C E R T I F I C A T E

of Conformity

TÜVRheinland®

Registration No.: AK 60104859 0001

Report No.: 28108203 001

Holder:
Fronius International Gmbh
Guenter Fronius-Str. 1
4600 Wels - Thalheim
Austria

Product:
PV-Inverter
Solar Grid Tied Inverter

Identification:
Trademark: FRONIUS
Model: FRONIUS ECO 27.0-3-S
FRONIUS ECO 25.0-3-S

Attachment: Annex to Certificate

Tested acc. to: EN 50438:2013

The certificate of conformity refers to the above mentioned product. This is to certify that the specimen is in conformity with the assessment requirement mentioned above. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity.

Certification Body

TÜV Rheinland LGA Products GmbH · TÜVRheinland Zertifizierungsstelle

Marco Piva

Date 30.09.2015

TÜV Rheinland LGA Products GmbH - Tillystraße 2 - 90431 Nürnberg

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E.1 General Details

E.1.1 Micro-generator details

Models of the same family: FRONIUS ECO 25.0-3-S; FRONIUS ECO 27.0-3-S
FRONIUS International GmbH Guenter Fronius-Str.1 A-4600 Wels-Thalheim _ Austria

E.1.2 Test house details

Name and address of test house	TÜV Rheinland Italia S.r.l. Via Mattei. 3 - 20010 Pogliano Milanese (MI) - Italy
Telephone number	Tel: +39.02.939 687
Facsimile number	Fax: +39.02.939 687 23
E-mail address	info@it.tuv.com

E.1.3 Test details

Date of test	See First Page
Name of test Engineer	Alessandro Luciani
Signature of test Engineer	See First Page
Test location (if different from above)	See above

E.2 Type testing of the interface protection

E.2.1 General

If the interface protection is considered as a dedicated device external to the micro-generator, only the operate time of the interface protection can be evaluated. In this case, the opening time of the interface switch shall be taken into account when evaluating the compliance with this European Standard.

E.2.2 Over / Under frequency

	Under frequency		Over frequency	
Parameter	**Frequency [Hz]**	**Time[s]**	**Frequency [Hz]**	**Time[s]**
Protection Limit	47.00	0.5	51.00	0.5
Trip Value	46.99	0.44	51.02	0.46
Supplementary information: none				

E.2.3 Over / Under voltage

	Under Voltage		Over Voltage	
Parameter	**Voltage [V]**	**Time [s]**	**Voltage [V]**	**Time [s]**
Protection Limit	195.5 (230 V -15%)	0.2	264.5 (230 V +15%)	0.2
Trip Value	197	0.154	262.3	154
Supplementary information: none				

	Over Voltage		Remarks
Parameter	**Voltage [V]**	**Time [s]**	
Protection Limit	255.3 (230 V +11%)	60	--
Trip Value	255.3	50	--
Supplementary information: none			

E.2.4 Loss of main (LoM)

