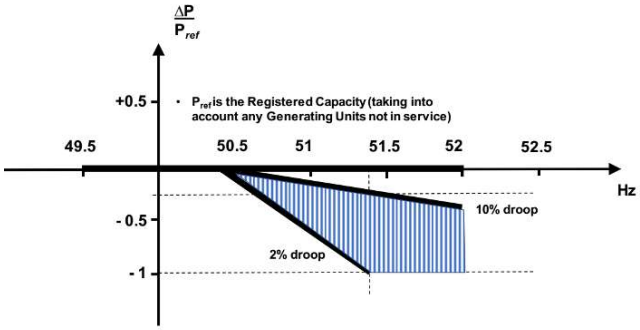
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.2.1	Under abnormal conditions automatic low-frequency load-shedding provides for load reduction down to 47 Hz. In exceptional circumstances, the frequency of the DNO's Distribution Network could rise above 50.5 Hz. Therefore all Power Generating Modules should be capable of continuing to operate in parallel with the Distribution Network in accordance with the following:		P
	(a) 47 Hz – 47.5 Hz Operation for a period of at least 20 s is required each time the frequency is within this range. (b) 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. (c) 49.0 Hz – 51.0 Hz Continuous operation of the Power Generating Module is required. (d) 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. (e) 51.5 Hz – 52 Hz Operation for a period of at least 15 minutes is required each time the frequency is within this range.	See appended table.	P
11.2.2	With regard to the rate of change of frequency withstand capability, a Power Generating Module shall be capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs^{-1} as measured over a period of 500 ms unless disconnection was triggered by a rate of change of frequency type loss of mains protection or by the Power Generating Module's own protection system for a co-incident internal fault as detailed in paragraph 10.6.18.		P
11.2.3	Output power with falling frequency		P
11.2.3.1	Each Power Generating Module, must be capable of:		P
	(a) continuously maintaining constant Active Power output for system frequency changes within the range 50.5 to 49.5 Hz; and		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	(b) (subject to the provisions of paragraph 11.2.1) maintaining its Active Power output at a level not lower than the figure determined by the linear relationship shown in Figure 11.1 for system frequency changes within the range 49.5 to 47 Hz for all ambient temperatures up to and including 25°C, such that if the system frequency drops to 47 Hz the Active Power output does not decrease by more than 5%. In the case of a CCGT Module this requirement shall be retained down to 48.8 Hz, which reflects the first stage of the automatic Low Frequency Demand Disconnection scheme. For system frequency below 48.8 Hz, the existing requirements shall be retained for a minimum period of 5 minutes while system frequency remains below 48.8Hz, and any special measure(s) that may be required to meet this requirement shall be kept in service during this period. After that 5 minute period, if system frequency remains below the 49.5 Hz threshold, the special measure(s) must be discontinued if there is a materially increased risk of the Gas Turbine tripping. The need for special measure(s) is linked to the inherent Gas Turbine Active Power output reduction caused by reduced shaft speed due to falling system frequency. Where the need for special measures is identified in order to maintain output in line with the level identified in Figure 11.1 these measures should still be continued at ambient temperatures above 25°C maintaining as much of the Active Power achievable within the capability of the plant.  **Figure 11.1 Change in Active Power with falling frequency**		P
11.2.3.2	For the avoidance of doubt in the case of a Power Generating Module using an Intermittent Power Source where the power input will not be constant over time, the requirement is that the Active Power output shall be independent of system frequency under (a) above and should not drop with system frequency by greater than the amount specified in (b) above.		P
11.2.3.3	Electricity Storage Power Generating Modules when operating in an importing mode of operation:		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.2.3.3.1	Each Generator in respect of an Electricity Storage Power Generating Module is required to meet the requirements of 11.2.3.3.1 (a) – (f): (a) Be capable of automatically maintaining its Active Power output within the shaded operating region shown in Figure 11.2 until the stored energy has been depleted. The Electricity Storage Power Generating Module could initially be operating at any level of import between zero Active Power and the Rated Import Power within a system frequency range of 50 Hz and 49.5 Hz as shown in Figure 11.2. The Electricity Storage Power Generating Module is only required to reach its Registered Capacity if the Electricity Storage Power Generating Module has headroom and the ability to increase Active Power output. A typical value of the Droop would be 0.6% where this does not result in control system instability or plant difficulties. In all cases the Droop shall be between 0.6% and 1.2% and shall be agreed with the DNO. (b) Automatically respond in accordance with the characteristic of Figure 11.2 when the system frequency falls to 49.5 Hz and below. (c) The reduction in Active Power import (during an import mode of operation), and the transition to the final value of Active Power output shall be continuously and linearly proportional, as far as is practicable, to the reduction in frequency below 49.5 Hz. Active Power output must be provided increasingly with time as required by 11.2.3.3.1 (d) below. (d) As much as possible of the proportional reduction in Active Power import must result from the frequency control device (or speed governor) action and must be achieved within 10 s of the time of the frequency decreases below 49.5 Hz. The Electricity Storage Power Generating Module shall be capable of initiating a power frequency response with an initial delay that is as short as possible. Delays that exceed 2 s shall be justified by the Generator providing technical evidence to the DNO and in any event as much as possible of the proportional reduction in Active Power import shall be achieved within 10 s. This performance requirement is to be maintained when the Electricity Storage device makes the transition to an Active Power export mode of operation unless the energy store is depleted, in which case it shall be required to operate at zero Active Power output. (e) Where the Electricity Storage Power Generating Module is not capable of making a transition from import operation to export operation within 20 s of the frequency falling to 49.2 Hz, then it shall immediately reduce its Active Power import to zero. (f) If the Electricity Storage Power Generating Module has not achieved at least a zero Active Power import when the system frequency has reached 48.9 Hz, it shall be instantaneously tripped. Where an Electricity		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	Storage Power Generating Module trips, it shall not reconnect to the system until the conditions of 10.3.3 to 10.3.5 are met.  **Figure 11.2 Active Power performance with falling frequency**		
11.2.3.3.2	Where an Electricity Storage Power Generating Module was importing before the fall in frequency and has responded in accordance with the requirements of 11.2.3.3.1, its performance, once the system frequency starts to rise above the minimum reached, shall be in accordance with Figure 11.3 in respect of the Active Power output and Active Power import. For example, Figure 11.3, illustrates the four operating points W, X, Y and Z. If points W, X, Y and Z denotes the minimum frequency that the Total System reached during a particular low system frequency event, as the system frequency starts to rise, the Active Power output of the Electricity Storage Power Generating Module should remain at a constant level (where the energy source has not been depleted) until 49.5 Hz is reached as denoted by the dashed black lines. Once the system frequency has risen above 49.5 Hz the Electricity Storage Power Generating Module is permitted to reduce Active Power output so long as it is operating within the shaded area above 49.5 Hz shown in Figure 11.3, unless the Electricity Storage Power Generating Module has insufficient capability in which case it shall operate at zero Active Power.  **Figure 11.3 Active Power performance with increasing frequency**		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.2.3.3.3	Where an Electricity Storage Power Generating Module is exporting Active Power (including zero) to the Total System and the system frequency falls below 49.5 Hz the requirements of 11.2.3.3.1 and 11.2.3.3.2 shall apply.		N/A
11.2.4	Limited Frequency Sensitive Mode – Over frequency		P
11.2.4.1	Each Power Generating Module shall be capable of reducing Active Power output in response to 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 frequency exceeds 50.5 Hz.		P
	(a) The rate of change of Active Power output must be at a minimum a rate of 2% of output per 0.1 Hz deviation of system frequency above 50.4 Hz (ie a Droop of 10%) as shown in Figure 11.2. For the avoidance of doubt, this would not preclude a Generator from designing their Power Generating Module with a Droop of less than 10%, but in all cases the Droop should be 2% or greater.	See appended table.	P
	(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.		P
	(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. Refer to Figure A.7.10 for details.		P
	(d) For deviations in frequency beyond 50.9 Hz the measured rate of change of Active Power reduction shall exceed 0.5% s^{-1} of the initial output. Refer to Figure A.7.9 for details.		P
	(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 Active Power increase shall exceed 0.5%s^{-1}.		P
	(f) 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.		P

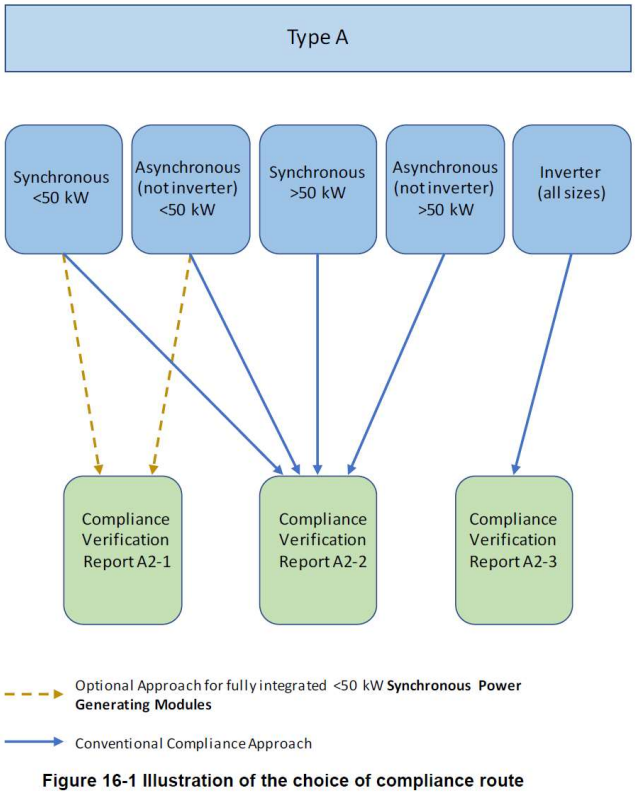
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	 P ref is the reference **Active Power** to which ΔP is related and. ΔP is the change in **Active Power** output from the **Power Generating Module**. **Figure 11.3 Active Power Frequency Response capability when operating in LFSM-O**		P
11.2.4.2	When the Power Generating Module is providing Limited Frequency Sensitive Mode Over frequency (LFSM-O) response it must continue to provide the frequency response until the frequency has returned to, or is below, 50.4 Hz.		P
11.2.4.3	Steady state operation below Minimum Generation is not expected but if system operating conditions cause operation below Minimum Generation which give rise to operational difficulties then the Generator shall be able to return the output of the Power Generating Module to an output of not less than the Minimum Generation.		P
11.3	**Fault Ride Through and Phase Voltage Unbalance**		P
11.3.1	Where it has been specifically agreed between the DNO and the Generator that a Power Generating Facility will contribute to the DNO's Distribution Network security, (eg for compliance with EREC P2) the Power Generating Module(s) may be required to withstand, without tripping, the effects of a close up three phase fault and the Phase (Voltage) Unbalance imposed during the clearance of a close-up phase-to-phase fault, in both cases cleared by the DNO's main protection. The DNO will advise the Generator in each case of the likely tripping time of the DNO's protection, and for phase-phase faults, the likely value of Phase (Voltage) Unbalance during the fault clearance time.		P
11.3.2	In the case of phase to phase faults on the DNO's system that are cleared by system back-up protection which will be within the plant short time rating on the DNO's Distribution Network the DNO, on request during the connection process, will advise the Generator of the expected Phase (Voltage) Unbalance.		P
11.4	**Voltage Limits and Control**		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
11.4.1	Where a Power Generating Module is remote from a Network voltage control point it may be required to withstand voltages outside the normal statutory limits. In these circumstances, the DNO should agree with the Generator the declared voltage and voltage range at the Connection Point. Immunity of the Power Generating Module to voltage changes of ± 10% of the declared voltage is recommended, subject to design appraisal of individual installations.		P
11.4.2	The connection of a Power Generating Module to the Distribution Network shall be designed in such a way that operation of the Power Generating Module does not adversely affect the voltage profile of and voltage control employed on the Distribution Network. ETR 126 provides DNOs with guidance on active management solutions to overcome voltage control limitations. Information on the voltage regulation and control arrangements will be made available by the DNO if requested by the Generator.		P
11.4.3	The final responsibility for control of Distribution Network voltage does however remain with the DNO.		P
11.4.4	Automatic Voltage Control (AVC) schemes employed by the DNO often assume that power flows from parts of the Distribution Network operating at a higher voltage to parts of the Distribution Network operating at lower voltages.		P
11.4.5	Power Generating Modules can cause problems if connected to networks employing AVC schemes which use negative reactance compounding and line drop compensation due to changes in Active Power and Reactive Power flows. ETR 126 provides guidance on connecting generation to such networks using techniques such as removing the generation circuit from the AVC scheme using cancellation CTs.		P
12	**TYPE B POWER GENERATING MODULE TECHNICAL REQUIREMENTS**		N/A
12.1	**Power Generating Module Performance and Control Requirements - General**		N/A
12.2	**Frequency response**		N/A
12.3	**Fault Ride Through and Phase Voltage Unbalance**		N/A
12.4	**Voltage Limits and Control**		N/A
12.5	**Reactive Capability**		N/A
12.6	**Fast Fault Current Injection**		N/A
12.7	**Operational monitoring**		N/A
13	**TYPE C AND TYPE D POWER GENERATING MODULE TECHNICAL REQUIREMENTS**		N/A
13.1	**Power Generating Module Performance and Control Requirements**		N/A
13.2	**Frequency response**		N/A
13.3	**Fault Ride Through**		N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
13.4	**Voltage Limits and Control**		N/A
13.5	**Reactive Capability**		N/A
13.6	**Fast Fault Current Injection**		N/A
13.7	**Black Start Capability and rapid re-synchronisation**		N/A
13.8	**Technical Requirements for Embedded Medium Power Stations**		N/A
13.9	**Operational monitoring**		N/A
13.10	**Steady State Load Inaccuracies**		N/A
14	**INSTALLATION, OPERATION AND CONTROL INTERFACE**		P
14.1	**General**		P
14.2	**Isolation and Safety Labelling**		P
14.2.1	Every Generator's Installation which includes Power Generating Modules operating in parallel with the Distribution Network must include a means of isolation capable of disconnecting the whole of the Power Generating Module7 infeed to the Distribution Network. This equipment will normally be owned by the Generator, but may by agreement be owned by the DNO.		P
14.2.2	The Generator must grant the DNO rights of access to the means of isolation without undue delay and the DNO must have the right to isolate the Power Generation Modules infeed at any time should such disconnection become necessary for safety reasons and in order to comply with statutory obligations. The isolating device should normally be installed at the Connection Point, but may be positioned elsewhere with the DNO's agreement.		P
14.2.3	To ensure that DNO staff and that of the Generator and their contractors are aware of the presence of a Power Generating Module, appropriate warning labels should be used.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
14.2.4	Where the installation is connected to the DNO LV Distribution Network the Generator should generally provide labelling at the Connection Point (Fused Cut-Out), meter position, consumer unit and at all points of isolation within the Generator's premises to indicate the presence of a Power Generating Module. The labelling should be sufficiently robust and if necessary fixed in place to ensure that it remains legible and secure for the lifetime of the installation. The Health and Safety (Safety Signs & Signals) Regulations 1996 stipulates that labels should display the prescribed triangular shape, and size, using black on yellow colouring. A typical label, for both size and content, is shown below in Figure 14.1.  **Figure 14.1 Warning label**		P
14.3	**Site Responsibility Schedule**		Info.
14.4	**Operational and Safety Aspects**		Info.
14.5	**Synchronizing and Operational Control**		P
15	**Common Compliance and Commissioning Requirements for all Power Generating Modules**		N/A
15.1	**Demonstration of Compliance**		N/A
15.2	**Wiring for Type Tested Power Generating Modules**		N/A
15.3	**Commissioning Tests / Checks required at all Power Generating Facilities**		N/A
15.4	**Additional Commissioning requirements for Non Type Tested Interface Protection**		N/A
15.5	**Compliance of Vehicle to Grid Electric Vehicles**		N/A
15.6	**Family approach to Type Testing**		N/A
15.7	**Compliance demonstration for Infrequent Short-Term Parallel Power Generating Modules**		N/A
15.8	**Compliance demonstration for long term parallel operation with islanding capability (OM2) and infrequent short term parallel operation (OM3)**		N/A
15.9	**Compliance monitoring**		N/A
16	**TYPE A COMPLIANCE TESTING, COMMISSIONING AND OPERATIONAL NOTIFICATION**		P
16.1	**Type Test Certification**		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
16.1.1	The Power Generating Module can comprise Fully Type Tested equipment or be made up of some Type Tested equipment and require additional site testing prior to operation. The use of Fully Type Tested equipment simplifies the connection process, the protection arrangements and reduces the commissioning test requirements.		P
16.1.2	Type Tested certification is the responsibility of the Manufacturer. The Manufacturer shall submit the Type Test Verification Report confirming that the product has been Type Tested to satisfy the requirements of this EREC G99 to the Energy Networks Association (ENA) Type Test Verification Report Register. The report shall detail the type and model of product tested, the test conditions and results recorded. The report can include reference to Manufacturers' Information.		P
16.1.3	The required Type Test Verification Report and declarations including that for a Fully Type Tested Power Generating Module are shown in Annex A.2:		P
	• Form A2-1 - Compliance Verification Report for Synchronous Power Generating Modules up to and including 50 kW,	Inverter Connected Power Generating Modules.	N/A
	• Form A2-2 Compliance Verification Report for Synchronous Power Generating Modules greater than> 50 kW and also for Synchronous Power Generating Modules ≤ 50 kW where the approach of this form is preferred to that in Form A2-1, or	Inverter Connected Power Generating Modules.	N/A
	• Form A2-3 - Compliance Verification Report for Inverter Connected Power Generating Modules.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
	The choice of compliance route available is shown in Figure 16-1 below.  **Figure 16-1 Illustration of the choice of compliance route**	Compliance Verification Report A2-3 used.	P
	It is intended that the Manufacturers will use the requirements of this EREC G99 to develop type verification certification (ie the Compliance Verification Report as shown in Annex A.2) for each of their Power Generating Module models.		P
	Form A2-3 caters for all asynchronous and inverter technologies of any size, with the exception of conventional induction Generating Units. Manufacturers of induction Generating Units may find it more appropriate to use forms A2-2 or A2-1 in preference to Form A2-3 (Annex A.2).		P
16.1.4	Guidance for Manufacturers on type testing for Power Generating Modules is included in Annex A.7 of this document.		P
16.1.5	Compliance with the requirements detailed in this EREC G99 will ensure that the Power Generating Module is considered to be approved for connection to the DNO's Distribution Network.		P
16.1.6	The Power Generating Module shall comply with all relevant UK and European Directives and should be labelled in accordance with those requirements.		P
16.2	**Connection Process**		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
16.2.1	The Installer shall discuss the installation project with the local DNO at the earliest opportunity. The connection application will need to be in format as shown in Annex A.1 (Form A1) or for Power Generating Modules greater than 50 kW by using the Standard Application Form (generally available from the DNOs website). Where a Power Generating Module is Fully Type Tested and registered with the Energy Networks Association Type Test Verification Report Register, the application should include the Manufacturer's reference number (the Product ID), and the compliance test results do not need to be submitted as part of the application.	Relied on installer.	P
16.2.2	On receipt of the application, the DNO will assess: • whether any Distribution Network studies are required; • whether there is a need for work on the Distribution Network before the Tested Power Generating Module can be connected to the Distribution Network; and • whether there is a requirement to witness the commissioning tests and checks.	Fully Type Test.	N/A
16.2.3	Connection of the Power Generating Module is only allowed after the application for connection has been approved by the DNO and any DNO works facilitating the connection have been completed.	It's depended on installer and DNOs.	N/A
16.2.4	Where a Power Generating Module is not Fully Type Tested, the Generator or Installer shall provide the DNO with a Compliance Verification Report as per Annex A.2 (Forms A2-1, A2-2 or A2-3 as applicable) confirming that the Power Generating Module has or will be tested to satisfy the requirements of this EREC G99. This should be provided prior to commencing commissioning.	It's depended on installer and DNOs.	N/A
16.2.5	Where Power Generating Modules require connection to the DNO's Distribution Network in advance of the commissioning date, for the purposes of testing, the Power Generating Facility must comply with the requirements of the Connection Agreement. The Generator shall provide the DNO with a commissioning programme, which will be approved by the DNO if reasonable in the circumstances, to allow commissioning tests to be coordinated.	It's depended on installer and DNOs.	N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
16.2.6	Where commissioning tests are not witnessed, confirmation of the commissioning of each Power Generating Module will need to be made no later than 28 days after commissioning; the format and content shall be as shown in Annex A.3 (Form A3) Installation Document. The Installer or Generator, as appropriate, shall complete the declaration at the bottom of the Installation Document (Form A3) noting that this declaration also covers the Site Compliance and Commissioning Test Form (Form A2-4). Where the tests are witnessed a copy shall be provided to the DNO at the time of commissioning.	It's depended on installer and DNOs.	N/A
16.2.7	It is the responsibility of the Generator (which may be delegated to the Installer) to ensure that the relevant information is forwarded to the local DNO. The pro forma in Annex A are designed to: (a) simplify the connection procedure for both DNO and Installer; (b) provide the DNO with all the information required to assess the potential impact of the Power Generating Module connection on the operation of the Distribution Network; (c) inform the DNO that the Generator's Installation complies with the requirements of this EREC G99; (d) allow the DNO to accurately record the location of all Power Generating Modules connected to the Distribution Network.	It's depended on installer and DNOs.	N/A
16.3	**Witnessing and Commissioning**		N/A
16.4	**Operational Notification**		N/A
16.4.1	Notification that the Power Generating Module has been connected / commissioned is achieved by completing an Installation Document as per Annex A.3, which also includes the relevant details on the Generator's Installation required by the DNO.		N/A
16.4.2	The Installer, or an agent acting on behalf of the Installer, shall supply separate Installation Documents (Form A3-1 (Annex A.3) for Type A Power Generating Modules or Form A3-2 (Annex A.3) for Integrated Micro Generation and Storage installations) for each Power Generating Facility installed under EREC G99 to the DNO. Documentation shall be supplied either at the time of commissioning (where tests are witnessed) or within 28 days of the commissioning date (where the tests are not witnessed) and may be submitted electronically.	It's depended on installer and DNOs.	N/A
16.4.3	Generators who own Type A Power Generating Modules do not have permanent rights to operate their Power Generating Modules until the commissioning tests have been successfully completed (and witnessed by the DNO if required) and the Installation Document has been fully completed and sent to the DNO	It's depended on installer and DNOs.	N/A

