

Certificate

EN 50438 BASIC

The results of tests performed according to reference standard EN 50438 BASIC are summarized in this certificate.
Power-One Italy S.p.a. declares that the units set for EN 50438 BASIC operations are characterized by the following features:

- The internal specification and parameters are set to be compliant with **EN 50438 BASIC** engineering requirements.
- All units have identical internal parameters setting.
- These parameters cannot be changed without the usage of password protected tool.

SSEG DETAILS (Small-Scale Embedded Generator)

SSEG Type Reference:	PHOTO-VOLTAIC end EOLIC GRID TIED INVERTER
SSEG Model Reference:	PVI-4.2-TL-OUTD PVI-4.2-TL-OUTD-S PVI-4.2-TL-OUTD-W PVI-3.6-TL-OUTD PVI-3.6-TL-OUTD-S PVI-3.6-TL-OUTD-W PVI-3.0-TL-OUTD PVI-3.0-TL-OUTD-S PVI-3.0-TL-OUTD-W
Maximum export capability (SSEG rating less parasitic load)	4600 W (PVI-4.2-TL-OUTD and derived models) 4000 W (PVI-3.6-TL-OUTD and derived models) 3300 W (PVI-3.0-TL-OUTD and derived models)
Nominal Output AC Power	4200 W (PVI-4.2-TL-OUTD and derived models) 3600 W (PVI-3.6-TL-OUTD and derived models) 3000 W (PVI-3.0-TL-OUTD and derived models)

MANUFACTURER AND TEST HOUSE DETAILS

Name:	Power-one Italy S.p.A. - R. & D. Department
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TEST RESULTS SUMMARY

Power Quality:

- Harmonic Current Emission as per UL1741 (worst)
- Voltage Fluctuation and Flickers as per EN-61000-3-3
- DC Injection as per IEC-61727
- Power Factor as per VDE-0126-1-1/A1

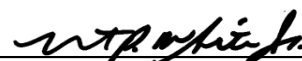
Protection:

- Under/Over Frequency Tests
- Under/Over Voltage Tests
- Reconnection Times
- Loss of Main – (Anti-Islanding) Tests as per EN 50438

Power-One Italy S.p.a.

Terranuova Bracciolini, June 30, 2014

Robert White
(Director Safety & Environmental Compliance)



TEST RESULTS DETAILS – TYPE VERIFICATION TEST SHEET

**POWER QUALITY
HARMONICS CURRENT EMISSIONS**

PVI-4.2-TL-OUTD, Harmonics Current Emission as per UL1741 (worst)							
Value of short circuit power SSC=0.1386 MVA @ RSCE=33							
Harmonic	2rd [%A]	3rd [%A]	4rd [%A]	5rd [%A]	6rd [%A]	7rd [%A]	8rd [%A]
Limit	1.000	4.0000	1.000	4.000	1.000	4.000	1.000
Result L1	0.075	1.4800	0.021	0.180	0.031	0.229	0.026
Harmonic	9rd [%A]	10rd [%A]	11rd [%A]	12rd [%A]	13rd [%A]	THD [%A]	PWHD [%A]
Limit	4.000	1.000	2.000	0.500	2.000	5.000	---
Result L1	0.215	0.031	0.091	0.014	0.095	1.720	---

PVI-3.6-TL-OUTD, Harmonics Current Emission as per UL1741 (worst)							
Value of short circuit power SSC=0.1188 MVA @ RSCE=33							
Harmonic	2rd [%A]	3rd [%A]	4rd [%A]	5rd [%A]	6rd [%A]	7rd [%A]	8rd [%A]
Limit	1.000	4.0000	1.000	4.000	1.000	4.000	1.000
Result L1	0.121	1.5511	0.043	0.297	0.029	0.228	0.026
Harmonic	9rd [%A]	10rd [%A]	11rd [%A]	12rd [%A]	13rd [%A]	THD [%A]	PWHD [%A]
Limit	4.000	1.000	2.000	0.500	2.000	5.000	---
Result L1	0.178	0.019	0.132	0.024	0.135	1.830	---