No.	P_{EUT} (% of EUT rating)	Reactive load (% of Q_L in 6.1.d)	P_{ac} (% of nominal)	Q_{ac} (% of nominal)	Run on time [ms]	P_{EUT} [kW]	Actual Qf	V_{dc}	Remarks
1	100	100	0	0	393	26.5	1	850	Test A at BL
2	66	66	0	0	354	17.3	1	710	Test B at BL
3	33	33	0	0	270	8.2	1	620	Test C at BL
4	100	100	-5	-5	285	26.5	1	850	Test A at IB
5	100	100	-5	0	161	26.5	1	850	Test A at IB
6	100	100	-5	+5	122	26.5	1	850	Test A at IB
7	100	100	0	-5	228	26.5	1	850	Test A at IB
8	100	100	0	+5	157	26.5	1	850	Test A at IB
9	100	100	+5	-5	116	26.5	1	850	Test A at IB
10	100	100	+5	0	142	26.5	1	850	Test A at IB
11	100	100	+5	+5	337	26.5	1	850	Test A at IB
12	66	66	0	-5	113	17.3	1	710	Test B at IB
13	66	66	0	-4	132	17.3	1	710	Test B at IB
14	66	66	0	-3	180	17.3	1	710	Test B at IB
15	66	66	0	-2	198	17.3	1	710	Test B at IB
16	66	66	0	-1	286	17.3	1	710	Test B at IB
17	66	66	0	1	225	17.3	1	710	Test B at IB
18	66	66	0	2	258	17.3	1	710	Test B at IB
19	66	66	0	3	257	17.3	1	710	Test B at IB
20	66	66	0	4	133	17.3	1	710	Test B at IB
21	66	66	0	5	177	17.3	1	710	Test B at IB
22	33	33	0	-5	199	8.2	1	620	Test C at IB
23	33	33	0	-4	262	8.2	1	620	Test C at IB
24	33	33	0	-3	242	8.2	1	620	Test C at IB
25	33	33	0	-2	260	8.2	1	620	Test C at IB
26	33	33	0	-1	253	8.2	1	620	Test C at IB
27	33	33	0	1	241	8.2	1	620	Test C at IB
28	33	33	0	2	231	8.2	1	620	Test C at IB
29	33	33	0	3	137	8.2	1	620	Test C at IB
30	33	33	0	4	256	8.2	1	620	Test C at IB
31	33	33	0	5	175	8.2	1	620	Test C at IB

[1] P_{EUT}: EUT output power
[2] P_{AC}: Real power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value.
[3] Q_{AC}: Reactive power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value
[4] BL: Balance condition, IB: Imbalance condition
*: Needs to be measured if any of the recorded run-on times at imbalanced condition are longer than the one recorded for the rated balance condition at test condition A
** "Run on time" must be < 2s
The filled out switch-off time values the highest among the three phase

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E.3 Type testing of a micro-generator

E.3.1 Operating range

Test sequence	Voltage [V]	Frequency [Hz]	Output power [W]	Primary power Source [W]
Test 1	195	47.5	23510	31000
Test 2	253	51.5	27020	31000

E.3.2 Active power feed-in at under-frequency

Test sequence	Output Power [W]	Frequency [Hz]	Primary power Source [W]
Test a)	27020	50.00	31000
Test b)	27010	49.65	31000
Test c)	27010	47.55	31000

E.3.3Power response to over-frequency

Test sequence at power level >80%	Output Power [W]	Frequency [Hz]	Primary Power Source [W]	Power Gradient [W/Hz]
Test a)	27010	50.00	31000	-
Test b)	26920	50.25	31000	-
Test c)	23300	50.70	31000	-
Test d)	4500	51.15	31000	-
Test e)	4500	50.70	31000	-
Test f)	4500	50.25	31000	-
Test g)	27030	50.00	31000	9.6% P_n min^{-1}

Test sequence at power level 40%-60%	Output Power	Frequency	Primary Power source	Power gradient
Test a)	15210	50.00	16200	-
Test b)	14970	50.25	16200	-
Test c)	6560	50.70	16200	-
Test d)	4330	51.15	16200	-
Test e)	4330	50.70	16200	-
Test f)	4330	50.25	16200	-
Test g)	15230	50.00	16200	9.6% P_n min^{-1}