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
17	**TYPE B COMPLIANCE TESTING, COMMISSIONING AND OPERATIONAL NOTIFICATION**		N/A
17.1	**General**		N/A
17.2	**Connection Process**		N/A
17.3	**Witnessing and Commissioning**		N/A
17.4	**Final Operational Notification**		N/A
18	**TYPE C COMPLIANCE TESTING, COMMISSIONING AND OPERATIONAL NOTIFICATION**		N/A
18.1	**General**		N/A
18.2	**Connection Process**		N/A
18.3	**Witnessing and Commissioning**		N/A
18.4	**Final Operational Notification**		N/A
19	**TYPE D COMPLIANCE TESTING, COMMISSIONING AND OPERATIONAL NOTIFICATION**		N/A
19.1	**General**		N/A
19.2	**Connection Process**		N/A
19.3	**Interim Operational Notification**		N/A
19.4	**Witnessing and Commissioning**		N/A
19.5	**Final Operational Notification**		N/A
19.6	**Limited Operational Notification**		N/A
19.7	**Processes Relating to Derogations**		N/A
20	**ONGOING OBLIGATIONS**		N/A
20.1	**Periodic Testing for Power Generating Modules**		N/A
20.2	**Operational Incidents affecting Compliance of any Power Generating Module**		N/A
20.3	**Changes to the Power Generating Facility or Power Generating Module**		N/A
20.4	**Notification of Decommissioning**		N/A
21	**Manufacturers' Information applicable to Power Park Modules**		P
21.1	**General**		P
21.1.1	Manufacturers' Information covers such information as type testing details, parameters or data, simulation models and reports on studies run using those models. The guidance in this Section 21 Manufacturers' Information relates to simulation models.		P
21.1.2	In most cases Manufactures' Information is submitted by the Generator to the DNO. However, data and performance characteristics in respect of simulation models may be registered with the DNO by Generating Unit Manufacturers in the form of Manufacturers' Information.		P

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
21.1.3	A Generator planning to construct a new Power Generating Facility containing the appropriate version of Generating Units in respect of which Manufacturers' Information has been submitted to the DNO may reference the Manufacturers' Information in its submissions to the DNO. Any Generator considering referring to Manufacturers' Information for any aspect of its plant and apparatus may contact the DNO to discuss the suitability of the relevant Manufacturers' Information to its project to determine if, and to what extent, the data included in the Manufacturers' Information contributes towards demonstrating compliance with those aspects of this EREC G99 applicable to the Generator. The DNO will inform the Generator if the reference to the Manufacturers' Information is not appropriate or not sufficient for its project.		P
21.1.4	The process to be followed by Generating Unit Manufacturers submitting Manufacturers' Information must be agreed by the DNO. Paragraph 21.2 below indicates the specific requirement areas in respect of which Manufacturers' Information may be submitted.		P
21.1.5	The DNO may maintain and publish a register of that Manufacturers' Information which the DNO has received and accepted as being an accurate representation of the performance of the relevant plant and / or apparatus. Such register will clearly identify the Manufacturer, the model(s) of Generating Unit(s) to which the report applies and the provisions of EREC G99 in respect of which the report contributes towards the demonstration of compliance in such a way that these models can easily be identified for appropriate use in other similar projects. The inclusion of any report in the register does not in any way confirm that any Power Park Modules which utilise any Generating Unit(s) covered by a report is or will be compliant with EREC G99.	It's depended on installer and DNOs.	N/A
21.2	Manufacturers' Information in respect of Generating Units may cover one (or part of one) or more of the following provisions: (a) Fault Ride Through capability; (b) Power Park Module mathematical model DDRC 5c.		P
21.3	Reference to a Manufacturer's Data & Performance Report in a Generator's submissions does not by itself constitute compliance with EREC G99.		P
21.4	A Generator referencing Manufacturers' Information should insert the relevant Manufacturers' Information reference in the appropriate place in the submission forms detailed in the Annexes. The DNO will consider the suitability of Manufacturers' Information in place of DDRC data submissions such as a mathematical model suitable for representation of the entire Power Park Module as per Annex B.4.4 or Annex C.7.4.5 as applicable. Site specific parameters will still need to be submitted by the Generator.		P

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Clause	Requirement - Test	Result - Remark	Verdict
21.5	It is the responsibility of the Generator to ensure that the correct reference for the Manufacturers' Information is used and the Generator by using that reference accepts responsibility for the accuracy of the information. The Generator shall ensure that the Manufacturer has kept the DNO informed of any relevant variations in plant specification since the submission of the relevant Manufacturers' Information which could affect the validity of the information.		P
21.6	The DNO may contact the Generating Unit Manufacturer directly to verify the relevance of the use of such Manufacturers' Information. If the DNO believes the use some or all of such Manufacturers' Information is incorrect or the referenced data is inappropriate then the reference to the Manufacturers' Information may be declared invalid by the DNO. Where, and to the extent possible, the data included in the Manufacturers' Information is appropriate, the compliance assessment process will be continued using the data included in the Manufacturers' Information.	It's depended on installer and DNOs.	N/A
22	**TYPE TESTING AND ANNEX INFORMATION**		P
22.1	**Fully Type Tested and Type Tested equipment**		P
	The following matrix demonstrates where Manufacturers' Information and compliance and installation checks on site can be combined to demonstrate compliance for each Power Generating Module.	Fully Type Tested.	P

	Manufacturers' Information	**Power Quality Assessment and Site Tests**
Fully Type Tested (**Type A** only ≤ 50 kW)	Registered as **Fully Type Tested** information on ENA website via the Compliance Verification Report (Form A2-1, A2-2 or A2-3 as appropriate)	An assessment of compliance with EREC G5 and EREC P28 is necessary. This will generally allow connection of a **Fully Type Tested** device with no need for mitigation. However, where the fault level is unusually low (eg in remote rural locations) mitigation measures might be needed Only installation checks required – as on the Installation Document (Form A3-1 or A3-2)

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Clause	Requirement - Test	Result - Remark	Verdict

					P
	Type Tested (Type A)	Registered as product or component Type Test information on ENA Website using applicable parts of Compliance Verification Report (Form A2-1, A2-2 or A2-3); and/or Supplied by the **Generator** using applicable parts of Compliance Verification Report (Form A2-1, A2-2 or A2-3)	Compliance of the installation with EREC G5 and EREC P28 Demonstration of technical requirements not covered by **Manufacturers' Information**. (Form A3-1 or A3-2) Standard installation checks (Form A3-1 or A3-2). Additional Site Compliance and Commissioning Checks (Form A2-4) may also be required		
	Type Tested (B, C, D)	Registered as product or component Type Test information on ENA Website; and/or Supplied by the **Generator**	Compliance of the installation with EREC G5 and EREC P28 Demonstration of technical requirements not covered by **Manufacturers' Information**. (Form B2-1 or Form C2-1) Standard installation checks (Form B3 or Form C3). Additional Site Compliance and Commissioning Checks (Form B2-2 or Form C2-2) may also be required		
	One off installation (B, C, D)	To be provided by the **Generator** for those aspects that cannot be demonstrated on site (including simulations etc)	Compliance of the installation with EREC G5 and EREC P28 Demonstration of technical requirements not covered by **Manufacturers' Information**. (Form B2-1 or Form C2-1) Standard installation checks also required (Form B3 or Form C3). Additional Site Compliance and Commissioning Checks (Form B2-2 or Form C2-2) may also be required		
22.2	**Annex Contents and Form Guidance**				P
					P

Annex	Application	Form Title
A.0	Cover Sheet for **Type A Power Generating Facility** Forms	
A.1	Connection Application for **Type A Fully Type Tested** (<50 kW) **Power Generating Modules** Connection Application for **Integrated Micro Generation and Storage** Note for all other **Power Generating Modules** the **DNO**'s Standard Application Form shall be used.	Form A1-1: Application for connection of **Power Generating Module**(s) with Total Aggregate Capacity <50 kW 3-phase or 17 kW single phase Form A1-2: Application for connection of an **Integrated Micro Generation and Storage** installation
A.2	Compliance report for **Type A Type Tested**	Form A2-1: Compliance Verification Report for **Synchronous Power Generating Modules** up to and including 50 kW Form A2-2: Compliance Verification Report for **Synchronous Power Generating Modules** > 50 kW and also for **Synchronous Power Generating Modules** ≤ 50 kW where the approach of this form is preferred to that in Form A2-1 Form A2-3 Compliance Verification Report for **Inverter** Connected **Power Generating Modules**
A.2	Additional Compliance and Commissioning test requirements for **Type A Power Generating Modules**	Form A2-4: Site Compliance and Commissioning test requirements for **Type A Power Generating Modules**

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Clause	Requirement - Test	Result - Remark	Verdict

	A.3	Installation and Commissioning a **Power Generating Facility** comprising one or more **Type A Generating Modules**	Form A3-1: Installation Document for **Type A Power Generating Modules** Form A3-2: Installation Document for **Integrated Micro Generation and Storage** installations	P
	A.4	Emerging Technologies and other Exceptions		
	A.5	Example calculations to determine if unequal generation across different phases is acceptable or not		
	A.6	Scenario examples in respect of the application of EREC G59 and EREC G99 to new or modified sites after 27/04/19		
	A.7	Requirements for Type Testing **Type A Power Generating Modules**		
	B.1	Application	Refer to Standard Application Form	
	B.2-1	Compliance documentation for **Type B Power Generating Modules**	Form B2-1: **Power Generating Module Document** for **Type B Power Generating Modules**	
	B.2-2	Additional Compliance and Commissioning test requirements for **Type B Power Generating Modules**	Form B2-2 Site Compliance and Commissioning test requirements for **Type B Power Generating Modules**	
	B.3	Installation and Commissioning Confirmation Form	Form B2: Installation and Commissioning Confirmation Form for **Type B Power Generating Modules**	
	B.4	Simulation Studies for **Type B Power Generating Modules**		
	B.5	Compliance Testing of **Type B Synchronous Power Generating Modules**		
	B.6	Compliance testing of **Type B Power Park Modules**		
	C.1	Application	Refer to Standard Application Form	
	C.2-1	Compliance documentation for **Type C** and **Type D Power Generating Modules**	Form C2-1: **Power Generating Module Document** for **Type C and Type D Power Generating Modules**	
	C.2-2	Additional Compliance and Commissioning test requirements for **Type C** and **Type D Power Generating Modules**	Form C2-2 Site Compliance and Commissioning test requirements for **Type C** and **Type D Power Generating Modules**	
	C.3	Installation and Commissioning Confirmation Form	Form C3: Installation and Commissioning Confirmation Form for **Type C** and **Type D Power Generating Modules**	
	C.4	Performance Requirements For Continuously Acting Automatic Excitation Control Systems For **Type C** and **Type D Synchronous Power Generating Modules**		
	C.5	Performance Requirements For Continuously Acting Automatic Excitation Control Systems For **Type C** and **Type D Power Park Modules**		
	C.6	Functional Specification for Fault Recording and Power Quality Monitoring Equipment Studies for **Type C** and **Type D Power Generating Modules**		
	C.7	Simulation Studies for **Type C** and **Type D Power Generating Modules**		

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict
			P

C.8	Compliance Testing of **Type C** and **Type D Synchronous Power Generating Module**s	
C.9	Compliance Testing of **Type C** and **Type D Power Park Module**s	
C.10	Minimum Frequency Response Capabilities for **Type C** and **Type D Power Generating Module**s	
D.0	Decommissioning of any **Power Generating Module**	Form D1: **Decommissioning Confirmation**
D.1	Additional Information Relating to **System Stability** Studies	
D.2	Loss of Mains Protection Analysis	
D.3	Main Statutory and other Obligations	
D.4	Summary of **Reactive Power** and voltage control requirements	

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Appendix 1: A2-3 Compliance Verification Report –Tests for Type A Inverter Connected Power Generating Modules

1. Operating Range:	**P**

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 ± 5 % of the apparent power value set for the entire duration of each test sequence.

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.

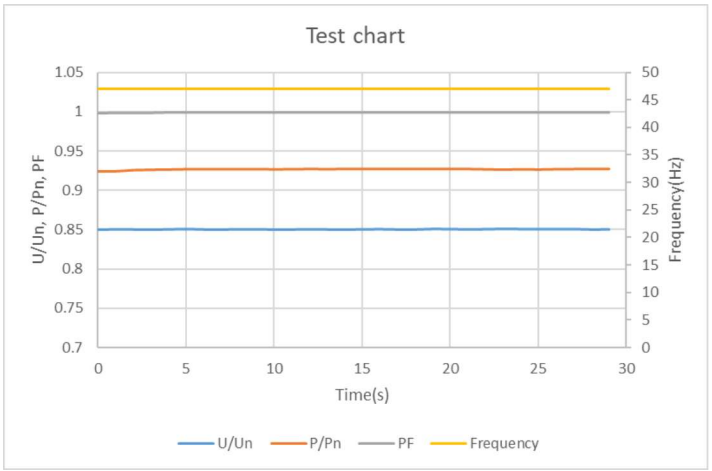
The **Interface Protection** shall be disabled during the tests.

In case of a PV **Power Park Module** the PV primary source may be replaced by a DC source.
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.

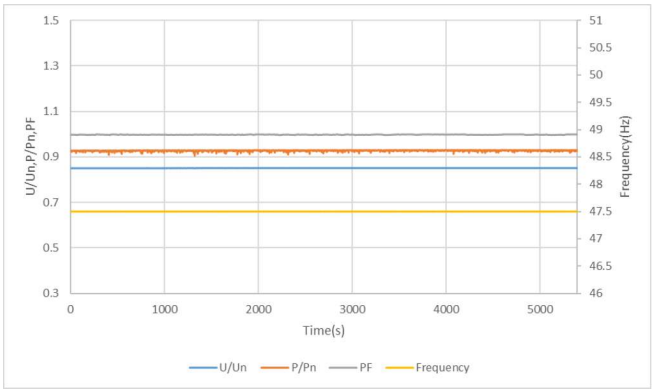
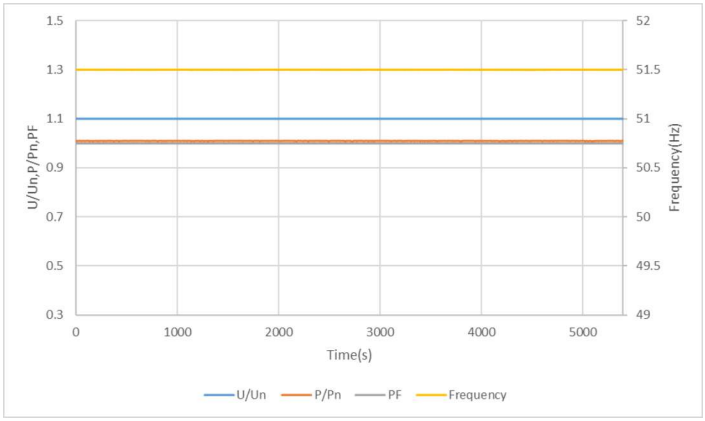
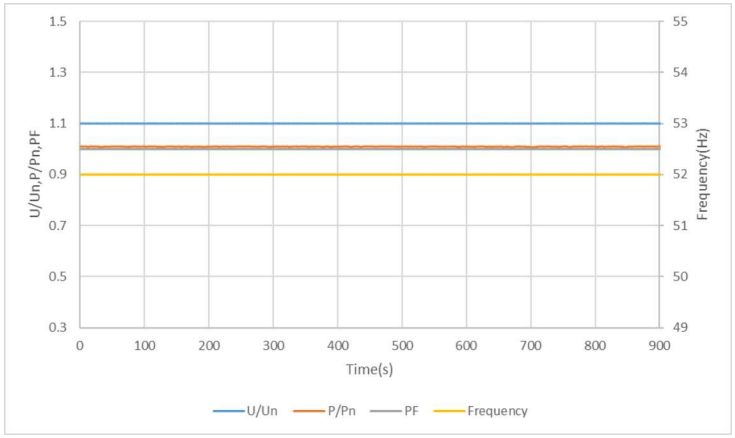
Pass or failure of the test should be indicated in the fields below (right hand side), for example with the statement “Pass”, “No disconnection occurs”, etc. Graphical evidence is preferred.

Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.

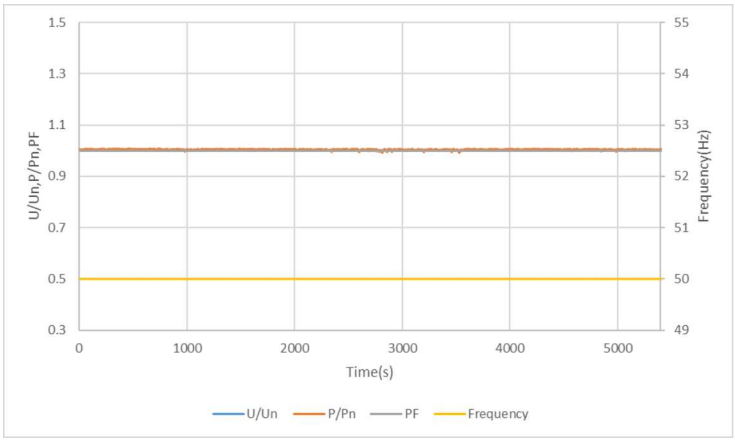
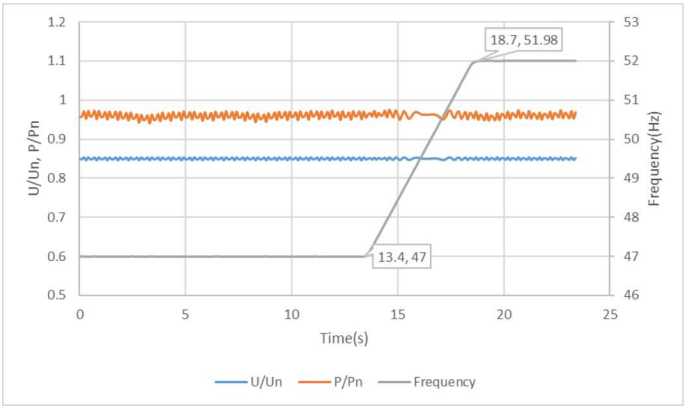
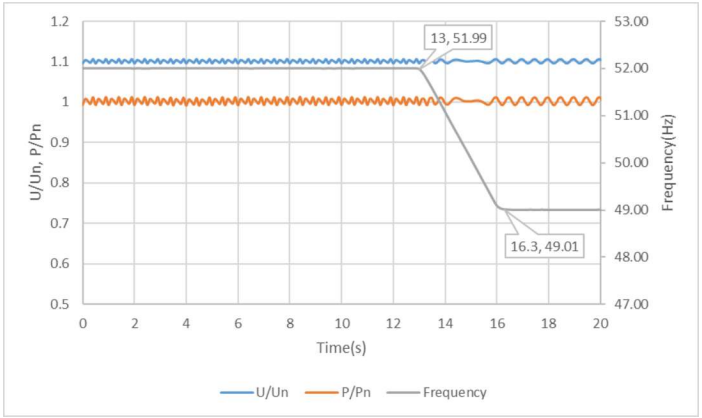
Test 1
Voltage = 85% of nominal (195.5 V),
Frequency = 47 Hz,
Power Factor = 1,
Period of test 20 s



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2 Voltage = 85% of nominal (195.5 V), Frequency = 47.5 Hz, **Power Factor** = 1, Period of test 90 minutes	
Test 3 Voltage = 110% of nominal (253 V), Frequency = 51.5 Hz, **Power Factor** = 1, Period of test 90 minutes	
Test 4 Voltage = 110% of nominal (253 V), Frequency = 52.0 Hz, **Power Factor** = 1, Period of test 15 minutes	

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5 Voltage = 100% of nominal (230 V), Frequency = 50.0 Hz, **Power Factor** = 1, Period of test = 90 minutes	
Test 6 RoCoF withstand 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 Hzs^{-1} as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site.	Ramp: 47 Hz → 52 Hz 
	Ramp: 52 Hz → 49 Hz 

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model: AU6KESL-G3				**P**
Test 1:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (seconds)
195.58	47.00	5557	0.999	30
Test 2:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
195.98	47.50	5569	0.997	91.0
Test 3:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.42	51.50	6058	0.999	91.0
Test 4:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
253.42	52.00	6056	0.999	16.0
Test 5:				
Measured Voltage (V)	Measured Frequency (Hz)	Measured Power (W)	Measured Power factor	Test Time (Minutes)
230.46	50.00	6026	0.999	91.0
Test 6:				
Measured Voltage (V)	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
195.98	47.0 Hz to 52.0 Hz	+1.0 Hzs^{-1}	5.3	No trip
253.42	52.0 Hz to 49.0 Hz	-1.0 Hzs^{-1}	3.3	No trip

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

2. Power Quality – Harmonics:	**P**

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, and measurements for the 2nd – 13th harmonics should be provided. 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 three phase **Power Generating Modules**, measurements for all phases should be provided.

For **Power Generating Modules** of **Registered Capacity** of greater than 75 A per phase (ie 50 kW) the installation must be designed in accordance with EREC G5.

The rating of the **Power Generating Module** (per phase) should be provided below, and the Total Harmonic Distortion (THD) and Partial Weighted Harmonic Distortion (PWHD) should be provided at the bottom of this section.