PVI-3.0-TL-OUTD, Harmonics Current Emission as per UL1741 (worst)							
Value of short circuit power SSC=0.099 MVA @ RSCE=33							
Harmonic	2rd [%A]	3rd [%A]	4rd [%A]	5rd [%A]	6rd [%A]	7rd [%A]	8rd [%A]
Limit	1.000	4.0000	1.000	4.000	1.000	4.000	1.000
Result L1	0.153	2.9346	0.073	0.374	0.033	0.525	0.054
Harmonic	9rd [%A]	10rd [%A]	11rd [%A]	12rd [%A]	13rd [%A]	THD [%A]	PWHD [%A]
Limit	4.000	1.000	2.000	0.500	2.000	5.000	---
Result L1	0.382	0.016	0.248	0.034	0.204	3.444	---

DC INJECTION PERFORMANCES

PVI-4.2-TL-OUTD, DC injection as per IEC-61727				
Limit 0.200 [Adc] (1.0% of Inom) tested at three power levels				
Test Level	[%Pout]	33%	66%	100%
Test value L1	[Adc]	0.005	0.007	0.004

PVI-3.6-TL-OUTD, DC injection as per IEC-61727				
Limit 0.172 [Adc] (1.0% of Inom) tested at three power levels				
Test Level	[%Pout]	33%	66%	100%
Test value L1	[Adc]	0.011	0.001	0.000

PVI-3.0-TL-OUTD, DC injection as per IEC-61727				
Limit 0.145 [Adc] (1.0% of Inom) tested at three power levels				
Test Level	[%Pout]	33%	66%	100%
Test value L1	[Adc]	-0.004	-0.004	-0.008

POWER FACTOR PERFORMANCES

PVI-4.2-TL-OUTD, Power Factor as per VDE-0126-1-1/A1				
0.98 lag -0.98 lead at three voltage levels and three power levels				
Test Level	[Vac]	199.4	230.0	259.2
Test value	[10% Pout]	0.998	0.998	0.998
Test value	[50% Pout]	0.999	0.999	0.999
Test value	[100% Pout]	0.999	0.999	0.999

PVI-3.6-TL-OUTD, Power Factor as per VDE-0126-1-1/A1				
0.98 lag -0.98 lead at three voltage levels and three power levels				
Test Level	[Vac]	199.4	230.0	259.2
Test value	[10% Pout]	0.998	0.997	0.998
Test value	[50% Pout]	0.999	0.999	0.999
Test value	[100% Pout]	0.999	0.999	0.999

PVI-3.0-TL-OUTD, Power Factor as per VDE-0126-1-1/A1				
0.98 lag -0.98 lead at three voltage levels and three power levels				
Test Level	[Vac]	199.4	230.0	259.2
Test value	[10% Pout]	0.997	0.996	0.997
Test value	[50% Pout]	0.999	0.999	0.994
Test value	[100% Pout]	0.999	0.999	0.999

VOLTAGE FLUCTUATION AND FLICKERS

PVI-4.2-TL-OUTD, Voltage Fluctuation and Flickers as per EN-61000-3-3					
Voltage Disturbance	Pst [%]	Plt [%]	D(t)>3%	dc [%]	dmax [%]
Limit	1.000	0.650	0.500	3.300	6.000
Test value	0.240	0.241	0.000	0.000	1.004

PVI-3.6-TL-OUTD, Voltage Fluctuation and Flickers as per EN-61000-3-3					
Voltage Disturbance	Pst [%]	Plt [%]	D(t)>3%	dc [%]	dmax [%]
Limit	1.000	0.650	0.500	3.300	6.000
Test value L1	0.240	0.241	0.000	0.000	1.004

PVI-3.0-TL-OUTD, Voltage Fluctuation and Flickers as per EN-61000-3-3					
Voltage Disturbance	Pst [%]	Plt [%]	D(t)>3%	dc [%]	dmax [%]
Limit	1.000	0.650	0.500	3.300	6.000
Test value L1	0.240	0.241	0.000	0.000	1.004

POWER LIMITATIONS

PVI-4.2-TL-OUTD, Power limitations of input and output										
	Pin CH1	Pin CH2	Iin CH1	Iin CH2	P	Q	S	Id	Iq	I
	[W]	[W]	[A _{dc}]	[A _{dc}]	[W]	[var]	[VA]	[A _{ac}]	[A _{ac}]	[A _{ac}]
Limit	3000	3000	16.00	16.00	4600	4700	4700	20.0	20.50	20.50
Test value	3186	3216	16.20	16.30	4612	4560	4612	20.1	20.30	20.30