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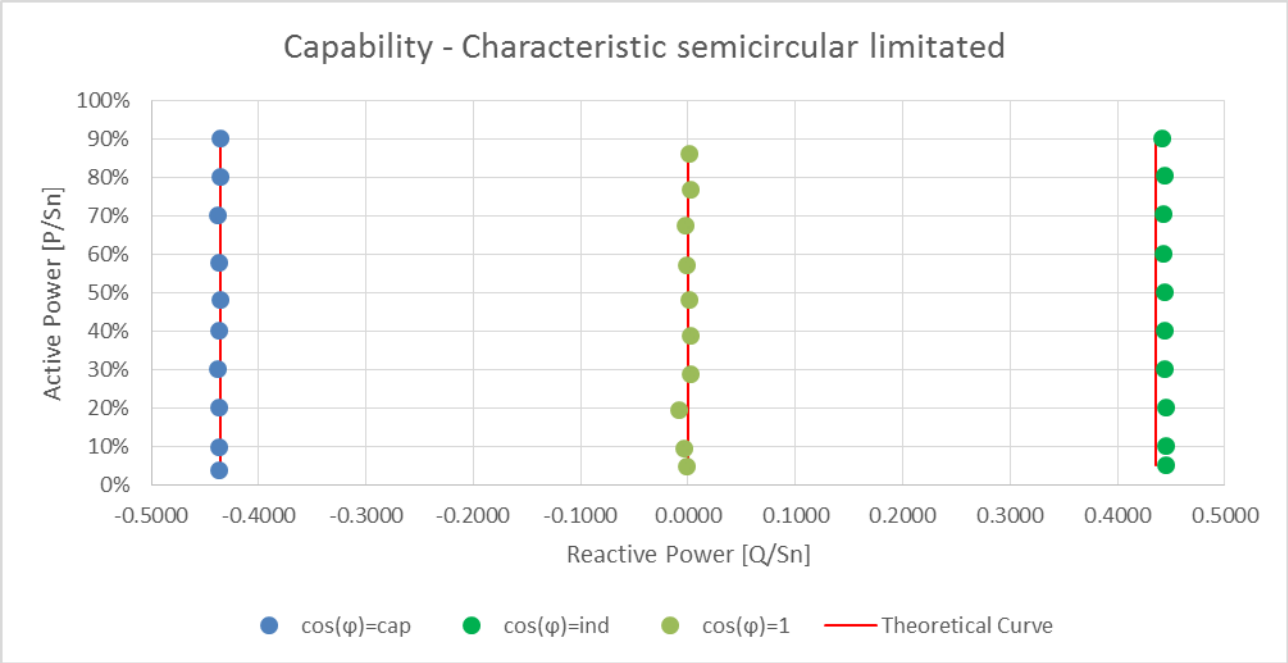
E.3.4Reactive power capability

E.3.4.2 Reactive power output capability

Reactive power output capability
Maximum reactive power adsorbed (Qmin) and produced (Qmax) as a function of the active power fed into the grid.



Adsorption of inductive reactive power

Power-Bin	Active power		Reactive power		DC power		Power factor
	[W]	p.u.	[VAr]	p.u.	[W]	p.u.	(cosφ)
0 % ±5%	1328	5%	12021	44,5%	1600	6%	0,1098
10 % ±5%	2697	10%	12018	44,5%	3000	11%	0,2189
20 % ±5%	5402	20%	12012	44,5%	5700	21%	0,4101
30 % ±5%	8112	30%	11993	44,4%	8400	31%	0,5603
40 % ±5%	10825	40%	11978	44,4%	11200	41%	0,6705
50 % ±5%	13543	50%	11975	44,4%	13400	50%	0,7491
60 % ±5%	16253	60%	11956	44,3%	16600	61%	0,8055
70 % ±5%	18970	70%	11969	44,3%	19500	72%	0,8457
80 % ±5%	21681	80%	11989	44,4%	22200	82%	0,8751
90 % ±5%	24355	90%	11920	44,1%	25000	93%	0,8982
100 % ±5%	-	-	-	-	-	-	-