Model: AU6KESL-G3

Power Generating Module tested to BS EN 61000-3-12

Power Generating Module rating per phase (rpp)	6	kVA	Harmonic % = Measured Value (A) x 23/rating per phase (kVA)
Single or three phase measurements (for single phase measurements, only complete L1 columns below)	Single phase		

Harmonic	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	0.008	-	-	0.03	-	-	8%	8%
3	0.050	-	-	0.19	-	-	21.6%	Not stated
4	0.008	-	-	0.03	-	-	4%	4%
5	0.133	-	-	0.51	-	-	10.7%	10.7%
6	0.008	-	-	0.03	-	-	2.67%	2.67%
7	0.077	-	-	0.29	-	-	7.2%	7.2%
8	0.007	-	-	0.03	-	-	2%	2%
9	0.236	-	-	0.90	-	-	3.8%	Not stated
10	0.006	-	-	0.02	-	-	1.6%	1.6%
11	0.168	-	-	0.64	-	-	3.1%	3.1%
12	0.006	-	-	0.02	-	-	1.33%	1.33%
13	0.124	-	-	0.48	-	-	2%	2%
THD	-	-	-	1.36	-	-	23%	13%
PWHD	-	-	-	2.27	-	-	23%	22%
Harmonic	At 100% of **Registered Capacity**						Limit in BS EN 61000-3-12	
	Measured Value (MV) in Amps			Measured Value (MV) in %				
	L1(6K)	L2	L3	L1(6K)	L2	L3	1 phase	3 phase

G99/2								
Clause	Requirement - Test					Result - Remark		Verdict
2	0.100	-	-	0.38	-	-	8%	8%
3	0.430	-	-	1.65	-	-	21.6%	Not stated
4	0.008	-	-	0.03	-	-	4%	4%
5	0.166	-	-	0.64	-	-	10.7%	10.7%
6	0.006	-	-	0.02	-	-	2.67%	2.67%
7	0.102	-	-	0.39	-	-	7.2%	7.2%
8	0.004	-	-	0.01	-	-	2%	2%
9	0.082	-	-	0.31	-	-	3.8%	Not stated
10	0.003	-	-	0.01	-	-	1.6%	1.6%
11	0.065	-	-	0.25	-	-	3.1%	3.1%
12	0.003	-	-	0.01	-	-	1.33%	1.33%
13	0.051	-	-	0.20	-	-	2%	2%
THD	-	-	-	1.93	-	-	23%	13%
PWHD	-	-	-	3.22	-	-	23%	22%

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model: AU4KESL-G3								
Power Generating Module tested to BS EN 61000-3-12								
Power Generating Module rating per phase (rpp)				4.2	kVA		Harmonic % = Measured Value (A) x 23/rating per phase (kVA)	
Single or three phase measurements (for single phase measurements, only complete L1 columns below)				Single phase				
Harmonic	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	0.018	-	-	0.10	-	-	8%	8%
3	0.103	-	-	0.59	-	-	21.6%	Not stated
4	0.007	-	-	0.04	-	-	4%	4%
5	0.092	-	-	0.53	-	-	10.7%	10.7%
6	0.004	-	-	0.02	-	-	2.67%	2.67%
7	0.083	-	-	0.48	-	-	7.2%	7.2%
8	0.002	-	-	0.01	-	-	2%	2%
9	0.069	-	-	0.40	-	-	3.8%	Not stated
10	0.002	-	-	0.01	-	-	1.6%	1.6%
11	0.052	-	-	0.30	-	-	3.1%	3.1%
12	0.002	-	-	0.01	-	-	1.33%	1.33%
13	0.038	-	-	0.22	-	-	2%	2%
THD	-	-	-	1.11			23%	13%
PWHD	-	-	-	2.13			23%	22%
Harmonic	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	0.031	-	-	0.18	-	-	8%	8%
3	0.211	-	-	1.21	-	-	21.6%	Not stated
4	0.017	-	-	0.10	-	-	4%	4%
5	0.103	-	-	0.59	-	-	10.7%	10.7%
6	0.015	-	-	0.08	-	-	2.67%	2.67%
7	0.083	-	-	0.48	-	-	7.2%	7.2%
8	0.011	-	-	0.06	-	-	2%	2%
9	0.069	-	-	0.40	-	-	3.8%	Not stated
10	0.008	-	-	0.04	-	-	1.6%	1.6%
11	0.055	-	-	0.32	-	-	3.1%	3.1%

G99/2								
Clause	Requirement - Test					Result - Remark		Verdict
12	0.006	-	-	0.03	-	-	1.33%	1.33%
13	0.043	-	-	0.25	-	-	2%	2%
THD	-	-	-	1.64	-	-	23%	13%
PWHD	-	-	-	3.75	-	-	23%	22%

Note：
THD = Total Harmonic Distortion of 1st ~ 13th harmonics
PWHD = Partial Weighted Harmonic Distortion of 14th ~ 40th harmonics

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

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

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 must be designed in accordance with EREC P28.
The standard test impedance is 0.4 Ω for a single phase **Power Generating Module** (and for a two phase unit in a three phase system) and 0.24 Ω for a three phase **Power Generating Module** (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.

Model:	AU6KESL-G3		
Test start date	2025-12-11	Test end date	2025-12-12
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.960%	0.815%	0.000%	1.382%	1.363%	0.000%	0.186	0.176
Normalised to standard impedance	0.960%	0.815%	0.000%	1.382%	1.363%	0.000%	0.186	0.176
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	0.4	Ω	XI	0.25	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

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AU4KESL-G3		
Test start date	2025-12-11	Test end date	2025-12-12
Test location	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China		

	Starting			Stopping			Running	
	d(max)	d(c)	d(t)	d(max)	d(c)	d(t)	P_{st}	P_{lt} 2 hours
Measured Values at test impedance	0.992%	0.963%	0.000%	1.431%	1.380%	0.000%	0.125	0.110
Normalised to standard impedance	0.992%	0.963%	0.000%	1.431%	1.380%	0.000%	0.125	0.110
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

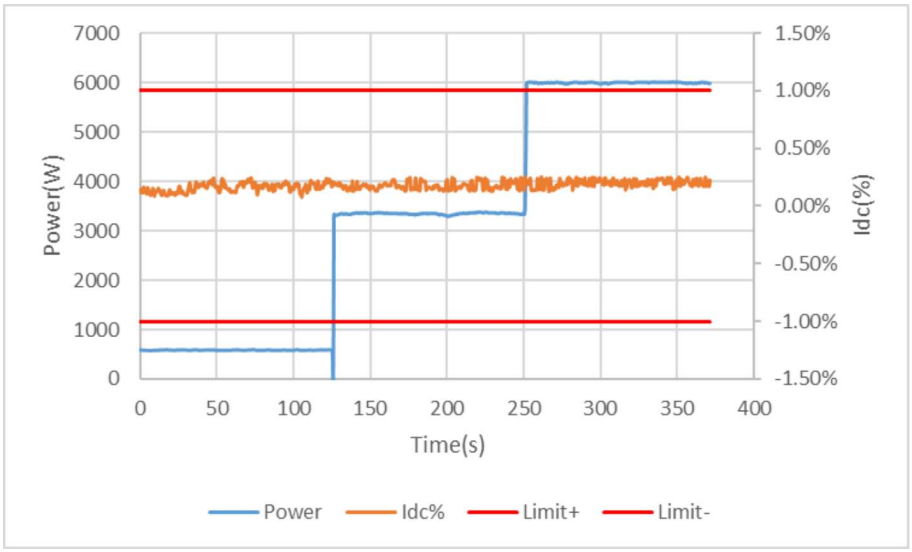
Test Impedance	R	0.4	Ω	XI	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^	Ω	XI	0.15 * 0.25 ^	Ω
Maximum Impedance	R	N/A	Ω	XI	N/A	Ω

* 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. Delete as appropriate.

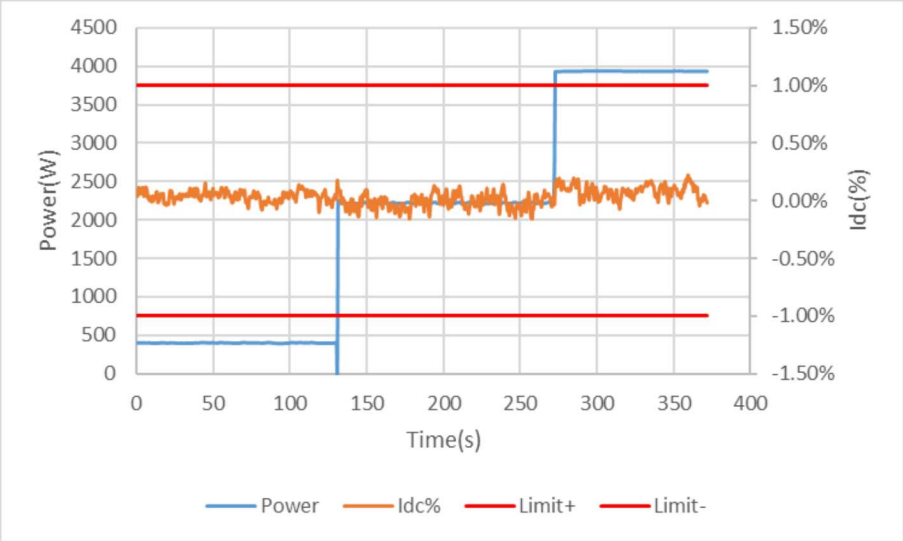
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

4. Power quality – DC injection:			**P**
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. 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) / Vphase. The % DC injection should not be greater than 0.25%.			
Model: AU6KESL-G3			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.032	0.042	0.049
as % of rated AC current	0.12%	0.16%	0.18%
Limit	0.25%	0.25%	0.25%



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Model: AU4KESL-G3			
Test power level	10%	55%	100%
Recorded DC injection value in Amps	0.016	0.016	0.020
as % of rated AC current	0.10%	0.10%	0.12%
Limit	0.25%	0.25%	0.25%



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

5. Power Factor:			**P**
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** 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. These tests should be undertaken in accordance with Annex A.7.1.4.2 Note that the value of voltage stated in brackets assumes a **LV** connection. This should be adjusted for **HV** as required.			
Model: AU6KESL-G3			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.955	0.954	0.952
Power Factor Limit	>0.95	>0.95	>0.95
Model: AU4KESL-G3			
Voltage	0.94 pu (216.2 V)	1 pu (230 V)	1.1 pu (253 V)
Measured value	0.954	0.953	0.951
Power Factor Limit	>0.95	>0.95	>0.95

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

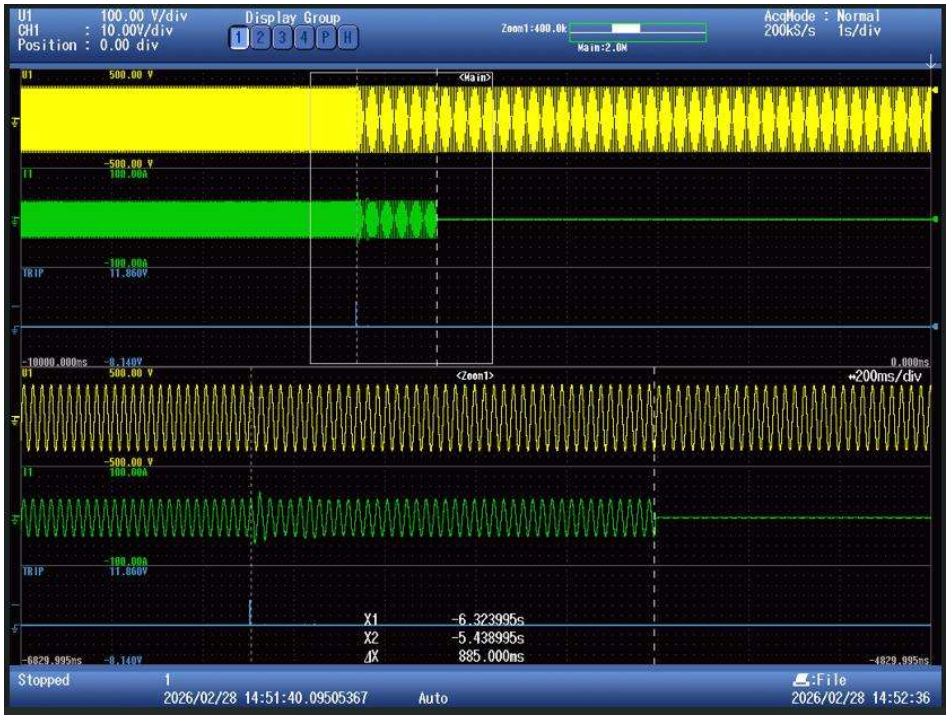
6. Protection – Frequency tests:						**P**
These tests should be carried out in accordance with the Annex A.7.1.2.3. For trip tests, frequency and time delay should be stated. For “no trip tests”, “no trip” can be stated.						
Model: AU6KESL-G3						
Function	Setting		Trip test		“No trip tests”	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.49 Hz	20.46s	47.7 Hz 30 s	No trip
U/F stage 2	47.0 Hz	0.5 s	47.00 Hz	0.885 s	47.2 Hz 19.5 s	No trip
					46.8 Hz 0.45 s	No trip
O/F	52.0Hz	0.5 s	52.01 Hz	0.890 s	51.8 Hz 120 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 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.						

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of U/F stage 1 – Trip test

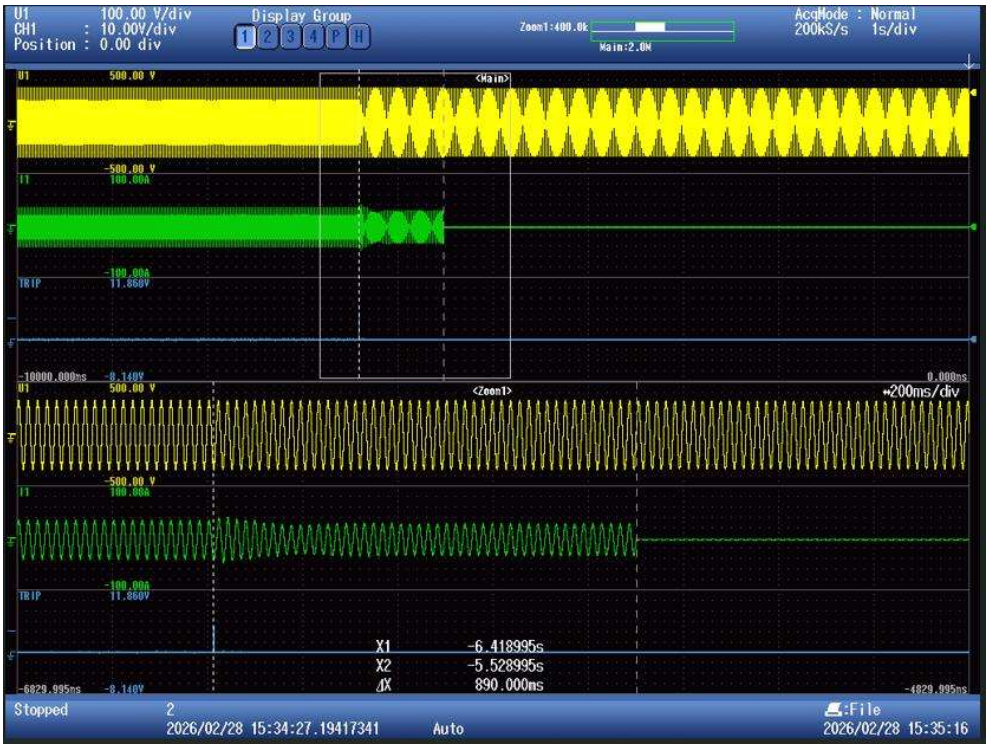


Graph of U/F stage 2 – Trip test



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of O/F – Trip test



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

7. Protection – Voltage tests:						**P**
These tests should be carried out in accordance with Annex A.7.1.2.2. For trip tests, voltage and time delay should be stated. For “no trip tests”, “no trip” can be stated. Note that the value of voltage stated below assumes a **LV** connection This should be adjusted for **HV** taking account of the VT ratio as required.						
Model: AU6KESL-G3						
L1-N						
Function	Setting		Trip test		“No trip tests”	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V	0.8 pu (184 V)	2.5 s	184.4 V	2.74 s	188 V 5.0 s	No trip
					180 V 2.45 s	No trip
O/V stage 1	1.14 pu (262.2 V)	1.0 s	261.7 V	1.24 s	258.2 V 5.0 s	No trip
O/V stage 2	1.19 pu (273.7 V)	0.5 s	273.1 V	0.850 s	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.						

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of U/V – Trip test



Graph of O/V stage 1 – Trip test



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of O/V stage 2 – Trip test



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

8. Protection – Loss of Mains test:	**P**

These tests should be carried out in accordance with BS EN 62116. Annex A.7.1.2.4.

For test condition A, EUT output = 100 % P_n, test condition B, EUT output = 50 % to 66 % P_n, and test condition C, EUT output = 25 % to 33 % P_n.

Model: AU6KESL-G3

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**	190 ms	191ms	185 ms	182 ms	197 ms	167 ms

No.	P_{EUT} [a] (% of EUT rating)	Reactive load (% of Q_L)	P_{AC} [b] (% of nominal)	Q_{AC} [c] (% of nominal)	Run-on time (ms)	P_{EUT} (W)	Actual Q_f	V_{DC} [d]	Remarks [e]
1	100	100	0	0	191	5971	1.00	356	Test A at BL
2	66	66	0	0	235	3879	1.00	287	Test B at BL
3	33	33	0	0	215	1888	1.00	200	Test C at BL
4	100	100	-5	-5	164	5970	0.97	356	Test A at IB
5	100	100	-5	0	185	5981	1.00	356	Test A at IB
6	100	100	-5	+5	179	5981	1.02	356	Test A at IB
7	100	100	0	-5	184	5911	0.98	356	Test A at IB
8	100	100	0	+5	178	5930	1.01	356	Test A at IB
9	100	100	+5	-5	169	5972	1.02	356	Test A at IB
10	100	100	+5	0	167	5931	0.97	356	Test A at IB
11	100	100	+5	+5	175	5947	1.00	356	Test A at IB
12	66	66	0	-5	191	3877	0.97	287	Test B at IB
13	66	66	0	-4	204	3891	0.98	287	Test B at IB
14	66	66	0	-3	207	3901	0.99	287	Test B at IB
15	66	66	0	-2	219	3844	0.99	287	Test B at IB
16	66	66	0	-1	221	3852	1.00	287	Test B at IB
17	66	66	0	+1	224	3819	1.00	287	Test B at IB
18	66	66	0	+2	214	3844	1.01	287	Test B at IB
19	66	66	0	+3	204	3852	1.01	287	Test B at IB
20	66	66	0	+4	201	3845	1.02	287	Test B at IB
21	66	66	0	+5	197	3895	1.02	287	Test B at IB
22	66	66	0	-5	190	1897	0.97	200	Test B at IB
23	33	33	0	-4	194	1881	0.98	200	Test C at IB
24	33	33	0	-3	200	1854	0.98	200	Test C at IB
25	33	33	0	-2	204	1834	0.99	200	Test C at IB

G99/2									
Clause	Requirement - Test						Result - Remark		Verdict
26	33	33	0	-1	211	1820	1.00	200	Test C at IB
27	33	33	0	+1	198	1877	1.00	200	Test C at IB
28	33	33	0	+2	197	1834	1.01	200	Test C at IB
29	33	33	0	+3	190	1863	1.01	200	Test C at IB
30	33	33	0	+4	188	1899	1.02	200	Test C at IB
31	33	33	0	+5	182	1875	1.02	200	Test C at IB

Note:

a) P_{EUT}: EUT output power.

b) P_{ac}: Active power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

c) Q_{ac}: Reactive power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0 % test condition value.

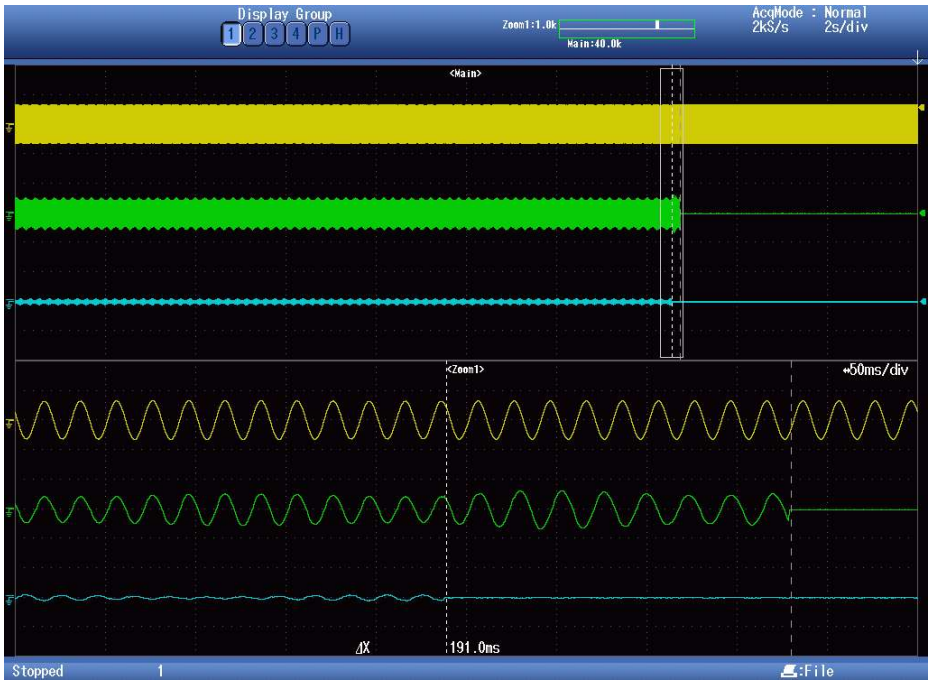
d) For test condition A, > 75 % of rated input voltage range used, for test condition B, 50 % of rated input voltage range, ±10 % used, for test condition C, < 20 % of rated input voltage range used. Based on EUT rated input operating range. For example, if range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

e) BL: Balance condition, IB: Imbalance condition.

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.

