Bureau Veritas
Consumer Products Services
Germany GmbH
Businesspark A96
86842 Türkheim
Germany
+ 49 (0) 40 740 41 – 0
cps-tuerkheim@de.bureauveritas.com

Certification body of BV CPS GmbH
Accredited according to EN 45011 -
ISO / IEC Guide 65

Certificate of compliance

Applicant: **ABB Oy Power Conversion**
Hiomotie 13
FI-00380 Helsinki
Finland

Product: **Grid-tied photovoltaic (PV) inverter**

Model: **PRO-33.0-TL-OUTD-400**
PRO-33.0-TL-OUTD-S-400
PRO-33.0-TL-OUTD-SX-400

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with Engineering Recommendation G59/3 for photovoltaic systems with a three-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function that can access the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G59/3:2013
Recommendation for the Connection of Generating Plant to the Distribution Systems of licensed Distribution Network Operators.

DIN V VDE V 0126-1-1:2006-02 (Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

The PRO-33.0-TL-OUTD-400, PRO-33.0-TL-OUTD-S-400 and PRO-33.0-TL-OUTD-SX-400 are rated >16A and <= 50kW (3 phase). The default values for “Small Power Stations” on the low-voltage grid were verified.

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

Report number: **13TH0463-G59/3**
Certificate number: **U14-0268**
Date of issue: **2014-04-30**

Certification body

Dieter Zitzmann

Annex to the G59/3 certificate of compliance No. U14-0268

Appendix 13.1 Type Testing a Generating Unit	
Extract from test report according the Engineering Recommendation G59/3	**Nr. 13TH0463**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G59/3.			
Manufacturer / applicant:	**ABB Oy Power Conversion** Hiomotie 13, FI-00380 Helsinki **Finland**		
Generating Unit technology	**Grid-tied photovoltaic inverter**		
Rated values	**PRO-33.0-TL-OUTD-400**	**PRO-33.0-TL-OUTD-S-400**	**PRO-33.0-TL-OUTD-SX-400**
Maximum rated capacity	**33,0 kW**		
Rated voltage	**230V**		
Firmware version	**v1.61.0.0**		
* The tests were performed with Firmwareversion v1.61.0.0. Changes in the Firmwareversion on position v1.61.0.x has no effect on the required electrical properties. x = could be any number or sign			
Measurement period:	**2014-01-07 to 2014-04-14**		

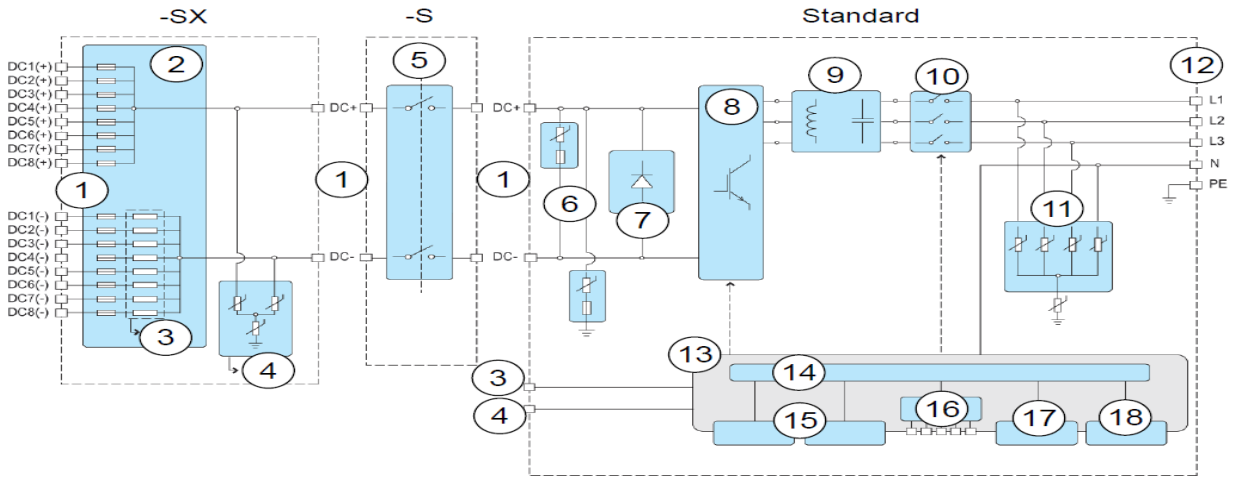
Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Description of the structure of the power generation unit (Figure 1):