PVI-3.6-TL-OUTD, Power limitations of input and output										
	Pin CH1	Pin CH2	Iin CH1	Iin CH2	P	Q	S	Id	Iq	I
	[W]	[W]	[A _{dc}]	[A _{dc}]	[W]	[var]	[VA]	[A _{ac}]	[A _{ac}]	[A _{ac}]
Limit	3000	3000	16.00	16.00	4000	4040	4040	17.20	17.90	17.90
Test value	3192	3215	16.20	16.30	4009	4024	4020	17.30	17.80	17.80

PVI-3.0-TL-OUTD, Power limitations of input and output										
	Pin CH1	Pin CH2	Iin CH1	Iin CH2	P	Q	S	Id	Iq	I
	[W]	[W]	[A _{dc}]	[A _{dc}]	[W]	[var]	[VA]	[A _{ac}]	[A _{ac}]	[A _{ac}]
Limit	2000	2000	10.00	10.00	3300	3380	3380	14.5	15.00	15.00
Test value	2042	2068	9.70	9.70	3279	3520	3520	14.5	15.58	15.58

PROTECTION

PVI-4.2-TL-OUTD - PVI-3.6-TL-OUTD - SPVI-3.0-TL-OUTD

UNDER FREQUENCY TESTS

Fnom=50.00 Hz	EN 50438 Limit		Settings		Results	
	Frequency [Hz]	Time [s]	Frequency [Hz]	Time [s]	Frequency [Hz]	Time [s]
Under Frequency <	47.00	0.50	47.00	0.42	47.00	0.39

OVER FREQUENCY TESTS

Fnom=50.00 Hz	EN 50438 Limit		Settings		Results	
	Frequency [Hz]	Time [s]	Frequency [Hz]	Time [s]	Frequency [Hz]	Time [s]
Over Frequency >	51.00	0.50	51.00	0.42	51.00	0.41

UNDER VOLTAGE TESTS

Vφ-n nom = 230.0 Vac	EN 50438 Limit		Settings		Results	
	Voltage [Vac]	Time [s]	Voltage [Vac]	Time [s]	Voltage [Vac]	Time [s]
Under Voltage <	195.5	1.50	195.5	1.45	194.2	1.47
L1-N	195.5	1.50	195.5	1.45	194.2	1.47

OVER VOLTAGE TESTS

Vφ-n nom = 230.0 Vac	EN 50438 Limit		Settings		Results	
	Voltage [Vac]	Time [s]	Voltage [Vac]	Time [s]	Voltage [Vac]	Time [s]
Over Voltage >>	264.5	0.20	264.5	0.12	262.5	0.14
L1-N	264.5	0.20	264.5	0.12	262.5	0.14

BEFORE CONNECTION

	EN 50438 Limit	Settings	Results
Frequency max [Hz]	51.00	51.00	51.00
Frequency min [Hz]	47.00	47.00	47.01
Voltage max [Vac]	264.5	264.5	263.9
Voltage min [Vac]	195.5	195.5	195.4

RECONNECTION TIMES

	After U/O Voltage	After U/O Frequency	After Loss of Main	After any other fault
Minimum Value Limit [s]	20	20	20	60
Actual setting [s]	20	20	20	60
Recorded value [s]	25	23	23	65

LOSS OF MAIN TESTS

Method used	Rate of change of frequency and active power variation		
	25%	50%	100%
EN 50438 Limit [s]	1	1	1
Trip value [s]	<1	<1	<1

SSEG Short Circuit Current Contribution Test

PVI-4.2-TL-OUTD and derived models

RMS Value over 1 Period (Cycle)	21.12	[Aac]
RMS Value over 3 Periods (Cycles)	14.70	[Aac]
Peak Current	164.4	[A]

PVI-3.6-TL-OUTD and derived models

RMS Value over 1 Period (Cycle)	18.04	[Aac]
RMS Value over 3 Periods (Cycles)	12.50	[Aac]
Peak Current	136.5	[A]

PVI-3.0-TL-OUTD and derived models

RMS Value over 1 Period (Cycle)	15.6	[Aac]
RMS Value over 3 Periods (Cycles)	10.6	[Aac]
Peak Current	139.7	[A]

SELF MONITORING – SOLID STATE SWITCHING

Not applicable because electro-mechanical relays are used

ACCURACY

Voltage reading accuracy [%]	= +/- 1
Frequency reading accuracy [%]	= +/- 0.05
Current reading accuracy [%]	= +/-2
Power reading accuracy [%]	= +/-2
Time reading accuracy [s]	= +/-0.08

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