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 100% nominal power



Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 66% nominal power



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

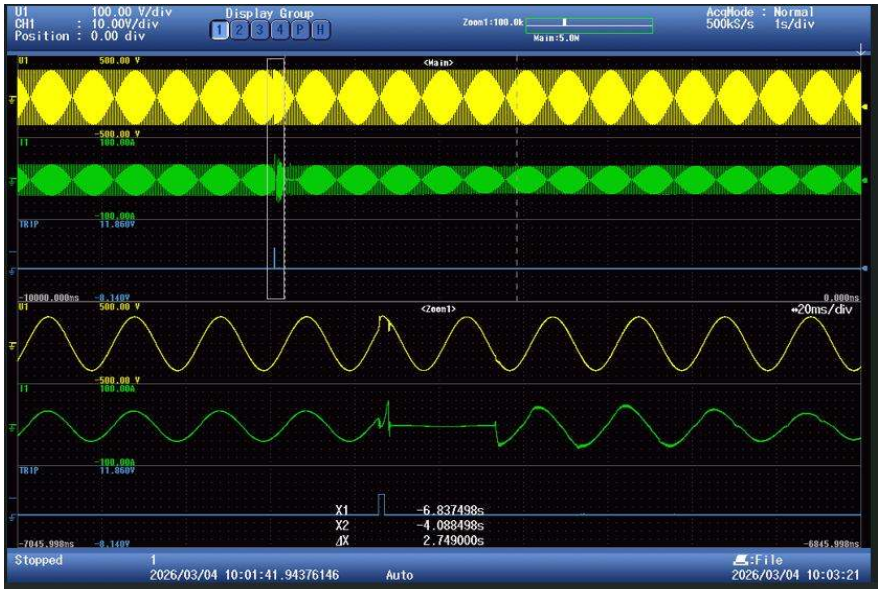
Graph of disconnection at P_{AC} 0% and Q_{AC} 0% reactive load and 33% nominal power



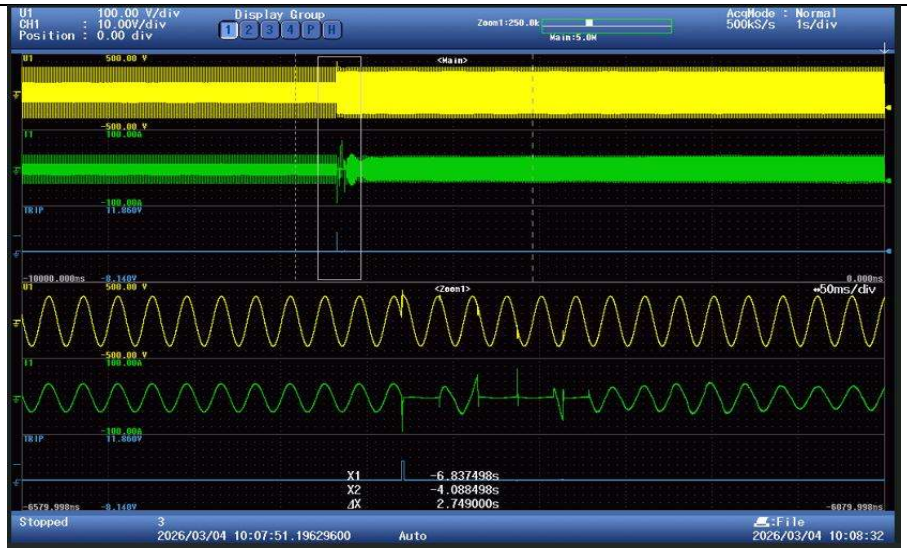
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Loss of Mains Protection, Vector Shift Stability test			**P**
This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip under positive / negative vector shift.			
Model: AU6KESL-G3			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.5 Hz	+50 degrees	No trip
Negative Vector Shift	50.5 Hz	- 50 degrees	No trip

Positive Vector Shift



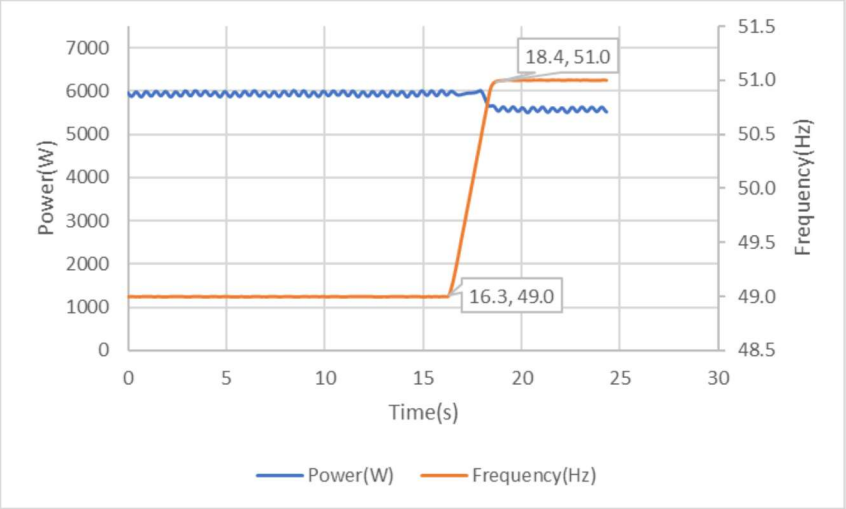
Negative Vector Shift



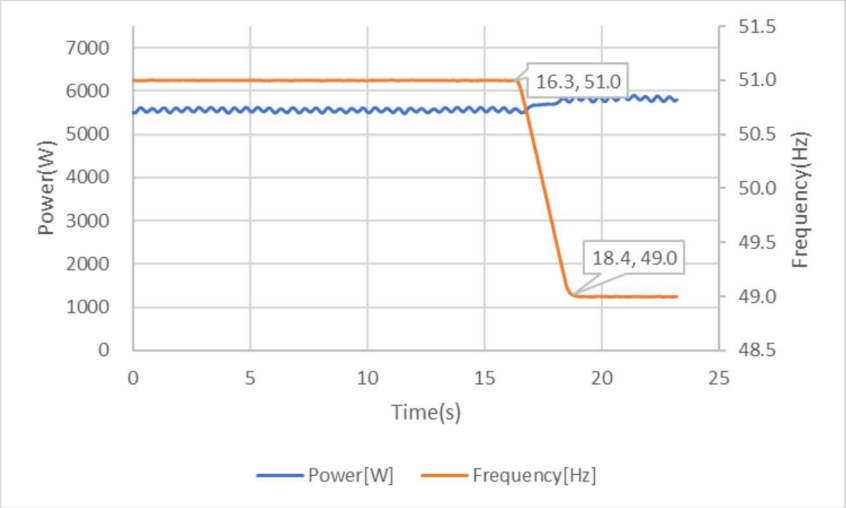
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Loss of Mains Protection, RoCoF Stability test:			**P**
This test should be carried out in accordance with Annex A.7.1.2.6. Confirmation is required that the **Power Generating Module** does not trip for the duration of the ramp up and ramp down test.			
Model: AU6KESL-G3			
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

ROCOF – From 49.0 Hz to 51.0 Hz



ROCOF – From 51.0 Hz to 49.0 Hz

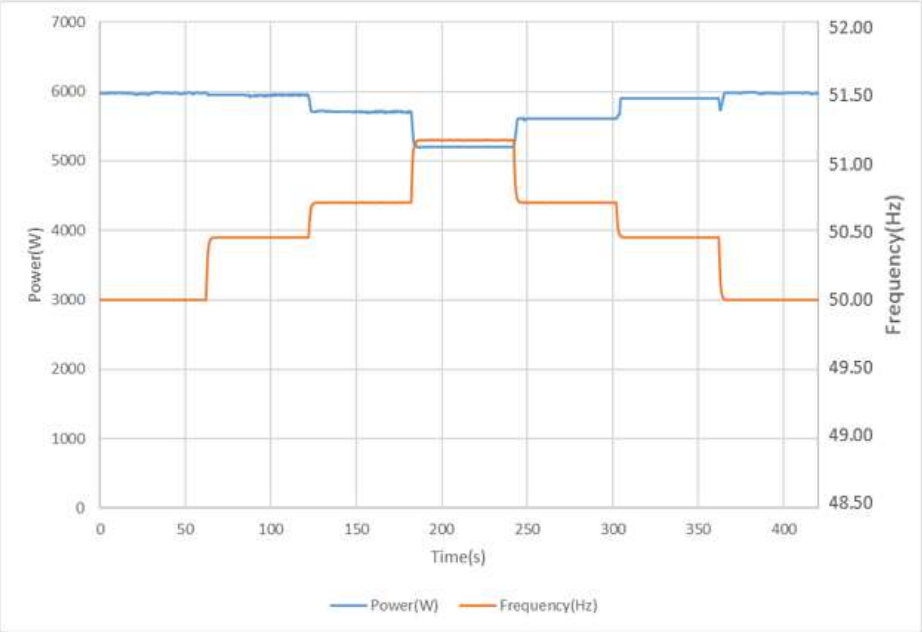


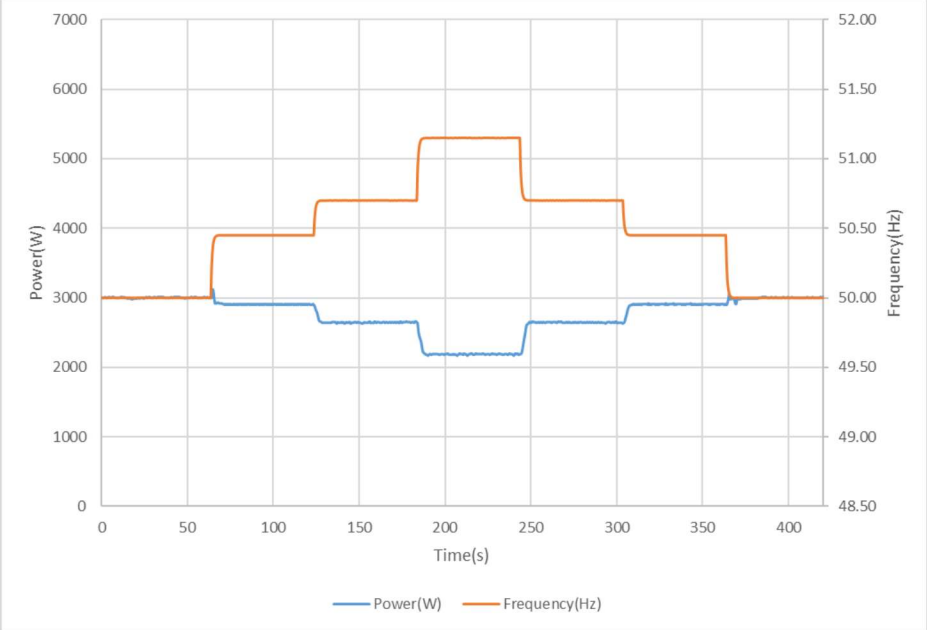
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

9-1. Limited Frequency Sensitive Mode – Over frequency test					**P**
The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%. This test should be carried out in accordance with A.7.1.3, which also contains the measurement tolerances.					
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.7.2.4					N/A
Model: AU6KESL-G3					
Alternatively, simulation results should be noted below:					
Test sequence at **Registered Capacity** >80%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient ($\%P_a s^{-1}$)
Step a) 50.00 Hz ±0.01 Hz	5970.12	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	5909.22	50.45	9.85%		-
Step c) 50.70 Hz ±0.10 Hz	5651.18	50.70	11.29%		-
Step d) 51.15 Hz ±0.05 Hz	5104.91	51.15	10.40%		-
Step e) 50.70 Hz ±0.10 Hz	5621.12	50.70	10.32%		-
Step f) 50.45 Hz ±0.05 Hz	5907.12	50.45	9.52%		-
Step g) 50.00 Hz ±0.01 Hz	5977.81	50.00	-		-
Test sequence at **Registered Capacity** 40-60%	Measured **Active Power** Output (W)	Frequency (Hz)	Calculated droop (%)	Primary Power Source	**Active Power** Gradient ($\%P_a s^{-1}$)
Step a) 50.00 Hz ±0.01 Hz	2995.01	50.00	-	Photovoltaic array simulator	-
Step b) 50.45 Hz ±0.05 Hz	2900.75	50.45	8.79%		-
Step c) 50.70 Hz ±0.10 Hz	2650.12	50.70	10.44%		-
Step d) 51.15 Hz ±0.05 Hz	2100.11	51.15	10.06%		-
Step e) 50.70 Hz ±0.10 Hz	2640.15	50.70	10.14%		-
Step f) 50.45 Hz ±0.05 Hz	2900.12	50.45	8.71%		-
Step g) 50.00 Hz ±0.01 Hz	2995.53	50.00	-		-
The frequency at each step should be maintained for at least one minute and the Active Power reduction in the form of a gradient determined and assessed for compliance with paragraph 11.2.3. The Droop should be determined from the measurements between 50.4 Hz and 51.15 Hz. The allowed tolerance for the frequency measurement shall be ± 0.05 Hz. The allowed tolerance for Active Power output measurement shall be ±10% of the required change in Active Power. The resulting overall tolerance range for a nominal 10% Droop is +2.8% and – 1.5%, ie a Droop less than 12.8% and greater than 8.5%.					

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Test chart





G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

9-2. Power output with falling frequency test (For PV Inverter)				**P**
Tests should prove that the **Power Generating Module** does not reduce output power as the frequency falls. These tests should be carried out in accordance with 11.2.3.1, 12.2.3.1, 13.2.3.1.				
Model: AU6KESL-G3				
Test sequence	Measured **Active Power** Output (W)	Acceptable **Active Power**	Frequency (Hz)	Primary power source
50.5 Hz for 5 minutes	5974.22	100% **Registered Capacity**	50.50	Photovoltaic array simulator
50.0 Hz for 5 minutes	5977.25	100% **Registered Capacity**	50.00	Photovoltaic array simulator
49.5 Hz for 5 minutes	5973.12	100% **Registered Capacity**	49.50	Photovoltaic array simulator
49.0 Hz for 5 minutes	5971.90	99% **Registered Capacity**	48.50	Photovoltaic array simulator
48.0 Hz for 5 minutes	5888.71	97% **Registered Capacity**	48.00	Photovoltaic array simulator
47.6 Hz for 5 minutes	5884.20	96.2% **Registered Capacity**	47.60	Photovoltaic array simulator
47.1 Hz for 20 s	5886.70	95% **Registered Capacity**	47.10	Photovoltaic array simulator

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

NOTE:

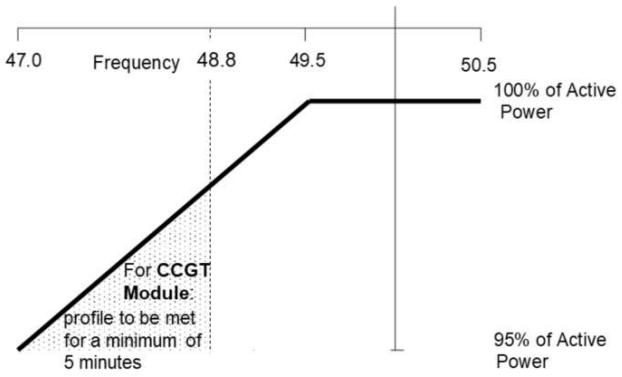
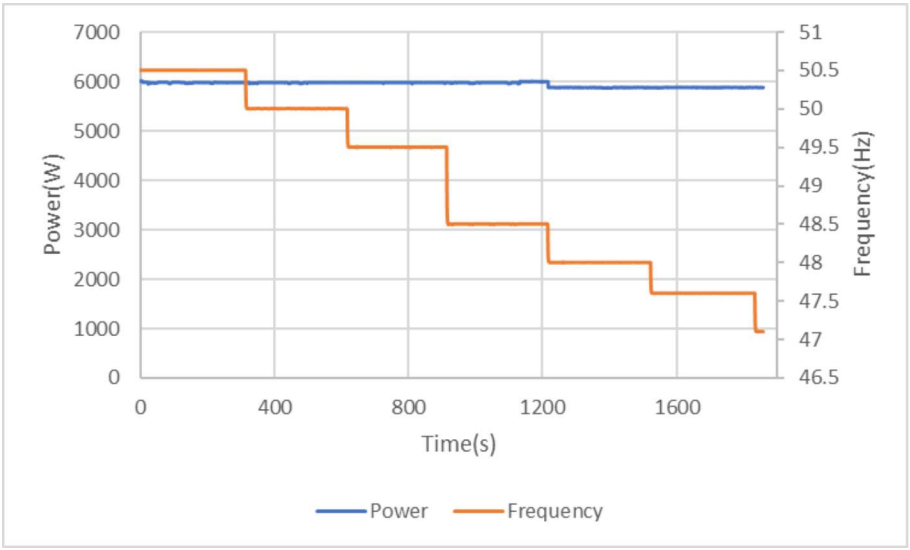


Figure 11.1 Change in Active Power with falling frequency



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

9-3. Power output with falling frequency test **9-4. Power output with increasing frequency test (For Electricity Storage Device)**				
This test should be carried out in accordance with clause 11.2.3.3, 12.2.3.3, 13.2.3.2 and A.7.1.7				
Model: AU6KESL-G3				
Test 1: 50 Hz to 49.0 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-5960	50.0	-	AC grid / Storage Battery
49.5	-5960	49.5	-	AC grid / Storage Battery
49.2	-2517	49.2	1.05%	AC grid / Storage Battery
49.0	5.081	49.0	1.01%	AC grid / Storage Battery
49.2	-2530	49.2	1.05%	AC grid / Storage Battery
49.5	-5976	49.5	-	AC grid / Storage Battery
49.8	-5977	49.8	-	AC grid / Storage Battery
50.0	-5977	50.0	-	AC grid / Storage Battery
Test 2: 50 Hz to 48.8 Hz, from **100%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-5950	50.0	-	AC grid / Storage Battery
49.5	-5950	49.5	-	AC grid / Storage Battery
49.2	-2536	49.2	1.05%	AC grid / Storage Battery
49.0	-8.42	49.0	1.01%	AC grid / Storage Battery
48.9	1179	48.9	1.01%	AC grid / Storage Battery
48.8	2414	48.8	1.00%	AC grid / Storage Battery
48.9	1170	48.9	1.01%	AC grid / Storage Battery
49.2	-2533	49.2	1.05%	AC grid / Storage Battery
49.5	-5940	49.5	-	AC grid / Storage Battery
49.8	-5940	49.8	-	AC grid / Storage Battery
50.0	-5940	50.0	-	AC grid / Storage Battery
Test 3: 50 Hz to 49.0 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-2465	50.0	-	AC grid / Storage Battery

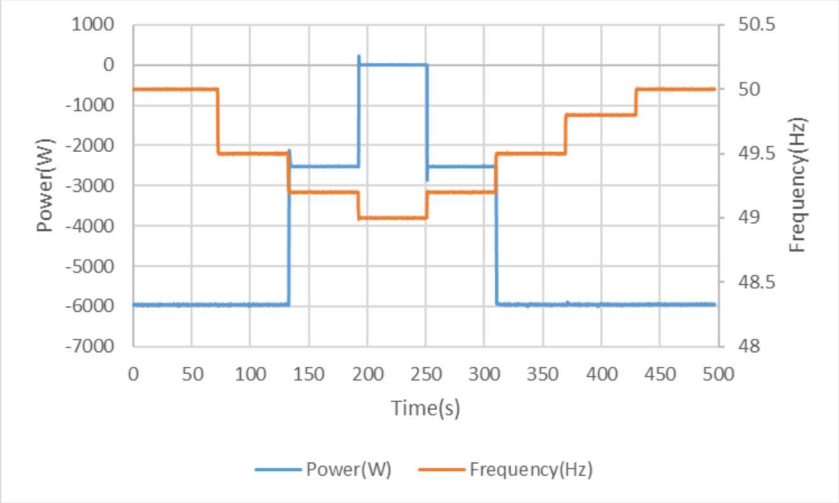
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

49.5	-2466	49.5	-	AC grid / Storage Battery
49.2	1075	49.2	1.02%	AC grid / Storage Battery
49.0	3628	49.0	0.98%	AC grid / Storage Battery
49.2	1050	49.2	1.02%	AC grid / Storage Battery
49.5	-2462	49.5	-	AC grid / Storage Battery
49.8	-2462	49.8	-	AC grid / Storage Battery
50.0	-2462	50.0	-	AC grid / Storage Battery
Test 4: 50 Hz to 48.8 Hz, from **40%** $P_{rated\text{-}import}$				
Test sequence (Hz)	Measured **Active Power** Output (W)	Steady frequency (Hz)	Calculated droop (%)	Primary power source
50.0	-2455	50.0	-	AC grid / Storage Battery
49.5	-2520	49.5	-	AC grid / Storage Battery
49.2	1046	49.2	1.03%	AC grid / Storage Battery
49.0	3630	49.0	0.99%	AC grid / Storage Battery
48.9	4865	48.9	0.98%	AC grid / Storage Battery
48.8	5846	48.8	1.01%	AC grid / Storage Battery
48.9	4845	48.9	0.99%	AC grid / Storage Battery
49.2	1036	49.2	1.03%	AC grid / Storage Battery
49.5	-2630	49.5	-	AC grid / Storage Battery
49.8	-2500	49.8	-	AC grid / Storage Battery
50.0	-2470	50.0	-	AC grid / Storage Battery

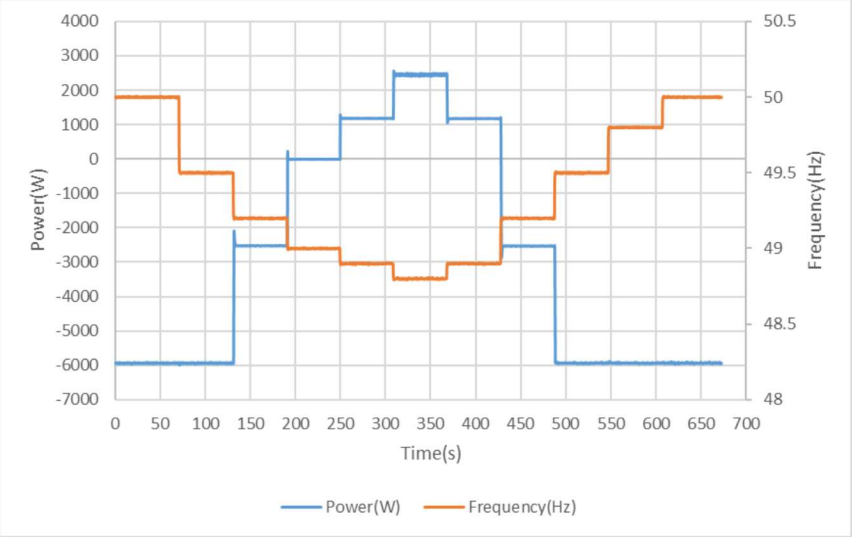
G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Chart:

Test1:

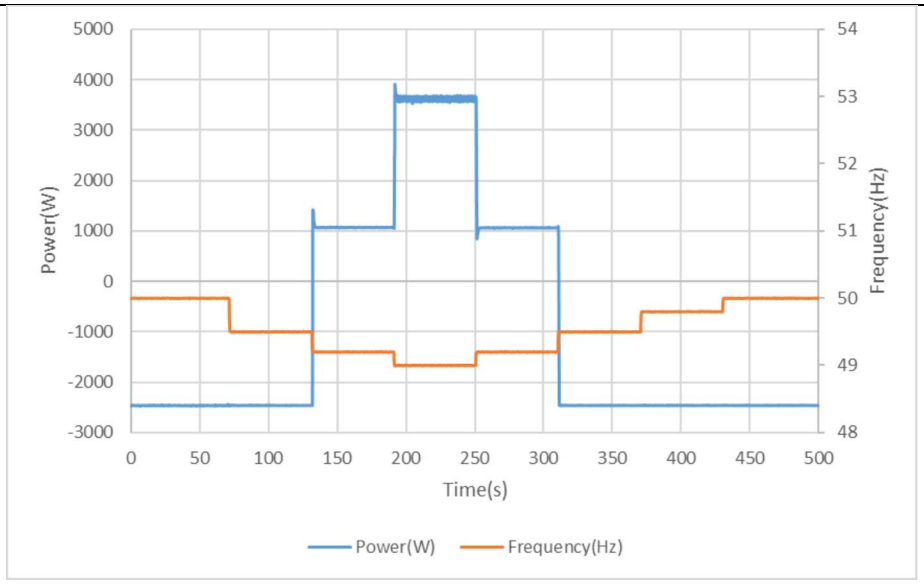


Test2:

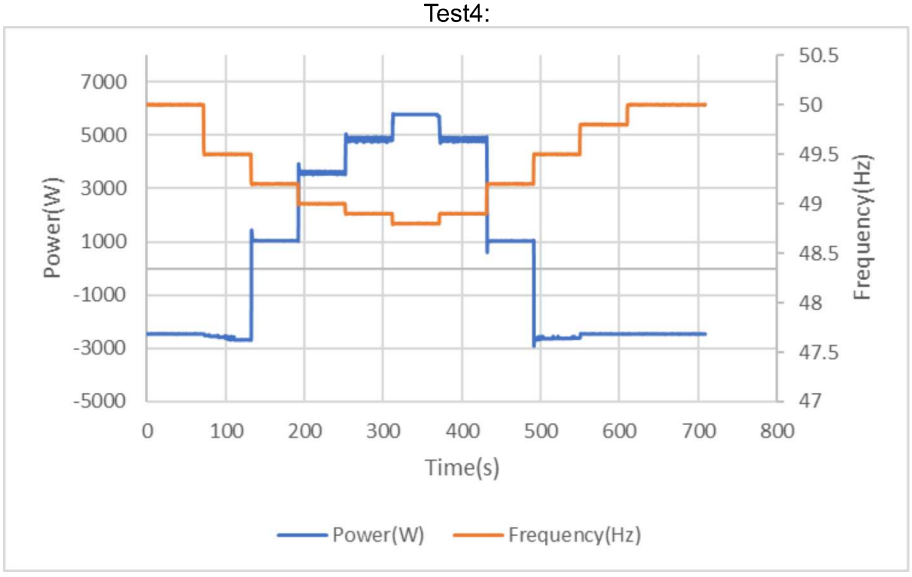


Test3:

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict



Test4:



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

10. Protection – Re-connection timer.					**P**
Model: AU6KESL-G3					
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.			
30 s	69.30 s	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 **Micro-generator** does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection
Recover to normal operation range after confirmation of no connection		Yes	Yes	Yes	Yes
Confirmation that the Power Generating Module shall reconnect		Reconnection after 44.4 s	Reconnection after 43.9s	Reconnection after 44.4 s	Reconnection after 44.4 s

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Reconnection – U < 1.16 p.u. (266.2 V)



Reconnection – U > 0.78 p.u. (180.0 V)



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

Reconnection – F > 47.4 Hz



Reconnection – F < 52.1 Hz



G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

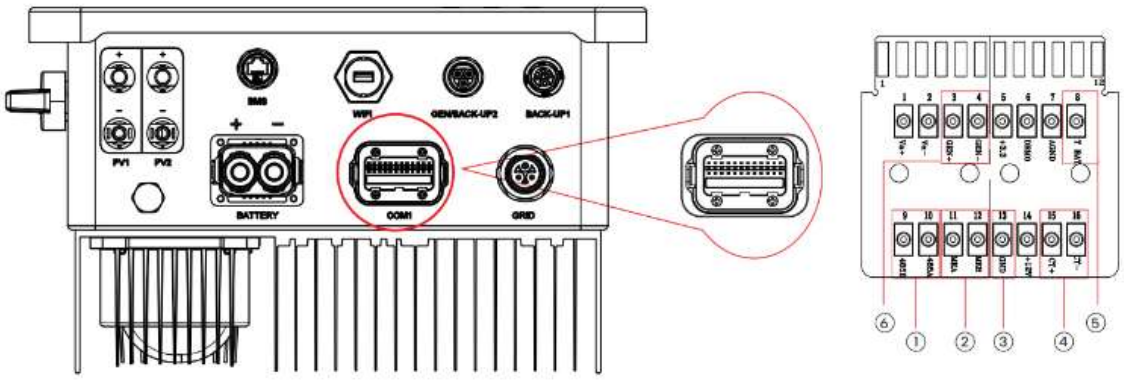
11. Fault level contribution:			**P**
These tests shall be carried out in accordance with EREC G99 Annex A.7.1.5. Please complete each entry, even if the contribution to the fault level is zero.			
Model: AU6KESL-G3			
For **Inverter** output			
Time after fault	Volts	Amps	
20ms	104	28.27	
100ms	67	28.27	
250ms	67	0.08	
500ms	68	0.05	
Time to trip	0.19	In seconds	

G99/2			
Clause	Requirement - Test	Result - Remark	Verdict

12. Self-Monitoring solid state switching: No specified test requirements. Refer to Annex A.7.1.6.	
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
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
14. Logic interface (input port).	
Confirm that an input port is provided and can be used to shut down the module.	Yes
Provide high level description of logic interface, e.g. details in 11.1.3.1 such as AC or DC signal (the additional comments box below can be used)	Yes
15. Cyber security	
Confirm that the Power Generating Module has been designed to comply with cyber security requirements, as detailed in 9.1.7.	Yes Manufacturer's declaration provided
Additional comments.	

An external emergency stop switch is required.The pins 6 and 7 need to be connected to the normally open contacts of the emergency switch. When the switch is turned on,the power generation module will reduce its active power to zero immediately .

2.Communication line end connector



Pin	1	2	3&5	4	6
Function	BMS 485	METER 485	External NTC of Battery	GRID CT	GEN+/-

Appendix 2: Photo documentation

Enclosure – Front View

Enclosure – Rear View


Enclosure – Side view (Right)



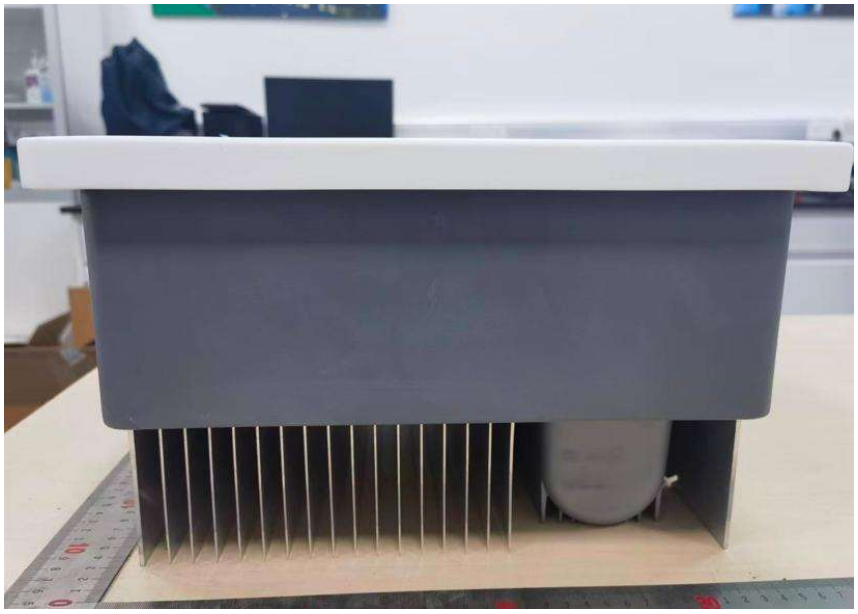
Enclosure – Side view (Left)



Enclosure – Bottom view



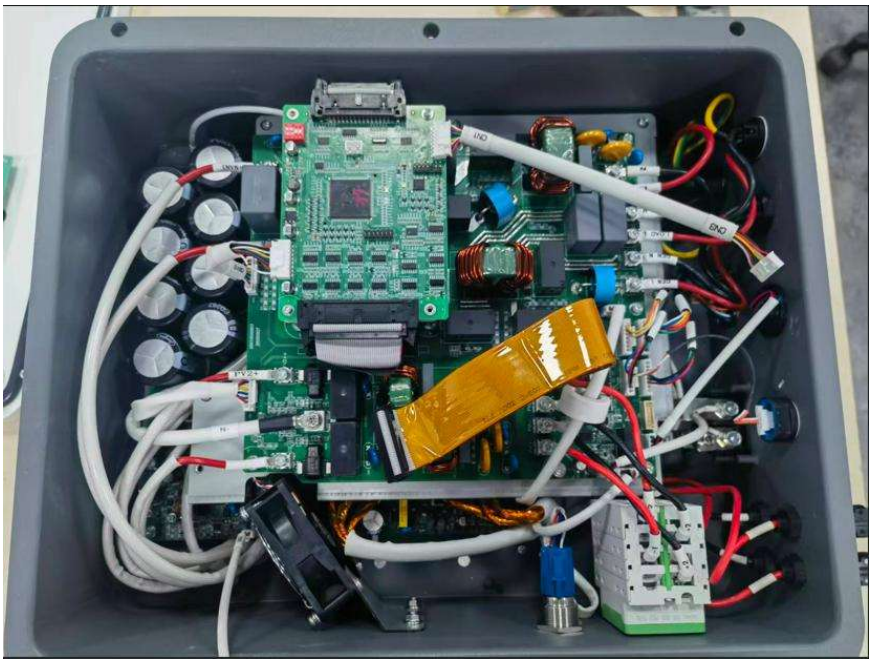
Enclosure – Top view



Upper cover – Rear view



Enclosure – inside view



--- End of test report---

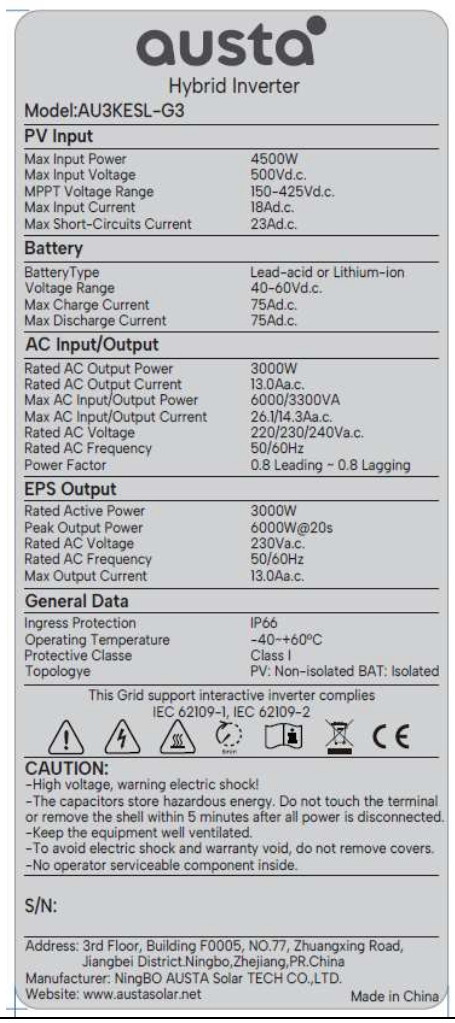
TEST REPORT
Engineering Recommendation G100
Technical Requirements for Customers' Export and Import Limitation Schemes

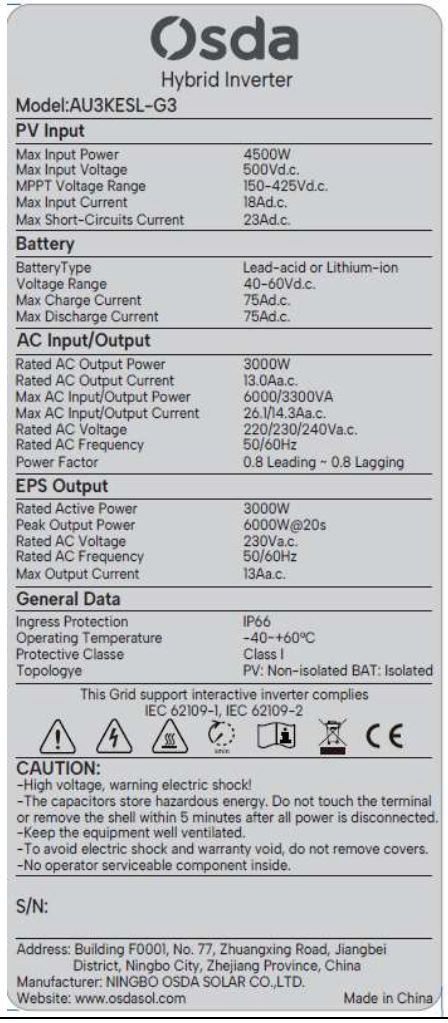
Report	
Report Number. .....:	6252420.51V1.1
Date of issue.....:	2026-06-24
Total number of pages.....:	39 pages
Testing Laboratory .....:	DEKRA Testing and Certification (Shanghai) Ltd.
Address.....:	No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China
Applicant's name .....:	NINGBO AUSTA SOLAR TECH CO.,LTD.
Address.....:	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Test specification:	
Standard .....:	Engineering Recommendation G100 Issue 2 – Amendment 2: 2023
Test procedure.....:	Type test
Non-standard test method……..:	N/A
Test Report Form No.....:	G100_V1.0
Test Report Form(s) Originator .....:	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF.....:	Dated 2023-05
Test item description .....:	Hybrid Inverter
Trade Mark .....:	AUSTA&OSDA
Manufacturer.....:	NINGBO AUSTA SOLAR TECH CO.,LTD.
	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo,Zhejiang, P.R.China
Model/Type reference.....:	AU3KESL-G3, AU3.6KESL-G3, AU4KESL-G3, AU5KESL-G3, AU6KESL-G3;
Ratings.....:	See Model List

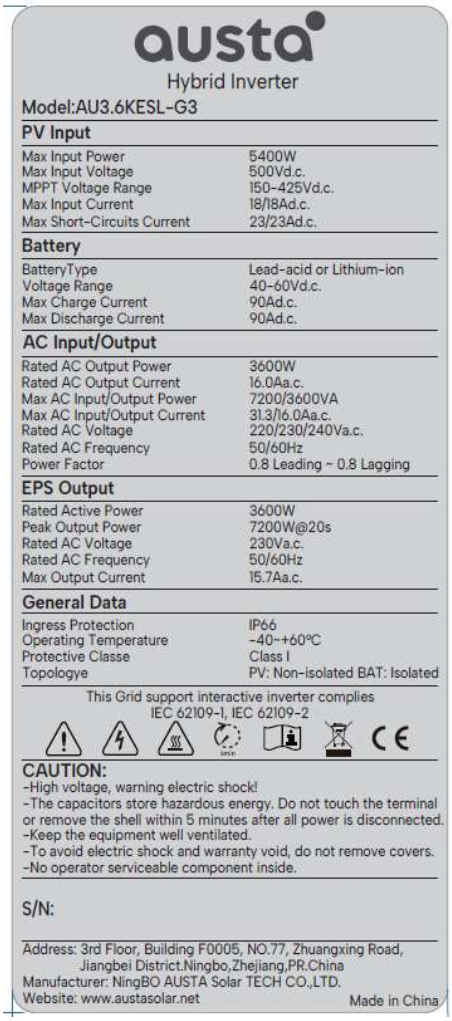
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	Testing Laboratory:	DEKRA Testing and Certification (Shanghai) Ltd.	
Testing location/ address..... :		No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R.China	
☐	Associated Testing Laboratory:		
Testing location/ address..... :			
Tested by (name, function, signature)..... :		Yuan Chen (ENG)	Yuan Chen
Approved by (name, function, signature) ..... :		Sandy Qian (REW)	Sandy Qian
☐	~~Testing procedure: TMP/CTF Stage 1:~~		
~~Testing location/ address..... :~~			
~~Tested by (name, function, signature)..... :~~			
~~Approved by (name, function, signature) ..... :~~			
☐	~~Testing procedure: WMT/CTF Stage 2:~~		
~~Testing location/ address..... :~~			
~~Tested by (name + signature) ..... :~~			
~~Witnessed by (name, function, signature) ..... :~~			
~~Approved by (name, function, signature) ..... :~~			
☐	~~Testing procedure: SMT/CTF Stage 3 or 4:~~		
~~Testing location/ address..... :~~			
~~Tested by (name, function, signature)..... :~~			
~~Witnessed by (name, function, signature) ..... :~~			
~~Approved by (name, function, signature) ..... :~~			
~~Supervised by (name, function, signature)..... :~~			

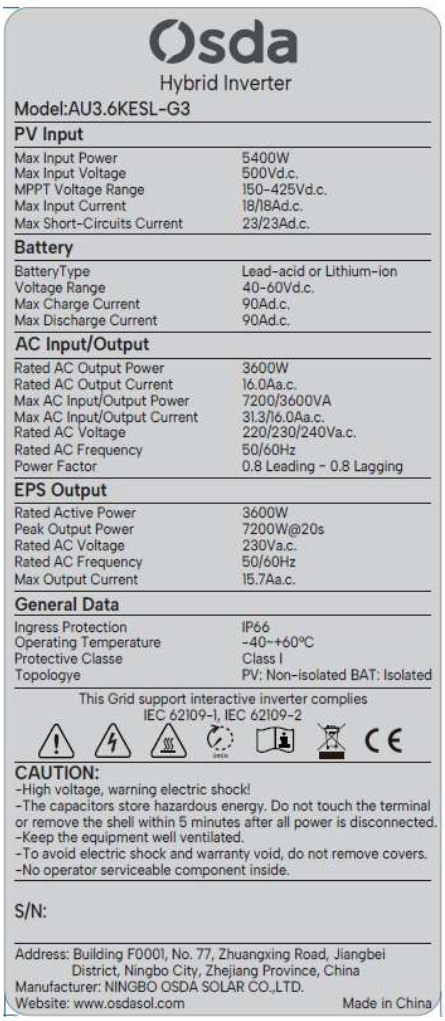
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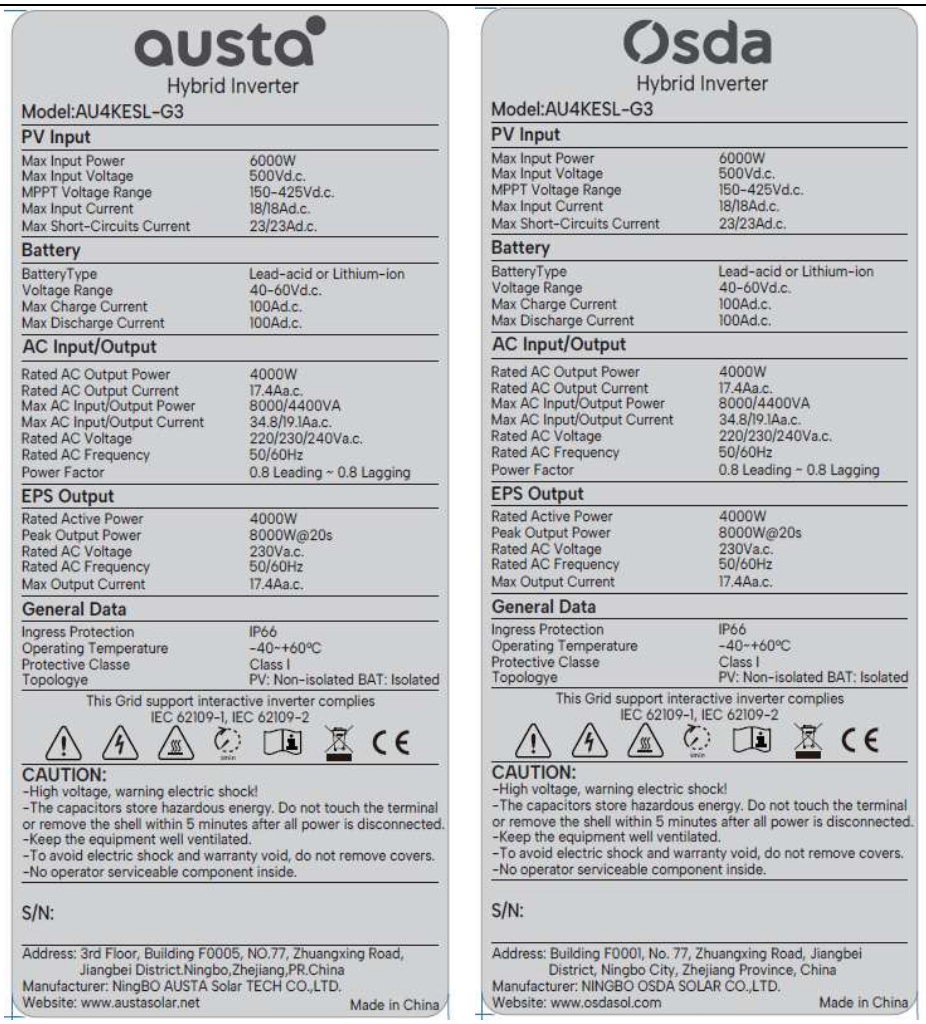
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.






austa
Hybrid Inverter
Model:AU3.6KESL-G3
PV Input
Max Input Power 5400W
Max Input Voltage 500Vd.c.
MPPT Voltage Range 150-425Vd.c.
Max Input Current 18/18Ad.c.
Max Short-Circuits Current 23/23Ad.c.
Battery
BatteryType Lead-acid or Lithium-ion
Voltage Range 40-60Vd.c.
Max Charge Current 90Ad.c.
Max Discharge Current 90Ad.c.
AC Input/Output
Rated AC Output Power 3600W
Rated AC Output Current 16.0Aa.c.
Max AC Input/Output Power 7200/3600VA
Max AC Input/Output Current 31.3/16.0Aa.c.
Rated AC Voltage 220/230/240Va.c.
Rated AC Frequency 50/60Hz
Power Factor 0.8 Leading ~ 0.8 Lagging
EPS Output
Rated Active Power 3600W
Peak Output Power 7200W@20s
Rated AC Voltage 230Va.c.
Rated AC Frequency 50/60Hz
Max Output Current 15.7Aa.c.
General Data
Ingress Protection IP66
Operating Temperature -40~+60℃
Protective Classe Class I
Topologye PV: Non-isolated BAT: Isolated
This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2
CE
CAUTION:
-High voltage, warning electric shock!
-The capacitors store hazardous energy. Do not touch the terminal or remove the shell within 5 minutes after all power is disconnected.
-Keep the equipment well ventilated.
-To avoid electric shock and warranty void, do not remove covers.
-No operator serviceable component inside.
S/N:
Address: 3rd Floor, Building F0005, NO.77, Zhuangxing Road, Jiangbei District.Ningbo,Zhejiang,PR.China
Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net
Made in China


Osda
Hybrid Inverter
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PV Input
Max Input Power 5400W
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Address: Building F0001, No. 77, Zhuangxing Road, Jiangbei District, Ningbo City, Zhejiang Province, China
Manufacturer: NINGBO OSDA SOLAR CO.,LTD.
Website: www.osdasol.com
Made in China



austa

Hybrid Inverter

Model:AU4KESL-G3

PV Input

Max Input Power	6000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	100Ad.c.
Max Discharge Current	100Ad.c.

