

Certificate

Applicant: **Victron Energy B.V.**
De Paal 35
1351 JG Almere Haven
Netherlands

Product: **Inverter with integrated automatic disconnection device
between a generator and the public low-voltage grid**

Model:	MultiGrid-II 48/3000/35-32 MultiPlus-II 48/3000/35-32
Rating:	2,4kW

Intended use:

An automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G59/3 for systems with a single-phase parallel coupling via an inverter to the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Applied standards and guidelines:

**Engineering Recommendation G59/3-2
Issue 3 Amendment 2 September 2015**

Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate to the valid safety specifications for the specified use in accordance with regulations.

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Certification Department



Power Quality. Harmonics.

Generating Unit tested to BS EN 61000-3-2

Generating Unit rating per phase (rpp)		2,4		kW		Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
Harmonic	At 45-55% of rated output		100% of rated output				
	Measured Value (MV) in Amps	Normalised Value (NV) in Amps	Measured Value (MV) in Amps	Normalised Value (NV) in Amps			
2	0,321	0,493	0,287	0,440	1,080		
3	0,316	0,485	0,233	0,357	2,300		
4	0,238	0,365	0,240	0,368	0,430		
5	0,213	0,326	0,228	0,350	1,140		
6	0,140	0,214	0,146	0,224	0,300		
7	0,120	0,184	0,093	0,142	0,770		
8	0,066	0,101	0,074	0,114	0,230		
9	0,072	0,110	0,054	0,083	0,400		
10	0,034	0,053	0,038	0,058	0,184		
11	0,046	0,070	0,050	0,077	0,330		
12	0,024	0,037	0,024	0,037	0,153		
13	0,039	0,059	0,039	0,059	0,210		
14	0,016	0,024	0,016	0,024	0,131		
15	0,041	0,062	0,045	0,069	0,150		
16	0,010	0,016	0,013	0,019	0,115		
17	0,030	0,046	0,035	0,054	0,132		
18	0,008	0,013	0,011	0,018	0,102		
19	0,020	0,030	0,018	0,027	0,118		
20	0,006	0,010	0,010	0,016	0,092		
21	0,023	0,035	0,022	0,034	0,107	0,160	
22	0,005	0,008	0,010	0,016	0,084		
23	0,023	0,035	0,023	0,035	0,098	0,147	
24	0,005	0,008	0,009	0,014	0,077		
25	0,017	0,026	0,016	0,024	0,090	0,135	
26	0,006	0,010	0,008	0,013	0,071		
27	0,017	0,026	0,018	0,027	0,083	0,124	
28	0,007	0,011	0,008	0,013	0,066		
29	0,011	0,018	0,010	0,016	0,078	0,117	
30	0,008	0,013	0,010	0,016	0,061		
31	0,011	0,018	0,009	0,014	0,073	0,109	
32	0,009	0,014	0,010	0,016	0,058		
33	0,014	0,021	0,011	0,018	0,068	0,102	
34	0,011	0,018	0,011	0,018	0,054		
35	0,013	0,019	0,013	0,019	0,064	0,096	
36	0,015	0,022	0,015	0,022	0,051		
37	0,013	0,019	0,011	0,018	0,061	0,091	
38	0,020	0,030	0,019	0,029	0,048		
39	0,021	0,032	0,026	0,040	0,058	0,087	
40	0,025	0,038	0,022	0,034	0,046		

Power Quality. Voltage fluctuations and flicker

	Starting			Stopping from full load			Running	
	d _{max}	d _c	d _(t)	d _{max}	d _c	d _(t)	P _{st}	P _{lt} 2 hours
Measured Values at test impedance	-2,148	-2,080	-	2,133	2,006	-	0,11	0,11
Normalised to standard impedance	-2,148	-2,080	-	2,133	2,006	-	0,11	0,11
Normalised to required maximum impedance	N/A							
Limits set under BS EN 61000-3-11	4%	3,3%	3,3%	4%	3,3%	3,3%	1,0	0,65

Test impedance	R	0,24	Ω	XI	0,15	Ω
Standard impedance	R	0,24* 0,4^	Ω	XI	0,15* 0,25^	Ω
Maximum impedance	R	N/A	Ω	XI	N/A	Ω

Power Quality. Power factor.

	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within + or - 1,5% of the stated level during test.
Measured Value	1,000	1,000	1,000	
Limit	>0,95	>0,95	>0,95	

Protection. Frequency tests

Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency / time	Confirm no trip
U/F stage 1	47,5Hz	20,0s	47,43Hz	20,038s	47,7Hz 25s	No trip
U/F stage 2	47,0Hz	0,5s	46,93Hz	0,578s	47,2Hz 19,98s	No trip
					46,8Hz 0,48s	No trip
O/F stage 1	51,5Hz	90,0s	51,59Hz	90,043s	51,3Hz 95s	No trip
O/F stage 2	52,0Hz	0,5s	52,09Hz	0,581s	51,8Hz 89,98s	No trip
					52,2Hz 0,48s	No trip

Protection. Voltage tests

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage / time	Confirm no trip
U/V stage 1	200,1V	2,5s	199,7V	2,575s	204,1V 3,5s	No trip
U/V stage 2	184,0V	0,5s	183,6V	0,564s	188,0V 2,48s	No trip
					180,0V 0,48s	No trip
O/V stage 1	262,2V	1,0s	263,3V	1,069s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	273,8V	0,582s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

a) Protection. Loss of Mains test and single phase test

Note as an alternative, inverters can be 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 Tests 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0,15s	0,13s	0,15s	0,15s	0,16s	0,16s

Single phase test for multi phase **Generating Units**. Confirm that when generating in parallel with a network operating at around 50Hz with no network disturbance, that the removal of a single phase connection to the **Generating Unit**, with the remaining phases connected causes a disconnection of the generating unit within a maximum of 1s.

Ph 1 removed	Confirm trip	Ph 2 removed	Confirm trip	Ph 3 removed	Confirm trip
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b) Protection. Frequency change, Stability test.

	Start frequency	Change	End frequency	Confirm no trip
Positive vector shift	49,5Hz	+9 degrees		No trip
Negative vector shift	50,5Hz	-9 degrees		No trip
Positive frequency drift	49,5Hz	+0,19Hz/sec	51,5Hz	No trip
Negative frequency drift	50,5Hz	-0,19Hz/sec	47,5Hz	No trip

c) Protection. Re-connection timer.

Time delay settings (s)	Measured delay (s)	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1			
20,0	22,8	At 266,2V	At 196,1V	At 47,4Hz	At 51,6Hz
Confirmation that the Generating Unit does not re-connect		No reconnection	No reconnection	No reconnection	No reconnection

d) Fault Level contribution.

For machines with electro-magnetic output			For inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	-	20ms	68,2V	15,0A
Initial Value of aperiodic current	A	-	100ms	31,8V	-
Initial symmetrical short-circuit current	I_k	-	250ms	31,3V	-
Decaying (aperiodic) component of short-circuit current	i_{DC}	-	500ms	31,5V	-
Reactance/Resistance Ratio of source	X/R	-	Time to trip	0,031	In seconds

e) Self Monitoring solid state switching.

It has been verified that in the event of the solid state switching device failing to disconnect the Generating Plant, the voltage on the output side of the switching device is reduced to a value below 50 volt within 0,5s. N/A