Adsorption of capacitive reactive power

Power-Bin	Active power		Reactive power		DC power		Power factor
	[W]	p.u.	[VAr]	p.u.	[W]	p.u.	(cosφ)
0 % ±5%	1047	4%	-11786	-43,7%	1600	6%	-0,0885
10 % ±5%	2663	10%	-11793	-43,7%	3000	11%	-0,2203
20 % ±5%	5377	20%	-11787	-43,7%	5700	21%	-0,4150
30 % ±5%	8087	30%	-11813	-43,8%	8400	31%	-0,5649
40 % ±5%	10795	40%	-11797	-43,7%	11200	41%	-0,6751
50 % ±5%	12951	48%	-11776	-43,6%	13400	50%	-0,7399
60 % ±5%	15571	58%	-11777	-43,6%	16600	61%	-0,8092
70 % ±5%	18938	70%	-11830	-43,8%	19500	72%	-0,8481
80 % ±5%	21649	80%	-11771	-43,6%	22200	82%	-0,8785
90 % ±5%	24322	90%	-11744	-43,5%	25000	93%	-0,9005
100 % ±5%	-	-	-	-	-	-	-

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Reactive power production with set point Q = 0

Power-Bin	Active power		Reactive power		DC power		Power factor
	[W]	p.u.	[VAr]	p.u.	[W]	p.u.	(cosφ)
0 % ±5%	1280	5%	-43	-0,16%	1600	6%	-0,9778
10 % ±5%	2564	9%	-82	-0,30%	3000	11%	-0,9995
20 % ±5%	5231	19%	-216	-0,80%	5700	21%	-0,9991
30 % ±5%	7774	29%	67	0,25%	8400	31%	0,9999
40 % ±5%	10438	39%	73	0,27%	11200	41%	0,9999
50 % ±5%	12994	48%	41	0,15%	13400	50%	1,0000
60 % ±5%	15416	57%	-24	-0,09%	16600	61%	1,0000
70 % ±5%	18197	67%	-54	-0,20%	19500	72%	1,0000
80 % ±5%	20727	77%	53	0,20%	22200	82%	1,0000
90 % ±5%	23265	86%	28	0,10%	25000	93%	1,0000
100 % ±5%	-	-	-	-	-	-	-

E.3.5 Connection and starting to generate electrical power

Connection after trip of interface protection

Test sequence after trip	Connection	Connection allowed	Primary power source	Power gradient after connection
Step a)	No	No	-	-
Step b)	Yes	Yes	31000	9.6% P_n min^{-1}
Step c)	No	No	-	-
Step d)	Yes	Yes	31000	9.6% P_n min^{-1}
Step e)	No	No	-	-
Step f)	Yes	Yes	31000	9.6% P_n min^{-1}
Step g)	No	No	-	-
Step h)	Yes	Yes	31000	9.6% P_n min^{-1}

NOTE 1 It is sufficient to evaluate the power gradient after connection only at one test out of b). d). f). h).

Start of generating electrical power

Test sequence start of generation	Connection	Connection allowed	Primary power source	Power gradient after connection
Step a)	No	No	-	-
Step b)	Yes	Yes	31000	9.6% P_n min^{-1}
Step c)	No	No	-	-
Step d)	Yes	Yes	31000	9.6% P_n min^{-1}
Step e)	No	No	-	-
Step f)	Yes	Yes	31000	9.6% P_n min^{-1}
Step g)	No	No	-	-
Step h)	Yes	Yes	31000	9.6% P_n min^{-1}

E.3.6 Short-circuit current contribution

E.3.6.1 Short circuit current at micro-generator terminals

Fault level contribution		
Time after fault [ms]	**Voltage [V]**	**Current [A]**
20	19.7	65
100	19.6	39.7
250	19.8	29.6
500	19.8	24.3
Note: Trip Time: 264.1ms		