AC Input/Output

Rated AC Output Power	4000W
Rated AC Output Current	17.4Aa.c.
Max AC Input/Output Power	8000/4400VA
Max AC Input/Output Current	34.8/19.1Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	4000W
Peak Output Power	8000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	17.4Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies IEC 62109-1, IEC 62109-2

CAUTION:

-High voltage, warning electric shock!
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Manufacturer: NingBO AUSTA Solar TECH CO.,LTD.
Website: www.austasolar.net Made in China

Osda

Hybrid Inverter

Model:AU4KESL-G3

PV Input

Max Input Power	6000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	100Ad.c.
Max Discharge Current	100Ad.c.

AC Input/Output

Rated AC Output Power	4000W
Rated AC Output Current	17.4Aa.c.
Max AC Input/Output Power	8000/4400VA
Max AC Input/Output Current	34.8/19.1Aa.c.
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Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	4000W
Peak Output Power	8000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	17.4Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

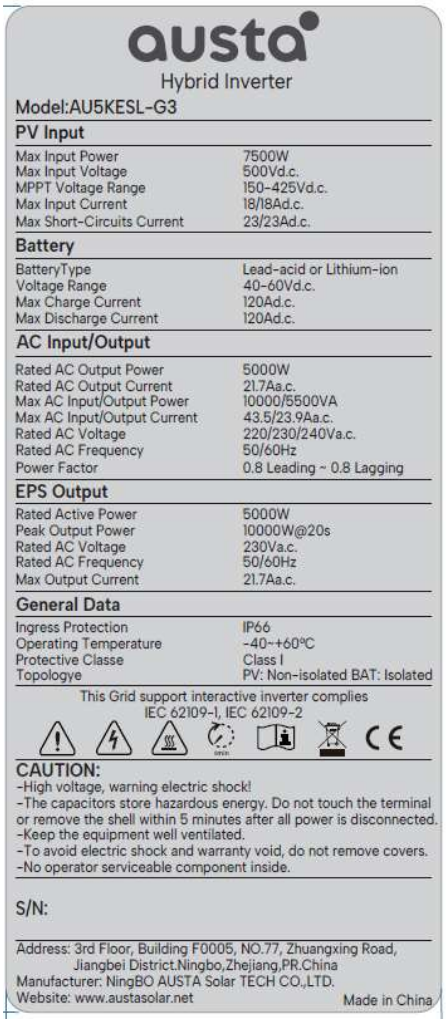
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Website: www.osdasol.com Made in China



austa

Hybrid Inverter

Model:AU5KESL-G3

PV Input

Max Input Power	7500W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	120Ad.c.
Max Discharge Current	120Ad.c.

AC Input/Output

Rated AC Output Power	5000W
Rated AC Output Current	21.7Aa.c.
Max AC Input/Output Power	10000/5500VA
Max AC Input/Output Current	43.5/23.9Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	5000W
Peak Output Power	10000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	21.7Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

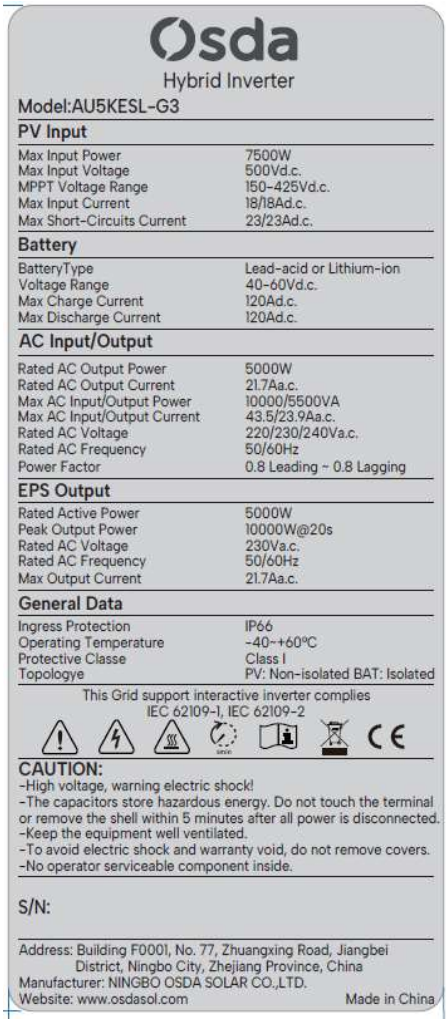
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Website: www.austasolar.net Made in China



Osda

Hybrid Inverter

Model:AU5KESL-G3

PV Input

Max Input Power	7500W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	120Ad.c.
Max Discharge Current	120Ad.c.

AC Input/Output

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Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	5000W
Peak Output Power	10000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	21.7Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60℃
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

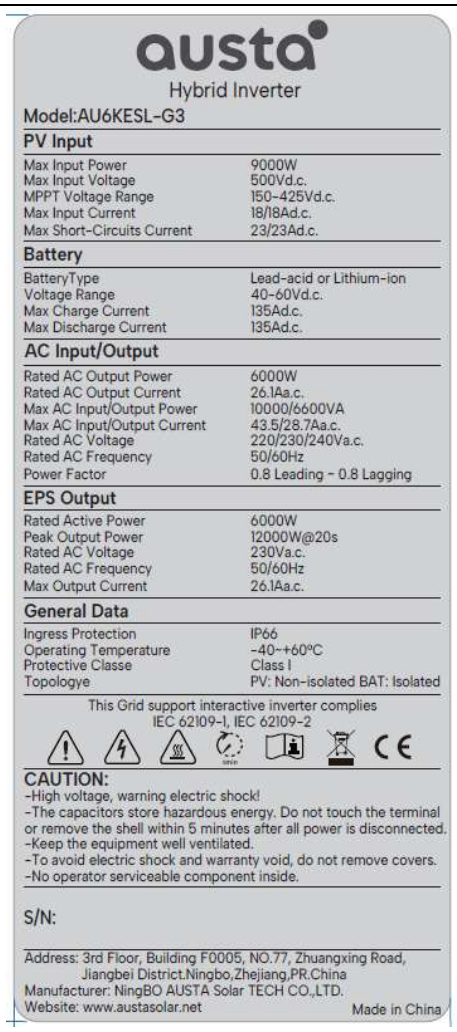
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Manufacturer: NINGBO OSDA SOLAR CO.,LTD.
Website: www.osdasol.com Made in China


austa

Hybrid Inverter

Model:AU6KESL-G3

PV Input

Max Input Power	9000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	135Ad.c.
Max Discharge Current	135Ad.c.

AC Input/Output

Rated AC Output Power	6000W
Rated AC Output Current	26.1Aa.c.
Max AC Input/Output Power	10000/6600VA
Max AC Input/Output Current	43.5/28.7Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	6000W
Peak Output Power	12000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	26.1Aa.c.

General Data

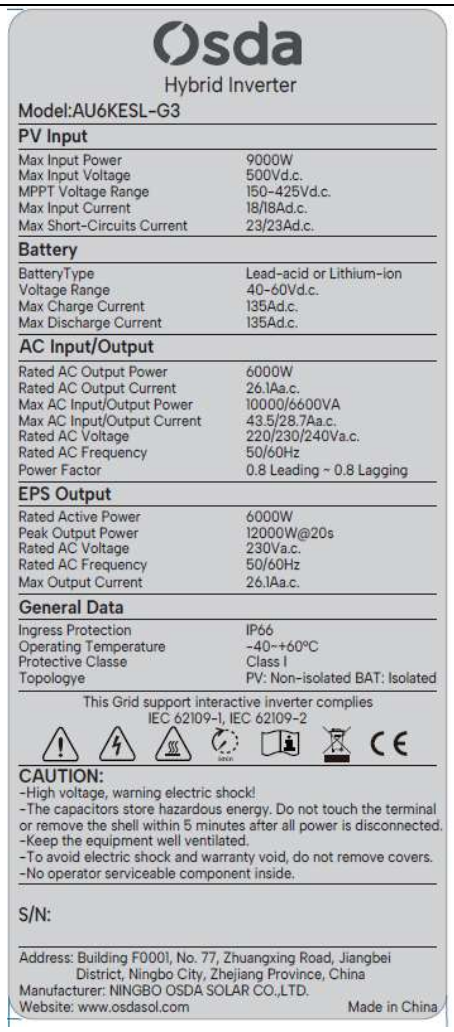
Ingress Protection	IP66
Operating Temperature	-40~+60°C
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies
IEC 62109-1, IEC 62109-2

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Osda

Hybrid Inverter

Model:AU6KESL-G3

PV Input

Max Input Power	9000W
Max Input Voltage	500Vd.c.
MPPT Voltage Range	150-425Vd.c.
Max Input Current	18/18Ad.c.
Max Short-Circuits Current	23/23Ad.c.

Battery

BatteryType	Lead-acid or Lithium-ion
Voltage Range	40-60Vd.c.
Max Charge Current	135Ad.c.
Max Discharge Current	135Ad.c.

AC Input/Output

Rated AC Output Power	6000W
Rated AC Output Current	26.1Aa.c.
Max AC Input/Output Power	10000/6600VA
Max AC Input/Output Current	43.5/28.7Aa.c.
Rated AC Voltage	220/230/240Va.c.
Rated AC Frequency	50/60Hz
Power Factor	0.8 Leading ~ 0.8 Lagging

EPS Output

Rated Active Power	6000W
Peak Output Power	12000W@20s
Rated AC Voltage	230Va.c.
Rated AC Frequency	50/60Hz
Max Output Current	26.1Aa.c.

General Data

Ingress Protection	IP66
Operating Temperature	-40~+60°C
Protective Classe	Class I
Topologye	PV: Non-isolated BAT: Isolated

This Grid support interactive inverter complies
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Manufacturer: NINGBO OSDA SOLAR CO.,LTD.
Website: www.osdasol.com Made in China

Test item particulars:	
Equipment mobility ..... :	movable hand-held stationary fixed transportable for building-in
Connection to the mains ..... :	pluggable equipment direct plug-in permanent connection for building-in
Environmental category ..... :	outdoor indoor unconditional indoor conditional
Over voltage category Mains ..... :	OVC I OVC II OVC III OVC IV
Over voltage category PV ..... :	OVC I OVC II OVC III OVC IV
Mains supply tolerance (%) ..... :	-90% / +110%
Tested for power systems ..... :	TN
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	Class I Class II Class III Not classified
Mass of equipment (kg) ..... :	See model list
Pollution degree ..... :	Outside PD3; Inside PD2
IP protection class ..... :	IP66
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
- test object does not evaluate according to manufacturer requirements ..... :	N/E
- this clause is information reference for installation .... :	Info.
Testing:	
Date of receipt of test item ..... :	2025-10-22 (samples provided by applicant)
Date (s) of performance of tests ..... :	2025-11-13 to 2025-12-13

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.
This report is not used for social proof function in China market.
"(see Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Use of uncertainty of measurement for decisions on conformity (decision rule):

No decision rule is specified by this standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method"

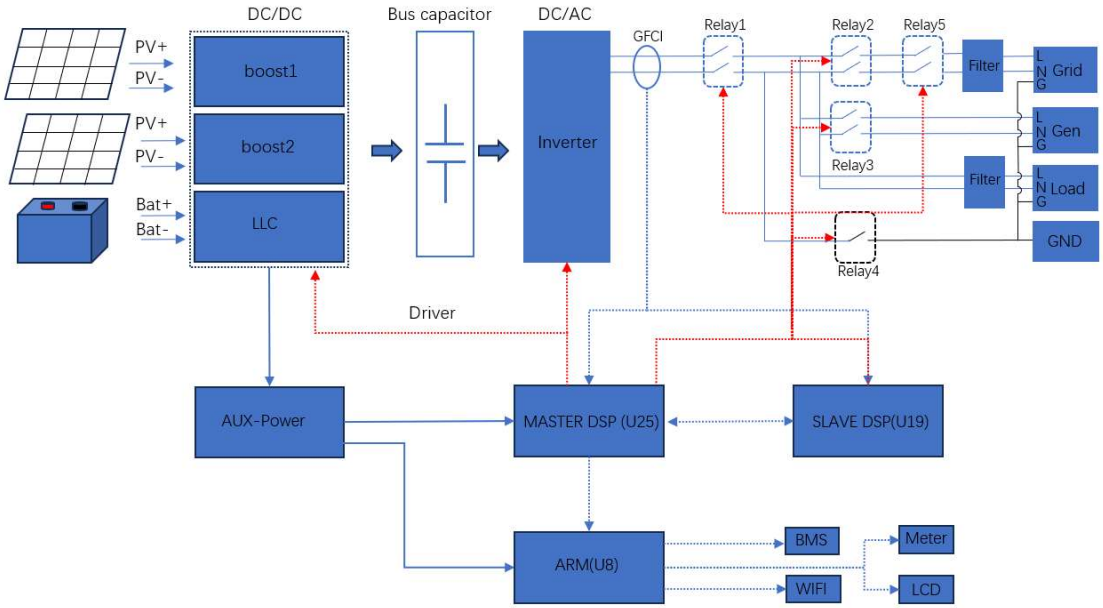
Name and address of factory (ies):

AUSTA(JIAXING) SOLAR TECH CO.,LTD.
No. 168, Cuijialu, Haiyan County, Jiaxing City, Zhejiang , P.R., China

General product information:

This product is a single-phase Hybrid inverter, which converts the DC voltage of solar panels into three - phase AC voltage and connects to the low-voltage grid to achieve power generation function. It can also control and dispatch power between grid, battery and back up. Inverter can dispatch AC power from grid to back up side, and also rectify AC power into DC power to charge the battery. The power flow between inverter and battery is bi-directional DC power. The specific dispatch mode and power flow direction is controlled by end user via inverter screen settings or APP settings.
There is an auxiliary power supply inside the product. The product can generate full power up to ambient temperature 45°C. When the temperature exceeds 45°C, the output power derates linearly until maximum ambient temperature 60°C.
The relay4 between phase N and GND shall be in the open position in final use.
The product does not provide galvanic separation between the PV input and AC output circuit (Non-isolation or transformerless type).

Block Diagram



All models are identical with hardware version and software version, the output power is derating by software.

The product was tested on:

If no special state, the tests were performed on model AU6KESL-G3.

Hardware version:

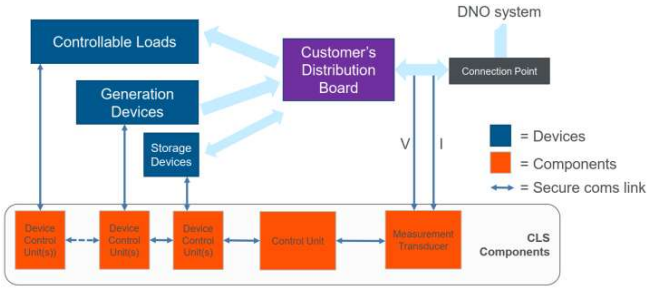
Control	Input / Output	Power	LLC	ARM	LCD
31700000805	31700000806	31700000804	31700000803	31700000801	31700000802

Software version:
DSP: Ver 1.0.0
ARM: Ver 1.0.0

CLS Designation:

Converter with Single-Phase Smart Meter
Smart Meter: DDSU666-Q

Model	AU3KESL-G3	AU3.6KESL-G3	AU4KESL-G3	AU5KESL-G3	AU6KESL-G3
PV input:					
Max input voltage (Vdc)	500				
MPPT voltage range (Vdc)	150 – 425				
Start-up voltage (Vdc)	125				
Max input current (A)	18	18 / 18			
Max short-circuits current (A)	23	23 / 23			
No. of MPPT trace paths	1	2			
Strings Per MPPT Tracker	1	1/1			
AC input (from grid):					
Rated voltage (Vac)	L / N / PE. 220/230/240				
Max. current (A)	26.1	31.3	34.8	43.5	43.5
Max. power (VA)	6000	7200	8000	10000	10000
Rated frequency (Hz)	50 / 60				
AC output (to grid):					
Rated power (W)	3000	3600	4000	5000	6000
Max. apparent power (VA)	3300	3600	4400	5500	6600
Rated current (A)	13	16	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 220/230/240				
Rated frequency (Hz)	50 / 60				
Power factor	0.8 leading …0.8 lagging				
EPS output:					
Rated power (W)	3000	3600	4000	5000	6000
Max. current (A)	13	15.7	17.4	21.7	26.1
Rated voltage (Vac)	L / N / PE. 230				
Rated frequency (Hz)	50 / 60				
Battery:					
Battery type	Lead-acid or Li-ion				
Voltage range (Vdc)	40 - 60				
Max. charge / discharge current (A)	75	90	100	120	135
General Data					
Topology	Transformerless				
Protective class	Class I				
Ingress protection (IP) rating	IP66				
Operating temperature	-40 to 60°C (>45°C derating)				
Altitude (m)	3000				
Dimension (W x H x D)	384 x 450 x 226 mm				
Weight	18 kg				

