

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:	ECOmulti 24/3000/70-50
Rating:	2,4kW

Intended use:

An automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G59/3 for generators 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.

Report No: 17PP247-01

Certificate No: 18-030-00

Date of issue: 2018-01-30



A handwritten signature in black ink, appearing to read "A. Aufmuth", is written over a light blue circular background.

Andreas Aufmuth
Certification Department



Power Quality. Harmonics.

Equipment Phases: Single Phase

Generating Unit rating per phase (rpp)	2,4	kW	
Harmonic:	At 45-55% of rated	At 100% of rated	Harmonic Limit (A)
	Measured Value (A)		
2nd	0,05	0,05	1,080
3rd	0,31	0,66	2,300
4th	0,06	0,05	0,430
5th	0,28	0,21	1,140
6th	0,06	0,05	0,300
7th	0,14	0,14	0,770
8th	0,06	0,06	0,230
9th	0,08	0,09	0,400
10th	0,03	0,03	0,184
11th	0,06	0,06	0,330
12th	0,00	0,00	0,153
13th	0,05	0,05	0,210
14th	0,00	0,00	0,131
15th	0,05	0,05	0,150
16th	0,00	0,00	0,115
17th	0,03	0,03	0,132
18th	0,00	0,00	0,102
19th	0,02	0,03	0,118
20th	0,00	0,00	0,092
21st	0,03	0,05	0,107
22nd	0,00	0,00	0,084
23rd	0,03	0,05	0,098
24th	0,00	0,00	0,077
25th	0,02	0,03	0,090
26th	0,00	0,00	0,071
27th	0,02	0,03	0,083
28th	0,00	0,00	0,066
29th	0,02	0,02	0,078
30th	0,00	0,00	0,061
31st	0,02	0,02	0,073
32nd	0,00	0,00	0,058
33rd	0,03	0,02	0,068
34th	0,00	0,00	0,054
35th	0,02	0,03	0,064
36th	0,00	0,00	0,051
37th	0,02	0,02	0,061
38th	0,00	0,00	0,048
39th	0,03	0,02	0,058
40th	0,00	0,00	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	-2,153	-2,034	-	1,766	1,61	-	0,30	0,29
Normalised to standard impedance	-2,153	-2,034	-	1,766	1,61	-	0,30	0,29
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	0,999	0,999	0,999	
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	49,49Hz	20,05s	47,7Hz 25s	No trip
U/F stage 2	47,0Hz	0,5s	46,99Hz	0,59s	47,2Hz 19,98s	No trip
					46,8Hz 0,48s	No trip
O/F stage 1	51,5Hz	90,0s	51,53Hz	90,10s	51,3Hz 95s	No trip
O/F stage 2	52,0Hz	0,5s	52,03Hz	0,58s	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	200,3V	2,55s	204,1V 3,5s	No trip
U/V stage 2	184,0V	0,5s	184,2V	0,57s	188,0V 2,48s	No trip
					180,0V 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,5V	1,08s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	274,0V	0,69s	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	0,13	0,15	0,15	0,15	0,16	0,18

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			
		At 266,2V	At 196,1V	At 47,4Hz	At 51,6Hz
Confirmation that the Generating Unit does not re-connect		No connection to grid	No connection to grid	No connection to grid	No connection to grid

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	83,2V	26,80A
Initial Value of aperiodic current	A		100ms	29,5V	-
Initial symmetrical short-circuit current	I_k		250ms	30,6V	-
Decaying (aperiodic) component of short-circuit current	i_{DC}		500ms	30,6V	-
Reactance/Resistance Ratio of source	X/R		Time to trip	0,03s	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.