E.3.7 Power quality

Harmonic current emission

Average harmonic current results Phase 1				
Hn	Ieff [mA]	Value [% I/In]	Limit [%I/In]	Result
1	14.859 [A]			
2	61.953	0.417	8.00	PASS
3	62.907			PASS
4	27.677	0.186	4.00	PASS
5	132.276	0.890	10.70	PASS
6	17.833	0.120	2.67	PASS
7	39.517	0.468	7.20	PASS
8	15.525	0.104	2.00	PASS
9	19.986			PASS
10	13.074	0.088	1.60	PASS
11	44.645	0.330	3.10	PASS
12	9.321	0.063	1.33	PASS
13	36.478	0.245	2.00	PASS
14	9.338			PASS
15	14.679			PASS
16	8.068			PASS
17	27.695			PASS
18	6.664			PASS
19	16.235			PASS
20	7.980			PASS
21	13.524			PASS
22	7.012			PASS
23	18.683			PASS
24	6.283			PASS
25	9.863			PASS
26	6.160			PASS
27	13.144			PASS
28	6.000			PASS
29	13.148			PASS
30	5.688			PASS
31	7.945			PASS
32	5.937			PASS
33	10.448			PASS
34	5.800			PASS
35	12.645			PASS
36	5.529			PASS
37	10.274			PASS
38	5.545			PASS
39	8.873			PASS
40	5.893			PASS

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Average harmonic current results Phase 2				
Hn	Ieff [mA]	Value [% I/In]	Limit [%I/In]	Result
1	15.103 [A]			
2	58.532	0.388	8.00	PASS
3	46.342			PASS
4	24.874	0.165	4.00	PASS
5	132.391	0.877	10.70	PASS
6	20.772	0.138	2.67	PASS
7	72.206	0.478	7.20	PASS
8	12.299	0.081	2.00	PASS
9	13.242			PASS
10	10.235	0.068	1.60	PASS
11	43.823	0.380	3.10	PASS
12	11.134	0.074	1.33	PASS
13	43.967	0.291	2.00	PASS
14	8.030			PASS
15	10.974			PASS
16	7.042			PASS
17	20.946			PASS
18	8.539			PASS
19	22.943			PASS
20	7.699			PASS
21	13.785			PASS
22	6.929			PASS
23	13.421			PASS
24	6.924			PASS
25	14.096			PASS
26	6.548			PASS
27	12.040			PASS
28	6.053			PASS
29	11.508			PASS
30	6.411			PASS
31	9.873			PASS
32	6.630			PASS
33	13.294			PASS
34	6.176			PASS
35	11.047			PASS
36	6.108			PASS
37	9.412			PASS
38	6.300			PASS
39	12.409			PASS
40	6.033			PASS

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Average harmonic current results Phase 3				
Hn	Ieff [mA]	Value [% I/In]	Limit [%I/In]	Result
1	14.849 [A]			
2	61.935	0.417	8.00	PASS
3	62.907			PASS
4	27.677	0.186	4.00	PASS
5	132.276	0.890	10.70	PASS
6	17.833	0.120	2.67	PASS
7	69.517	0.468	7.20	PASS
8	15.525	0.104	2.00	PASS
9	19.986			PASS
10	13.047	0.088	1.60	PASS
11	44.645	0.300	3.10	PASS
12	9.432	0.063	1.33	PASS
13	36.478	0.245	2.00	PASS
14	9.388			PASS
15	14.679			PASS
16	8.068			PASS
17	27.695			PASS
18	6.664			PASS
19	16.235			PASS
20	7.980			PASS
21	13.524			PASS
22	7.012			PASS
23	18.483			PASS
24	6.283			PASS
25	9.863			PASS
26	6.160			PASS
27	12.144			PASS
28	6.000			PASS
29	13.148			PASS
30	5.688			PASS
31	7.945			PASS
32	7.937			PASS
33	10.448			PASS
34	5.800			PASS
35	12.645			PASS
36	5.529			PASS
37	10.274			PASS
38	5.545			PASS
39	8.873			PASS
40	5.893			PASS

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Voltage fluctuations and flicker

	EUT values	Limit	Result
Pst	0.200	1.00	PASS
Plt	0.197	0.65	PASS
dc [%]	0.191	3.30	PASS
dmax [%]	0.570	4.00	PASS
dt [s]	0	0.50	PASS

End of the Annex