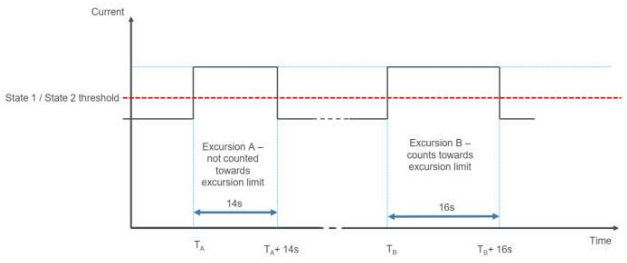
G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
4	**Requirements**		-
4.1	**Concept**		-
	A CLS can control any number of Devices.		Info.
	A CLS may comprise a single Component, communicating with one or more Devices, plus a Component which is a transducer at the Connection Point. Alternatively a CLS might comprise several discrete Components distributed in the Customer's Installation which communicate securely with each other and with the Devices they are controlling.		Info.
	Figure 4-1 Conceptual Representation of a CLS 		Info.
4.2	**General CLS Features**		-
	The maximum permissible tolerance for the CLS's measurement and control of current is ± 2% of the greater of the MEL or the MIL at the Connection Point. These tolerances shall, as far as possible, take account of sensing and/or measurement errors, processing errors, communication errors and control errors. Consideration shall also be given to environmental factors (eg the expected ambient temperature range). For example, where the MEL is zero and MIL is 400A the maximum acceptable tolerance for the measurement and control of current is ± 2% of 400A = ± 8A.		P
	The settings and controls of the CLS will not be generally accessible to Customers. The Manufacturer or Installer shall consider how settings can be applied by, and access limited to, Manufacturers or Installers via password, PIN or physical access capable of being sealed. These arrangements shall be stated in the description of the CLS referred to in this section.		P
4.3	**Operational States**		-
	A CLS has four key operating states:		-
4.3.1	State 1- Normal Operation		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	This is the normal operating state of the CLS. In this state the CLS will be modulating the consumption and generation of the Devices it controls such that current flowing at the Connection Point remains within that required by the MEL or MIL as appropriate and that the voltage at the Connection Point remains within statutory limits6. The CLS might be modulating the consumption and generation of the Devices continually in real time. Alternatively, if the behaviour of the Devices is balanced, or controlled by other systems, such that the current flow at the Connection Point is normally within the MEL or MIL, then only by exception should the balance be disturbed sufficiently such that the current flow at the Connection Point encroaches on the MEL or MIL. In this latter case the CLS will then need to actively modulate the consumption and generation of the Devices.		P
	It is also possible that Customers might have their Devices controlled by other systems than the EREC G100 CLS, eg in response to market or other signals. However, in this case, the CLS must be able to override any such system to ensure that the current flowing at the Connection Point remains within the state 1 limits.		P
4.3.2	State 2 – Occasional Excursion		P
	From time to time conditions within the Customer's Installation could be such that the current flow exceeds the MEL or MIL. This could be caused by normal operation (eg switching) of the Customer's Devices or other loads in the Customer's Installation (eg a kettle in a Domestic Installation), or it could be caused by the sudden failure or tripping of part of the Customer's load or generation equipment. Very short excursions into state 2 as part of normal operation are not problematic provided they are short, ie less than 15s. However longer excursions, such as might accompany failure or tripping of a Device should be rare by definition, and therefore not considered as normal operation. In both cases the CLS will recognize the condition and shall have the capability to control the Devices and bring the current flowing at the Connection Point back within the MEL or MIL and within a maximum response time.		P
	The default maximum response time for a CLS to bring the current flow back within MEL or MIL is 1 minute. For industrial or commercial installations where slow acting Devices (such as reciprocating gas engine driven generation, micro hydro etc) are controlled, a default maximum response time of 3 minutes will apply unless the DNO identifies that state 2 operation will result in network voltages above the statutory maximum. In these cases the DNO may require the response time to be 1 minute. There is more detail on this condition in section 4.4 below.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	As state 2 is designed to cater for rare events, the number of occasions that a CLS can operate in state 2 for more than 15s is limited. This is covered in more detail in section 4.5.		P
4.3.3	State 3 – Failed State		P
	This state is designed to cater for a failure of the CLS in some way. In this state the Devices shall be set to operate at levels that cannot, whatever happens next to equipment in the Customers Installation, breach the MEL or MIL. In many cases this will simply mean that the Devices are tripped or switched off. An alternative could be that some Devices are set to a clearly defined low power state such that their operation can never result in the current flowing at the Connection Point approach the MEL or MIL.		P
	If state 3 operation is caused by: • excessive import then the generation Devices shall not be constrained or tripped by the CLS; • excessive export then load Devices shall not be constrained or tripped by the CLS. The failure mechanisms, consequences and responses are covered in section 4.5 below. When a failure is detected by the CLS, it shall set all the Devices into their state 3 operational state within 15s.		P
4.3.4	State 4 – Operation without CLS		P
	State 4 need not be implemented by default. It is a state that allows operation of some of the Customer's Devices without the control of a CLS. Such a state might be required if the CLS is out of service for a considerable time for some reason.		P
	The operational arrangements for state 4 in many cases will be the same as those for state 3, ie with the Devices switched off or set to a permanently clearly defined low power state. However, particularly for larger industrial or commercial installations, the DNO might specifically agree how the installation can be operated in the absence of a functioning CLS. State 4 operation will only be allowed by pre-agreement with the DNO.		P
4.4	**Design Limits**		-
	The limitation on the capacities of Customer's Devices is set by state 2 operation. In state 2 operation, the MEL or MIL is breached and the resultant high current flows can lead to a number of undesirable or even dangerous situations. In general temporary high currents can be tolerated provided there are appropriate caps on their magnitude and duration, and on consequential effects such as voltage rises or dips.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	Any overload protection used for any Device in compliance with this EREC G100 must be arranged to grade with, and match the characteristics of, the DNO's protection at the Connection Point. The maximum operating time of such protection must not exceed 10s.		P
4.4.1	Thermal Limits		P
	The highest currents that can be imposed on the DNO's Distribution Network will be assessed and the DNO will confirm that these currents are tolerable on the DNO's Distribution Network for up to 5 minutes. Note that this is the design approach. The actual time that the CLS can allow state 2 operation to persist is only 1 minute (or 3 minutes where specifically notified to the DNO for appropriate technology such as reciprocating gas engine driven generation, micro hydro etc and where there is no adverse voltage effect as explained in section 4.3.2).		P
	In state 1 operation, if there is a risk that operating at the MEL or MIL causes frequent inadvertent excursion from state1 operation into state 2 operation it will be appropriate to set a state 1 operating limit that is sufficiently within the MEL or MIL limits, in order to minimise the frequency or duration of state 2 operation to avoid triggering the CLS functionality set out in 4.5.2.1.		P
4.4.2	Voltage Limits		P
4.4.2.1	State 2 Operating Limits		P
	DNOs have to respect the statutory limits on voltages as defined in the Electricity Safety Quality and Continuity Regulations (2002, SI 2002 2665). Circumstances, such as faults on Customers' Installations, or on the DNO's Distribution Network may cause temporary excursions outside these limits. These exceptions are expected occasionally, but must be limited. BS EN 50160 sets the expected worst case for excursions and any voltage excursion caused by state 2 operation shall fall within this envelope in BS EN 50160. Recognizing this limit, small excursions above or below the statutory limits should be limited to no more than 1 minute.		P
	DNOs will assess the worst case state 2 operation effect on the voltage of the Distribution Network. The Customer's Devices will be limited in capacity such that: • the worst case highest voltage cannot exceed 112% of nominal voltage (ie 257.6V at a nominal voltage of 230V) where the Customer's Connection Point is at LV or 108% of nominal voltage where the Customer's Connection Point is at HV; and • the worst case lowest voltage cannot be less than 87% of nominal (ie 200.1V) where the Customer's Connection Point is at LV and 92% of nominal voltage where the Customer's Connection Point is at HV.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
4.4.3	Protection Limits		P
	For installations where the DNO's interface or upstream protection is provided by fuses state 2 operation shall not impose a greater current flow than 145% of the nominal fuse rating.		P
	Where the DNO's interface or upstream protection is provided by relays, the DNO will assess the maximum current flow based on the appropriate settings for these relays.		P
4.5	**Fail Safe**		P
	All CLSs must fail to safety. If it is not inherently possible to arrange this within the CLS, alternative safety measures shall be provided as described in section 4.5.3.		P
4.5.1	Failure Detection		P
	Should a CLS fail, for any reason, there is the possibility that unsupportable high currents will flow, giving rise to the risk of damage to equipment or interference with other Customers' equipment and/or that excessively high or low voltages are present on the Distribution Network for unacceptable periods of time.		P
	Failure detection shall include internal failure of the CLS and its Components, as well as the failure of any communication channels used by the CLS to communicate between its Components and between Components and Devices as described in this section.		P
4.5.1.1	Internal Failure		P
	The CLS shall detect any internal failure and move its operation into state 3 immediately (ie within 15s) after detecting such a failure. The CLS Manufacturer or Installer shall state how: • the CLS will detect internal failures; • the Manufacturer or Installer has assessed that this is the complete range of possible failures; and • this can be demonstrated in testing.		P
4.5.1.2	Communication failures		P
	The CLS shall detect any defect in communication between its Components and Devices. This is especially necessary where the CLS is comprised of dispersed Components, including any Components that are transducers fitted at the Connection Point to measure current flows and direction. In particular the CLS shall detect discontinuity of the secondary circuit or the magnetic circuit of any current transformers employed. Any communication failure shall trigger a move into state 3 immediately (ie within 15s) after detecting such a failure.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
4.5.1.3	Excessive State 2 Operation		P
	Although state 2 operation is expected, operation for periods exceeding 15s is not expected to be frequent. Accordingly if a CLS breaches any of the following criteria, it shall enter state 3 operation immediately (ie within 15s): • A single excursion into state 2 operation that persists for more than 1 minute (or 3 minutes as allowed in 4.3.2); • There are more than three excursions (each of more than 15s and less than 1 minute (or 3 minutes as allowed in 4.3.2)) into state 2 operation in any 24 hour period; • The time between any two consecutive excursions into state 2 operation of greater than 15s is 10 minutes or less (measured from the time of re-entry into state 1 operation from state 2 operation following the first excursion).; or • For installations where the maximum excursion period is 3 minutes (as allowed in 4.3.2) the total time in state 2 operation in any 24 hour period, but neglecting any excursion of 15s or less, exceeds 8 minutes.		P
	Excursions that do or do not count towards excessive state 2 operation are shown diagrammatically in Figure 4-2. The implementation of the necessary counters and timers in the CLS must be done in nonvolatile memory so that they are not reset if power to the CLS is lost. **Figure 4-2 – Excursions into State 2 counting towards the excursion limit**  		P
4.5.2	Recovery from Failure		P
	The CLS should be capable of interrogation by the Customer to determine the nature of the failure.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	For internal failures, and excessive state 2 operation, the Customer, following resolution of the cause of the failure, shall be able to reset the CLS back to normal operation as follows: • For CLSs installed in Domestic Installations, 3 resets shall be allowed in any 30 day period. If this criterion is breached the CLS will remain locked in state 3 pending further investigation and resolution of the issues causing the CLS to be locked-out in state 3. The Manufacturer or Installer shall propose how lock out in state 3 can be resolved. • For CLSs installed in non-domestic installations any excursion into state 3 operation shall not be capable of being reset within 4 hours of the start of state 3 operation. • In both cases the Manufacturer or Installer has the option of performing a reset over the internet or by other remote means. Where such a remote reset facility is implemented, it must rely on direct communication between the Customer and the party implementing the reset to ensure that the reason for the lockout is understood and addressed. Note that there is no limit to the number of resets that are allowed for state 3 operation arising from communication failures, as required by 4.5.1.2 and 4.5.2.2.		P
4.5.2.2	Communication Failures		P
	The Customer shall be able to reset the CLS back to normal operation immediately in every case when communication has been restored, ie the lockout feature of 4.5.1.3 does not apply. A CLS may be arranged by the Manufacturer or Installer to self-reset from state 3 when state 3 operation is caused solely by communication failures.		P
4.5.3	Overload Protection and Alternatives to Fail Safe		N/A
	For Customer's Installations connected at HV overload and/or reverse power protection shall always be fitted. For Customers Installations connected at LV, if the Manufacturer or Installer does not provide a Fail Safe CLS, and/or the Customer cannot prove Fail Safe functionality then a CLS can still be used, but the Customer will need to install appropriate protection at the Connection Point.		N/A
4.6	**Communications**		P
	The Manufacturer or Installer must select an appropriate and secure communication medium for communication between the Components forming the CLS, and the Devices controlled by the CLS, noting that communication failures will cause state 3 operation of the CLS.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	The Manufacturer or Installer shall provide information describing the communication media used in the CLS with supporting information as to why this is appropriate in terms of reliability and security.		P
4.7	**Cyber security**		P
	Recognizing that cyber security is an evolving area, the Manufacturer or Installer shall consider the cyber security risks posed for the CLS both in terms of the communication between the Components forming the CLS, and the Devices controlled by the CLS and also in terms of interaction with any other system, including any Manufacturer's product management systems.		P
	Accordingly this EREC G100 makes no specific cyber security compliance requirements. However the Manufacturer or Installer shall provide information describing the high level cyber security approach, as well as the specific cyber security requirements complied with. The statement will make appropriate reference to the CLS's compliance with any relevant aspects of: • ETSI EN 303 645 CYBER; Cyber Security for Consumer Internet of Things: Baseline Requirements; • Distributed Energy Resources – Cyber Security Connection Guidance - published by BEIS and the ENA; • PAS 1879 Energy smart appliances – Demand side response operation – Code of practice; and • Any other relevant standard that has been incorporated in the design of the CLS.	Manufacturer's declaration provided for ETSI EN 303 645.	P
4.8	**Access to DNOs' Current and Voltage Signals**		P
	In general Customers will not have access to the DNO's current transformers, and where the Connection Point is at LV Customers will generally be able to provide appropriate voltage signals themselves.		P
4.9	**Generation in Non-exporting Sites**		P
	Where a Customer wishes to install generation but has no need to export power from the Customers Installation, an alternative to deploying a CLS is for the Customer to install reverse power protection at the Connection Point.		P
	The reverse power protection can be arranged to control or trip the generation or to trip the whole of the Customer's Installation. The design of the reverse power protection, and its settings, shall be agreed with the DNO and recorded in the Connection Agreement.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
4.10	**Multiple CLSs in a Single Installation**		P
	In some installations Customers might want to install more than one CLS controlling separate sets of Devices. For Customer's Installations connected at LV the sum of all the Current Ratings of generation and storage (in export mode) Devices, and/or the sum of all the capacities of significant loads and storage (in import mode) Devices shall be less than the respective state 2 limits for that installation. Ideally one CLS should be configured to act as the master CLS, and all other CLSs configured to harmonize with it, but this is not an essential requirement. Multiple independent CLSs are not prohibited provided compliance with this EREC G100 by the Customer's Installation is not compromised. Customers should note that multiple CLSs will need carefully setting up to avoid hunting, instability or other forms of undesirable interactions between them.		P
4.11	**Domestic Installations**		P
	The principles and requirements of this EREC G100 shall apply in full to Domestic Installations. It is expected that generally Domestic Installations will comprise Fully Type Tested CLSs.		P
	Where a CLS is designed to manage export to the DNOs Distribution Network and is Fully Type Tested it shall be capable of having the state 1 operating limit (ie the MEL) set to 16A, 32A, 60A, 80A or 100A (per phase values). Manufacturers can provide other settings, but not more than 100A, and shall ensure the design minimises the risk of Installers inadvertently selecting an inappropriate limit. The Installer shall make the appropriate selection for the specific installation, and which shall be protected from being changed in accordance with the requirements of section 4.2. The DNO would not expect to witness the installation, commissioning and operation of the CLS		P
	Where a CLS is designed to manage import from the DNOs Distribution Network and is Fully Type Tested it shall be capable of having the state 1 operating limit (ie the MIL) set to 60A, 80A or 100A (per phase values). Manufacturers can provide other settings, but not more than 100A and shall ensure the design minimises the risk of Installers inadvertently selecting an inappropriate limit. The Installer shall make the appropriate selection for the specific installation, and which shall be protected from being changed in accordance with the requirements of section 4.2. The DNO would not expect to witness the installation, commissioning and operation of the CLS.		P
	These principles would also apply where a Fully Type Tested CLS is designed to manage both export to and import from the DNOs Distribution Network. For commissioning Fully Type Tested CLSs the requirements of 5.2 apply.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
4.12	**Interfaces with DNOs' Systems**		P
	By agreement it may be appropriate to interface a Customer's CLS with systems used by a DNO to manage their network dynamically. This might be to implement active network management, a flexible connection or a flexibility contract between the Customer and the DNO.		P
	The interface could be to accept a single new set point for the maximum current that can be exchanged at the Connection Point, or a variable set point. In either case the DNO will provide the protocols and other information necessary for the interface.		P
5	**Application and Acceptance**		-
	Customers (or Installers on the Customers' behalf) shall provide information on the proposed CLS and Devices to enable DNOs to make an assessment of the risk to the Distribution Network.		-
5.1	**General**		-
	The Customer (or the Installer on the Customer's behalf) is responsible for demonstrating that any CLS installed in the Customer's Installation complies with the requirements detailed in this document. Installers are responsible for demonstrating, via Manufacturers' type tests, other published information, and/or appropriate site tests that the CLS complies with the requirements detailed in this document. Installers are also responsible for providing Customers who own that equipment with sufficient information to enable Customers to meet their own obligations to demonstrate compliance. In order to safely and effectively test a CLS, it is necessary to be able to simulate instances where the CLS is expected to operate. Where a CLS is integrated into the Device it controls, has a range of settings, and is intended to be a Fully Type Tested CLS, then it shall be tested at the extremities of its export and import current settings, and one intermediate export or import current setting. This requirement does not apply to stand alone CLSs that are commissioned on site.		Info.

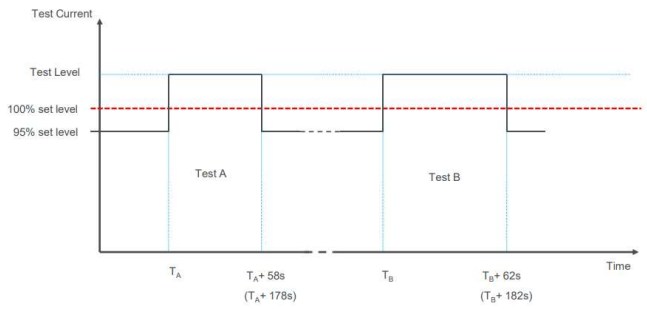
G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
5.2	**Site commissioning of Fully Type Tested CLSs**		Info.
	Where the functions described in section 5.6 have been validated in a type test by the Manufacturer (ie the CLS is Fully Type Tested), a reduced set of tests can be undertaken on site. In these cases it will be sufficient to undertake the communication and power supply Fail Safe tests in section 5.5 (i.e. all the tests in Table 5-1 - Test Sequencewith the exception of test 9) to prove that the CLS reacts appropriately. Form C (Appendix C) must be submitted in all cases, but Form B (Appendix B) is not required where the reference to the Fully Type Tested compliance information on the ENA's Type Test Register is included as a reference on Form C.		Info.
5.3	**Commissioning Sequence**		Info.
	CLS commissioning shall only be undertaken after all other Device commissioning has been successfully completed. The Customer (or the Installer on the Customer's behalf) shall provide to the DNO all relevant scheme drawings and information to enable safe, informed commissioning of the CLS.		Info.
	In order to ensure that commissioning does not cause any safety issues on the DNO's Distribution Network, the following commissioning sequence shall be followed. Tests shall be performed in the sequence indicated and the process shall only proceed to the next stage once the preceding stage has been successfully undertaken: The commissioning test actions shall be carried out in the following order: 1. Implement the measures to ensure that the MEL or MIL cannot be exceeded. 2. Perform Fail Safe tests. 3. Perform operational testing. 4. Set export and/or import limits. 5. Verify export and import limits are correct.		Info.

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
5.4	**Preventing the Limits Being Exceeded During Testing and Commissioning**		P
	Care shall be taken whilst testing and commissioning the CLS so that the MEL or MIL is not breached. This may involve setting the export or import limit to a lower threshold for compliance demonstration purposes. A combination of the following measures should be considered to ensure that MEL and/or MIL is not exceeded during setup/testing: • Temporarily programming the CLS export and/or import or setpoint limits to 50% (or less) than MEL and/or MIL; • Temporarily narrowing the range of the CLS voltage limits (ie bringing the set points closer to the nominal voltage); • Restricting the maximum output of the generation (eg on a PV system with multiple inverters, turning off a number of the inverters); • Restricting the amount of load that is connected; and • Operating a temporary load, load bank or generator. If the CLS settings need to be changed in order to demonstrate operation, then they shall be restored and confirmed once testing is complete. Note that testing will lead to what normally would be considered excessive state 2 operation and hence lock-out. Manufacturers or Installers may provide a test mode to allow for this – see 4.5.2.		P
5.5	**Fail Safe Tests**		P
	The purpose of the Fail Safe tests is to ensure that should any part of the CLS fail, the current flow across the Connection Point, and the voltage imposed on the Distribution Network, will remain within, or return within the required time to, the design limits. There are a number of potential options for reducing the current flows such that the design limits are not breached including: 1. Switching off relevant Devices completely; 2. Reducing the number of the Devices operating such that the aggregate current capacity of the Devices remaining operational is equal or less than the MEL and / or MIL; and 3. Operating all Devices at a restricted output such that as in aggregate their combined current is safely and securely limited to be equal or less than the MEL and/or MIL.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	The Fail Safe test process comprises a sequence of tests on each separate Component of the CLS. Each Component and Device needs to have, where relevant, its communication medium removed or interrupted and, separately, its power supply interrupted.		P
	At no time during the Fail-Safe test sequence shall the current flowing through the Connection Point rise above the programmed export and/or import limit (taking account of Manufacturer's published tolerances) for a period of time longer than the specified reaction time.		P
	The following table describes a typical test sequence. Not all CLSs will have all of the Components listed and others may have additional Components that need to be included in the test sequence. The CLS shall be restored to normal operation after each of the tests below.		P
	Table 5-1 - Test Sequence **No.** / **Component** / **Test** 1 / **Connection Point Component** (ie transducer) / Remove power supply to transducer† 2 / Principle **CLS Component(s)** / Remove power supply 3 / **Components** controlling generation **Devices** / Remove power supply to each in turn 4 / **Components** controlling storage **Devices** / Remove power supply to each in turn 5 / **Components** controlling load **Devices** / Remove power supply to each in turn 6 / Communication controller and or hubs/switches etc / Remove power supply to each in turn 7 / Communication between **Components** / Remove/interrupt communication to each **Component** in turn† 8 / Where applicable communication between **Components** and **Devices** / Remove/interrupt communication between each **Component** and associated **Device** in turn 9 / **CLS** system / With reference to the **Manufacturer**'s published information on internal failures (see 4.5.1.1) undertake the recommended tests etc to confirm that the **CLS** detects and reacts appropriately to internal failures.		P
	†There are safety issues in interrupting current transformer circuits, which can give rise to dangerously high voltages. Care must be taken to ensure that the current transformer connections and/or secondary circuits are either tested with zero primary current, or are short circuited, or ideally both, before the circuit to the transducer is opened.		P
	For each test confirm that the CLS enters state 3 operation, and that on restoration of communication or power to the relevant Component or Device it is then possible to immediately reset the CLS into state 1 operation.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

5.6	**Operational tests**		P
	In order to safely and effectively test a CLS, it is necessary to simulate normal state 1 operation and then the transition from state 1 to state 2 to confirm that it responds appropriately. Note that operating setpoints must be reduced so that state 2 operation for testing purposes does not exceed the MEL or MIL as explained in section 5.4. Two different means may be employed to simulate this: 1. Manual control over the Devices operating on the site; or 2. Injection testing using a calibrated test set The method adopted will depend on the nature of the site. On larger sites (eg an office, factory or school with multiple distributed Devices), injection testing may be the only practical option. Note that the tests described in 5.6.1 and 5.6.2 amalgamate the CLS's control capability (ie regulating output/input levels of Devices) with the correct operation in states 1, 2 and 3. Depending on the design of the CLS, and its facilities for testing, it might be necessary to devise a test plan that tests these two aspects (ie control of Devices and correct movement between states) separately.		P
	The correct orientation of any part of a Component that measures current and/or voltage shall be confirmed.		P
	Operational testing shall be performed that demonstrates satisfactory transition between state 1 operation and state 2 operation. Tests shall be undertaken that demonstrate the correct operation in returning to state 1 operation from state 2 operation as well as showing that excessive state 2 operation will lead to state 3 operation (Fail Safe). This is shown conceptually in Figure 5-1 Test A demonstrates that an excursion outside the test level threshold triggers the correct CLS response without triggering Fail Safe, whereas test B should trigger the Fail Safe condition.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
	Figure 5-1 shows the tests to be undertaken. Note that the time in brackets is for those technologies (see 4.4.1) where the three minute limit on excess current flow in state 2 applies. **Figure 5-1 – Current Step Tests**  		P
	To carry out the tests the site conditions should be adjusted and a generic test method could be: 1. The export and import current limits are adjusted (ie set to zero or a percentage of the MEL or MIL value). 2. The consumption and/or output of the Devices are manually increased / decreased.		P
	Note that if testing without a Manufacturer's or Installer's test mode, operation in state 2 will lead to lockout in state 3. This is not an issue for a Fully Type Tested CLS, but for an installation where the full EREC G100 tests are carried out on site, arrangements will need to be made to cater for this aspect.		P
	Pass-Fail criteria: The CLS is considered to have passed the test if during the test sequence the current exported from or imported to the site at the Connection Point do not breach the set-point limits for a period of time longer than the specified reaction time.		P
5.6.1	Operational testing – Manual Load Control		P
	The consumption and/or output of the Devices should be manually adjusted to achieve the test levels at the Connection Point. Arrangements will have to be made to hold the required test conditions at the Connection Point for sufficient time to demonstrate compliance noting that the natural behaviour of the CLS will be to resolve (ie reduce) the conditions, ie to move back from state 2 operation into state 1 operation. As described above it might be necessary to take other measures during testing to ensure that the correct fail safe behaviour occurs when the conditions at the Connection Point are maintained for longer than the fail-safe time threshold.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
5.6.2	Operational testing – Injection Testing		P
	Export and/or import limit conditions can be simulated by temporarily injecting current into the transducer(s) using a calibrated injection test set. When using an injection test set, there is normally no feedback loop between the CLS and the injection test set. This has two significant implications for the test process: 1. As soon as the CLS begins to operate, because it sees no corresponding decrease in current flow, the control loop will keep running until the relevant Devices reach the limit of their operating range; and 2. To ensure that the CLS is reacting by an appropriate amount and within an acceptable time period, a step change needs be applied by the test set to the Connection Point transducer		P
5.6.3	Test Sequence		P
	The following test sequence shall be performed as appropriate to the Devices installed (eg if there is no control over import, do not carry out the import or low voltage tests). Note that where testing is being done under manual load control, tests 1, 3, 4 and 6 shall be completed from Test A (ie tests 2 and 5 can be omitted.		P
	Table 5-2 – List of Tests Test A | Parameter stepped to the value shown and held there for 58s (or 178s by agreement with DNO) | Required outcome 1 | Export = 105% of programmed limit value | State 1 2 | Export = 110% of programmed limit value | " 3 | Export = 120% of programmed limit value | " 4 | Import = 105% of programmed limit value | " 5 | Import = 110% of programmed limit value | " 6 | Import = 120% of programmed limit value | " Test B: repeat test 1 and 4 only of the above | Test Level (step change) final value – maintained for 62s (or 182s by agreement with DNO) | 7 | Export = 105% of programmed limit value | State 3 8 | Import = 105% of programmed limit value | "		P
	The procedure for performing the test is as follows. The test needs to be repeated for import and export as appropriate. Test A demonstrates normal excursion into state 2 followed by a return to state 1 operation. Test B demonstrates excessive state 2 operation and hence confirms the Fail Safe functionality.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
5.6.3.1	Test A		P
	• Initially apply an injection of 100% of nominal voltage and inject current to mimic a current flow equivalent to of 95% of the limit setting. • Step up the current to give a current flow equivalent to 105% of the limit (for Test 1), Check that change in level is registered appropriately by the CLS. Check that the CLS is in state 2. • Check that the current from generation and exporting storage Devices reduces to a value at least 5% below the export limit setting within the specified reaction time. Be aware that as noted in 5.6.2 (1) the CLS will continue to drive the output of the Device away from its original set point. • Within 58s reduce the injected current back to 95% of the limit. Check that the CLS has returned to state 1. • Repeat the above for step increases from 95% to 110% of the set limit and from 95% to 120% of the set limit as detailed in Table 5-2.		P
5.6.3.2	Test B		P
	• Initially apply an injection of 100% of nominal voltage and inject current to mimic a current flow equivalent to of 95% of the limit setting. • Step up the current to give a current flow equivalent to 105% of the limit (for Test 7), Check that change in level is registered appropriately by the CLS. Check that the CLS is in state 2. • After 62s (or 182s where appropriate) check that the CLS has moved into state 3; reduce the injected current back to 95% of the limit. • Confirm that all Devices have assumed an operating state (including being tripped off) as required by state 3. • Confirm that Devices remain in state 3 operating mode (or off) until the CLS is reset.		P
5.6.3.3	Confirm Reset from State 3		P
	Confirm that state 3 remains in operation until reset, and that all Devices can only be operated (if at all) in their state 3 state. Confirm that the CLS in a Domestic Installations can be reset to state 1 immediately and that the CLS locks into state 3 on the third occasion. Confirm that the CLS in a non-domestic installation can only be reset after 4 hours.		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict
5.6.3.4	Test Completion		P
	When injection testing is complete, the correct orientation of any current monitoring connections (including transducer orientations) which may have removed for the test must be checked and verified as being correct. If settings have been changed in order to demonstrate operation, they must be restored and confirmed as being correct once testing is complete. Finally allow the CLS to operate under normal conditions and confirm that there is no inappropriate control cycling or hunting.		P
5.7	**Overload and Reverse Power Protection**		P
	Where overload protection and/or reverse power protection is used for Customer's Installations connected at HV, or as an alternative to installing an EREC G100 compliant CLS, or as an alternative to Fail Safe (see 4.5.3 and 4.10) these shall be tested by secondary injection.		P
6	**Ongoing Obligations**		P
	The DNO shall have the right to request that the Customer carry out compliance tests and simulations according to a repeat plan or scheme, and additionally after any failure, modification or replacement of any equipment that may have an impact on the CLS's compliance with the requirements of this EREC G100. Any repeat tests etc shall be undertaken in accordance with section 5 of this EREC G100.		P
7	**Manufacturers' CLS Product Declarations**		P
	Manufacturers of CLSs having undertaken the required tests shall complete the EREC G100 Product Declaration as set out in Appendix B. A copy of this declaration shall be provided to the Customer. The Customer will then provide a copy of the product declaration to the DNO as set out in section 5 of this EREC G100.		P
	The Manufacturer has the option of registering the Product Declaration on the ENA's Type Test Register. In which case it will be sufficient for the Customer to quote the ENA reference number on Form C in lieu of presenting a copy of the Product Declaration		P
Appendix A	**CLS Application Information**		Info.
Appendix B	**Manufacturer's CLS Product Information**		Info.
Appendix C	**CLS Installation and Commissioning Tests**		P

