

Type certification test result sheet.

Micro generator details

Manufacturer	N.V. Nederlandsche Apparatenfabriek „Nedap“		
Address	Parallelweg 2, 7141 DC Groenlo, The Netherlands		
Phone / Fax	+31 544 471 888 / +31 544 466 008		
Technical file reference No.	2.03.02093.1.0 and 2.03.02269.1.0		
PowerRouter Type reference	PR50S / PR50SB	PR37S / PR37SB	PR30S / PR30SB
Max. continuous output rating	5000W	3700W	3000W

Test house or laboratory details

Name and address of test house or laboratory	AIT Austrian Institute of Technology Österreichisches Forschungs- und Prüfzentrum Arsenal Ges.m.b.H. Giefinggasse 2, 1210 Vienna, Austria
Telephone number	+43 (0) 50 550-6612
Facsimile number	+43 (0) 50 550-6590
E-Mail address	www.ait.ac.at

Test details

Date of test	July 2010 and February 2011
Name of test engineer	Mr. R. Bründlinger, Mr. G. Lauss
Signature of test engineer	See separate reports 2.03.02093.1.0 and 2.03.02269.1.0
Test location if different from above	N/A

The complete documentation can be viewed at N.V. Nederlandsche Apparatenfabriek "Nedap" after prior announcement.

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Test Results

Power Quality

Harmonic current emissions

Maximum permissible current as per EN 61000-3-2 Class A

Harmonic	2nd	3rd	5th	7th	9th	11th	13th	15th ^h =n=39th
Limit (Amp)	1.08	2.3	1.14	0.77	0.4	0.33	0.21	0.15(A) (15/n)
Test value (Amp)	0.006	0.2	0.1	0.08	0.06	0.05	0.04	< limit EN 61000-2-3 A

(A) 50% or some other declared value close to the midpoint between minimum and maximum.

Voltage fluctuations and flicker

Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100% power) and flicker as per EN61000-3-3

	Starting	Stopping	Running	
Limit	3.3%	3.3%	Pst = 1.0	Plt = 0.65
Test value	0.7%	0.7%	0.138	0.138

DC injection

Power Factor

Protection limit	20mA, tested at tree power levels			+ 0.95 lag – 0.95 at 3 voltage levels		
Test level	Min.	Medium(a)	Max.	212 V	230 V	248 V
Test value	- 12mA	- 9mA	1mA	0.9999	0.9998	0.9998

(A) 50% or some other declared value close to the midpoint between minimum and maximum (230V)

Under frequency

Over frequency

Parameter	Frequency (Hz)	Time (s)	Frequency (Hz)	Time (s)
Protection limit (from IE – Ireland)	50 - 4%	0.5	50 + 1%	0.5
Actual setting (as applied to interface protection)	48	-	50.5	-
Trip value	48	< 0.5 s	50.5	< 0.5 s

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Under / overvoltage test (single stage protection)

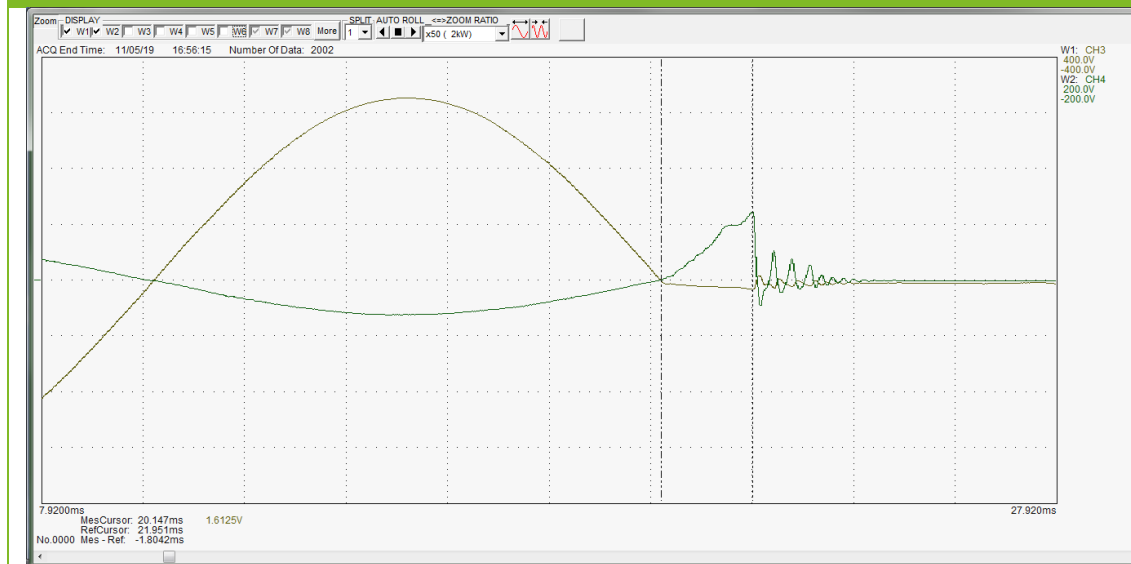
Parameter	Under Voltage		Over Voltage	
	Voltage (V)	Time (s)	Voltage (V)	Time (s)
Protection limit from IE – Ireland)	230 - 10%	0.5	230 + 10%	0.5
Actual setting (as applied to interface protection)	207	-	253	-
Trip value	207	< 0.5 s	253	< 0.5 s

Loss of Mains (LoM) test

Method used	Frequency shift		
Output power Level (a)	10% Prated	55% Prated	100% Prated
Trip setting clearance time	0.5(5)	0.5(5)	0.5(5)
Trip value clearance time	0.4	0.2	0.17
(a) Indicative values are shown for minimum, medium and maximum power levels			

Fault level contribution

Short circuit current at micro-generator terminals



0 to > 2 sec. plot at 180° phase angle. See also remark (1).

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Short-circuit test

Short-circuit test results

Parameter	Symbol	Value 1	Value 2	Value 3	Value 4	Value 5
Peak short-circuit current	I_p	79	-227(1)	-220(1)	61	225(1)
Initial value of aperiodical component	A	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
Initial symmetrical short-circuit current	I_k	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
Decaying (aperiodical) component of short-circuit current	iDC	N/A (2)	N/A (2)	N/A (2)	N/A (2)	N/A (2)
Reactance/Resistance ratio of source	X/R	N/A (3)	N/A (3)	N/A (3)	N/A (3)	N/A (3)

Remarks:

(1) Instantaneous peak value of the output current recorded during the short circuit, lasting for a period of a few 100 microseconds only.

(2) The test object is a self-commutated, current controlled PWM inverter, which has a fundamentally different behavior under short circuit conditions compared to synchronous or induction machine based generators. The output current is controlled by the internal controls and its r.m.s values cannot exceed the specified maximum output current. In case of a short circuit at the output terminals of the inverter, the inverter stops operating and reduces the output current to zero within a few milliseconds. Therefore, the values A, I_k , iDC and X/R cannot be evaluated as for rotating machine based micro generators.

(3) As AC source for the tests a programmable linear power amplifier was used (5mΩ at 50/60Hz). The output impedance is electronically compensated and therefore, no X/R ratio can be given.

Drawn up in	Groenlo, The Netherlands
Date	July 12 th , 2011 – re-issued Januar 28 th , 2015
	
Name und position	W. Klunder, Managing Director Nedap Energy Systems