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Appendix 1: Type Verification Test Report
G100/2 - Form B - Compliance Verification Report for Customer Export or Import Limitation Schemes

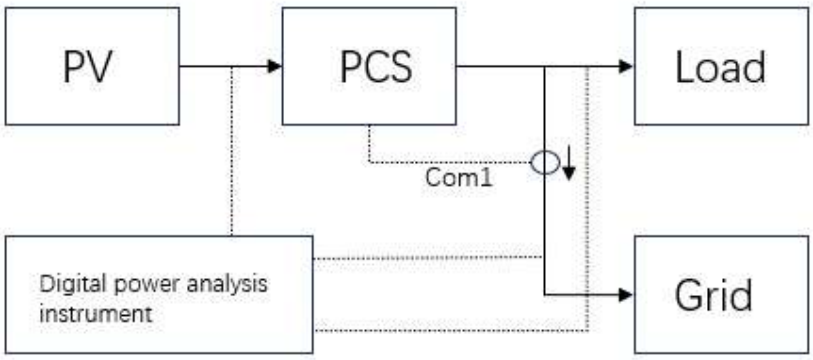
CLS Designation	Converter with Single-Phase Smart Meter
Manufacturer name	NINGBO AUSTA SOLAR TECH CO.,LTD.
Address	3rd Floor,Building F0005, NO.77,Zhuangxing Road,Jiangbei District,Ningbo, Zhejiang, P.R.China
CLS information:	
Converter	AU3KESL-G3, AU3.6KESL-G3, AU4KESL-G3, AU5KESL-G3,AU6KESL-G3;
Single-Phase Smart Meter	DDSU666-Q (Zhejiang Chint Electrics Co., Ltd)

Export/Import capabilities			
Export	Y	Import	Y

Description of Operation

EREC G100 section 4.2 requires a description of the **CLS**, and schematic diagram, to be provided to the **Customer**. Please provide that description and the diagram here.

schematic diagram:



Description

The CLS system is composed with the AUSTA&OSDA Hybrid Inverter and Single-Phase Smart Meter.

The Single -Phase Smart Meter is installed at downstream of the utility meter for billing of grid connection point of the system and measuring the current / voltage / power data, etc. The measuring data will be obtained by the inverter through PLC between the inverter and SAU, then SAU communicate with meter throuth RS485. Inverter will dynamically control its generation power or consumption power based on the metering data to guarantee the export current or import current at the grid connection point into the distribution network will not exceed the CLS in a normal condition.

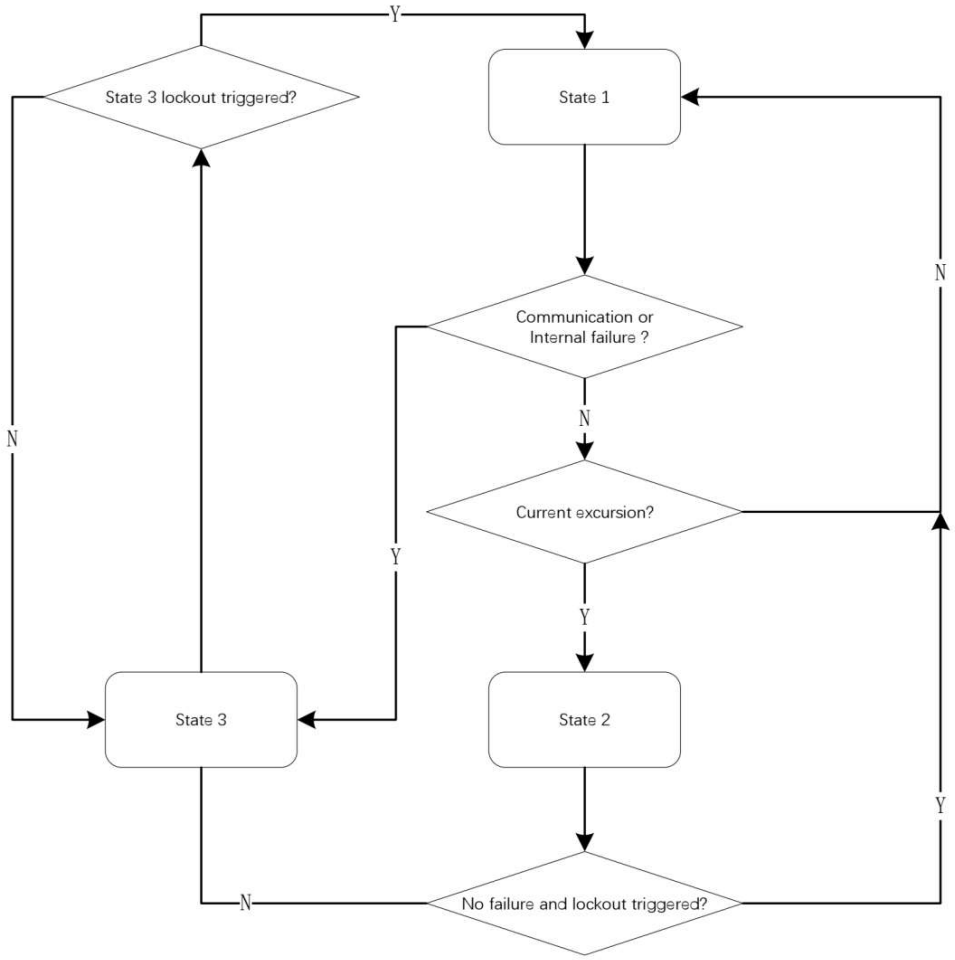
G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Communications Media
Document the provisions made for the use of various communication media, and both the inherent characteristics and the design steps made to ensure security and reliability.
Inverter and external module communication: 1.SAU communicates with meter through RS-485 interface For the RS-485 link between the SAU and the meter, shielded cables, standard termination resistors and Cyclic Redundancy Check (CRC) are adopted to reduce communication errors. 2. Inverter communicates with IOT module (WiFi) in with USB interface Industrial-grade USB interfaces with surge protection are used for connections among the inverter, IoT module and WIFI module. Heartbeat detection is enabled to monitor link status. 3. IOT module communicates with server through WIFI WIFI supports automatic reconnection and local data caching.
Cyber Security
Confirm that the **Manufacturer** or **Installer** of the **CLS** has provided a statement describing how the **CLS** has been designed to comply with cyber security requirements, as detailed in section 4.7.
We NINGBO AUSTA SOLAR TECH CO.,LTD declare that certified Hybrid Inverter AU3KESL-G3, AU3.6KESL-G3, AU4KESL-G3, AU5KESL-G3, AU6KESL-G3 and any associated equipment to be included in the certification, are in compliance with Cyber security requirements in accordance with the standards: • ETSI EN 303 645;
Power Quality Requirements
Where the **CLS** includes the power electronics that controls generation or loads (as opposed to the power electronics being included in **Devices** that are subject to their own power quality compliance requirements) please submit the harmonic and disturbance information here as required by EREC G5 and EREC P28.
AUSTA&OSDA Hybrid Inverter used with One-Phase Smart Meter fulfil the power quality test. Refer to the EREC G98/2 (up to 16A) test report no. 6252419.50V1.1 and EREC G99/2(more than 16A) test report no.6252420.50V1.1 for detail.

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Fail Safe

CLS internal failure: please submit here the description of the internal **Fail Safe** design and operation. Please also document how it has been demonstrated, including the non-volatile recording of times and numbers of state 2 operations, and confirm the overall response of the **CLS** to this internal failure.



AUSTA&OSDA CLS was designed with a fail-safe mechanism according to G100 section 4.5. Therefore, the system design ensures that it will limit the imported/exported current at the site to the DNO's agreed limit(s).

All the components in the AUSTA&OSDA CLS system are either wired or wireless and are registered by the CLS. At the commissioning process the device is registered as a generation/non generation device. In the event of a detected failure the system will operate the Fail-safe mechanism by reducing the component generation to zero immediately according to the table above.

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Communication and power supply failures between **Components** and **Devices**. Please document here compliance with EREC G100 section 5.5.

Table 5-1 - Test Sequence

No.	Component	Test
1	**Connection Point Component** (ie transducer)	Remove power supply to transducer†
2	Principle **CLS Component(s)**	Remove power supply
3	**Components** controlling generation **Devices**	Remove power supply to each in turn
4	**Components** controlling storage **Devices**	Remove power supply to each in turn
5	**Components** controlling load **Devices**	Remove power supply to each in turn
6	Communication controller and or hubs/switches etc	Remove power supply to each in turn
7	Communication between **Components**	Remove/interrupt communication to each **Component** in turn†
8	Where applicable communication between **Components** and **Devices**	Remove/interrupt communication between each **Component** and associated **Device** in turn
9	**CLS** system	With reference to the **Manufacturer**'s published information on internal failures (see 4.5.1.1) undertake the recommended tests etc to confirm that the **CLS** detects and reacts appropriately to internal failures.

†There are safety issues in interrupting current transformer circuits, which can give rise to dangerously high voltages. Care must be taken to ensure that the current transformer connections and/or secondary circuits are either tested with zero primary current, or are short circuited, or ideally both, before the circuit to the transducer is opened.

For each test confirm that the **CLS** enters state 3 operation, and that on restoration of communication or power to the relevant **Component** or **Device** it is then possible to immediately reset the **CLS** into state 1 operation.

Component/Device number/description	test	Enter state 3 within 15s Yes/No
Connection Point Component	Remove power supply to transducer	Yes
Components controlling generating Devices	Remove power supply to DSP	Yes
Communication controller	Remove power supply to communication controller	Yes
Communication between Meter and Inverter	Remove/Interrupt communication between Meter and Inverter	Yes
CLS system	Relay detect disabled, Voltage measurement disabled, Current measurement disabled	CLS can report the corresponding fault and enters state 3 within 15s

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Operational Tests

In accordance with EREC G100 section 5.6 undertake the tests A to D to confirm correct operation in state 1 and state 2, that transition into state 3 occurs as required, and that behaviour in state 3 is also as required.

Figure 5-1 – Current Step Tests

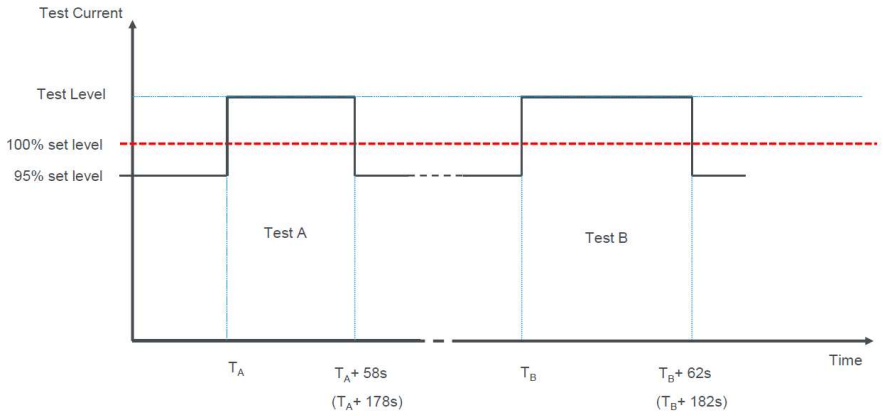


Table 5-2 – List of Tests

Test A	Parameter stepped to the value shown and held there for 58s (or 178s by agreement with DNO)	Required outcome
1	Export = 105% of programmed limit value	State 1
2	Export = 110% of programmed limit value	"
3	Export = 120% of programmed limit value	"
4	Import = 105% of programmed limit value	"
5	Import = 110% of programmed limit value	"
6	Import = 120% of programmed limit value	"
Test B: repeat test 1 and 4 only of the above	Test Level (step change) final value – maintained for 62s (or 182s by agreement with DNO)	
7	Export = 105% of programmed limit value	State 3
8	Import = 105% of programmed limit value	"

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

Test A (Setting MEL=MIL=26.08A, 0.95MEL=0.95MIL=24.77A)						
Nominal Export Limit (for type tests this will be at maximum, minimum and one intermediate setting) in Amp:						EL= 26.08 Amps
Nominal Import Limit (for type tests this will be at maximum, minimum and one intermediate setting) in Amp:						IL= 26.08 Amps
No	Starting level （A）	Step value(A)	**CLS** registers change in level?	**CLS** and/or **Component** and/or **Device** initiates correct response of ≥ 5%?	Duration of step in test	Correct state 1/ state 2 operation
1	24.78	27.40	yes	yes	58s	Yes, state 1->2->1
2	25.00	28.73	yes	yes	58s	Yes, state 1->2->1
3	25.01	31.39	yes	yes	58s	Yes, state 1->2->1
4	-24.58	-27.40	yes	yes	58s	Yes, state 1->2->1
5	-25.00	-28.71	yes	yes	58s	Yes, state 1->2->1
6	-24.58	-31.34	yes	yes	58s	Yes, state 1->2->1
Test B (Setting MEL=MIL=26.08A, 0.95MEL=0.95MIL=24.77A))						
Nominal Export Limit:						EL= 26.08 Amps
Nominal Import Limit						IL= 26.08 Amps
No	Starting level （A）	Step value （A）	**CLS** registers change in level?	**CLS** and/or **Component** and/or **Device** initiates correct response of ≥ 5%?	Duration of step in test	Correct state 3 operation
7	24.77	27.44	yes	yes	62s	Yes, state 1->2->3
8	-24.72	-27.46	yes	yes	62s	Yes, state 1->2->3

G100/2-2			
Clause	Requirement - Test	Result - Remark	Verdict

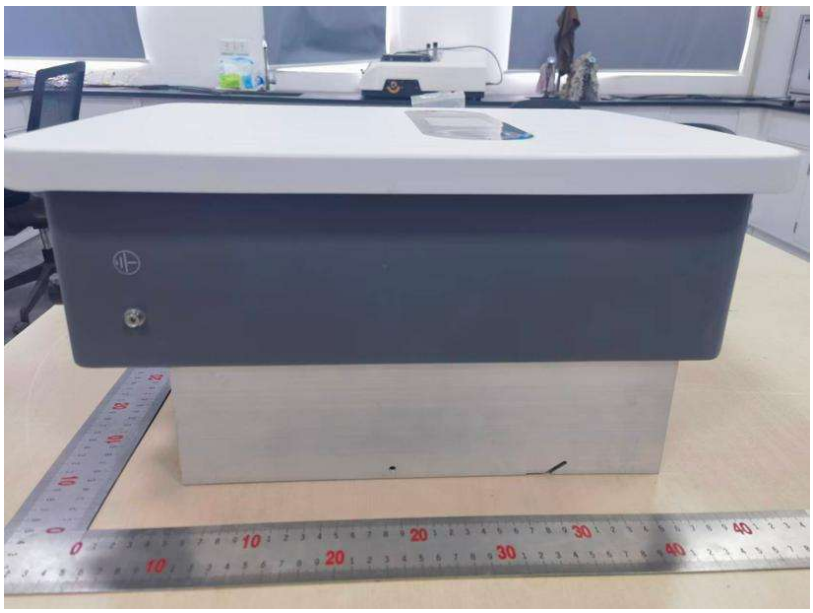
State 3 Reset
These tests are to demonstrate compliance with section EREC G100 4.5.2. Please document how the reset from state 3 to state 1 has been demonstrated. Please include how the reset is achieved. Please confirm that for **CLSs** to be installed in **Domestic installations** three (3) resets causes lockout or that for non-domestic installations lockout can only be reset after four hours. Please explain how lockout is reset.
1. After entering state 3, the system generates an alarm indicating that the power control of the grid-tied point is abnormal and the inverter enters the locked state. 2. Users or installers troubleshoot the system. 3. The installers performs reset settings through the app and starts unlocking and enters state 1. At this time, the system displays grid connected, indicating that the system has returned to normal operation mode state 1. 4. For CLSs installed in Domestic Installations, 3 resets shall be allowed in any 30-day period. If three resets occur, CLS enters state 3 and this state will be locked. After an electrician is sent to troubleshoot the problem, CLS can be restored to state 1.

Appendix 2: Photo documentation

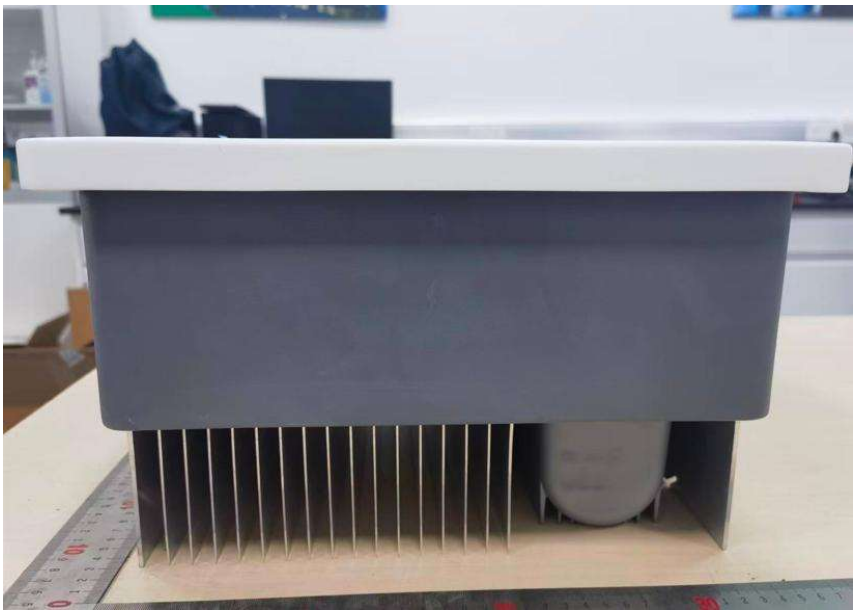
Enclosure – Front View

Enclosure – Rear View


Enclosure – Side view (Right)

Enclosure – Side view (Left)


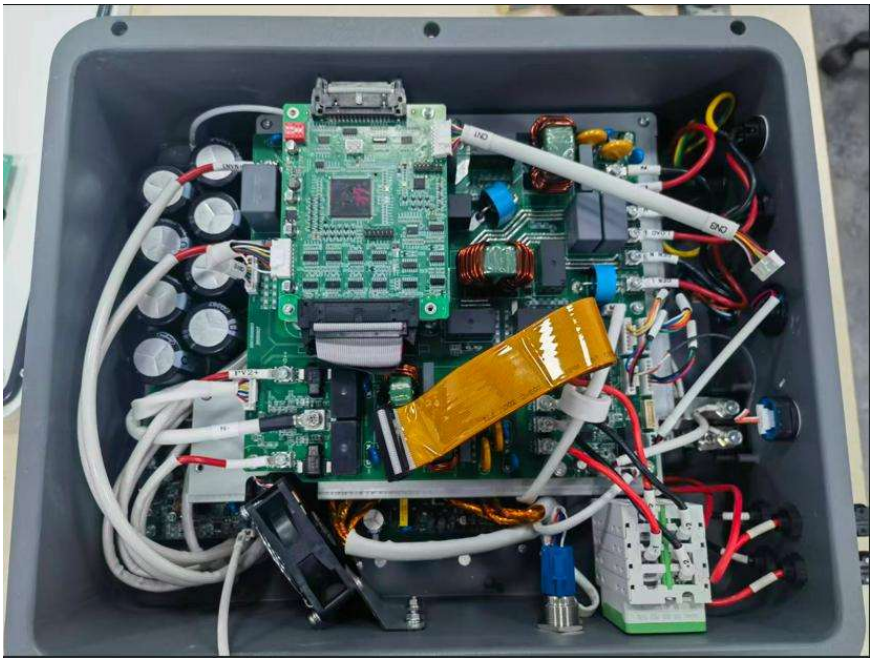
Enclosure – Bottom view

Enclosure – Top view


Upper cover – Rear view



Enclosure – inside view



--- End of test report---