The photovoltaic input is connected to wiring terminals. The input provides fuses for every PV input which are monitored by a fuse monitoring system and an overvoltage protection build of varistors to PE. The input current is measured via a current sensor. Afterwards there is the DC switch. EMC filtering is done via x-capacitors, y-capacitors and inductances. After the EMC filter, the Control Board checks the DC input voltage and current, before it is going to the IGBT modules which are also monitored by the control board with the gate driver control unit. A three level inverter makes the PWM signal. The PWM signal is smoothed by a LCL filter into a sine wave. The unit does not provide galvanic separation from input to output (transformerless inverter). The output is switched off redundant by the high power switching bridge and two relay contacts in series. This assures that the opening of the output circuit will also operate in case of one error. The AC current is measured by current sensors and the DC current directly after the PV-fuses. Additionally varistors are provided for overvoltage protection from the grid.

Block diagram



No.	Component	Description
1	Input terminals	DC cabling from the PV arrays with PV quick connectors (-SX) or with screw terminals (standard & -S)
2	Input board with string fuses (-SX)	Circuit board with optional string fuses for both poles (positive and negative) and string measurement functions.
3	String current monitoring (-SX)	Measures string current.
4	Monitored surge protection (-SX)	Detects overvoltage peaks caused by lightning discharge or electrostatic induction.
5	DC switch (-S & -SX)	On/Off switch which isolates the PV array from the electrical grid
6	Input varistors	Inverter overvoltage protection components. (standard & -S)
7	Reverse polarity protection diode	Protects the inverter from reverse connected inputs.
8	Inverter	DC to AC conversion and maximum power point tracker (MPPT)
9	Line filter	Three-phase output current filter.
10	AC relays	AC disconnecting relays.
11	AC output varistors	Protects the inverter from overvoltage peaks.
12	AC terminals	AC cabling connection.
13	Control board	Controls and interfaces to the inverter.
14	Control and monitoring	Control and monitoring circuits.
15	Extension modules	Extension module slots for optional modules.
16	Monitoring interface	Remote monitoring.
17	Control unit	Removable control unit.
18	Status LEDs	Inverter status LEDs on the control board.

Figure 1 – Schematic structure of the power generation unit

Annex to the G59/3 certificate of compliance No. U14-0268

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Differences between Generating Units:

The measurements were done with the inverter PRO-33.0-TL-OUTD-SX-400. If measurements were done at another inverter type of the series, a statement is given under the certain test.

The standard and -S models have screw terminals for DC connection, and they are designed to be used with external solar array junction boxes. In addition to the standard model, the -S model has an integrated DC switch, which disconnects both positive and negative DC inputs.

The -SX model has an integrated solar array junction box with comprehensive DC protection and monitoring features. It has the DC switch to disconnect both positive and negative DC inputs, monitored string fuses (16 pcs), string current monitoring with a configurable alarm limit, and monitored Type II DC overvoltage protection. It provides solar quick connectors to connect up to 8 strings.

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G59/3. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G59/3.

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Protection. Voltage tests.						
Phase 1						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage	**Time delay**	**Voltage**	**Time delay**	**Voltage / time**	**Confirm no trip**
U/V stage 1	200,1V	2,5s	200,1V	2,59s	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	184,0V	0,589s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,0V	1,09s	258.2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	273,6V	0,598s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip
Phase 2						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage	**Time delay**	**Voltage**	**Time delay**	**Voltage / time**	**Confirm no trip**
U/V stage 1	200,1V	2,5s	199,3V	2,59s	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	184,3V	0,602s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	260,9V	1,089s	258.2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	272,5V	0,596s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Phase 3						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage	**Time delay**	**Voltage**	**Time delay**	**Voltage / time**	**Confirm no trip**
U/V stage 1	200,1V	2,5s	199,9V	2,59s	204,1V / 3,5s	No trip
U/V stage 2	184V	0,5s	183,8V	0,598s	188V / 2,48s	No trip
					180V / 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,3V	1,09s	258.2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	273,7V	0,592s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip
Note. For Voltage tests the Voltage required to trip is the setting ±3,45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Frequency tests.						
Function	**Setting**		**Trip test**		**No trip test**	
	Frequency	**Time delay**	**Frequency**	**Time delay**	**Frequency / time**	**Confirm no trip**
U/F stage 1	47,5Hz	20s	47,47Hz	20,08s	47,7Hz / 25s	No trip
U/F stage 2	47Hz	0,5s	46,68Hz	0,576s	47,2Hz / 19,98s	No trip
					46.8Hz / 0,48s	No trip
O/F stage 1	51,5Hz	90s	51,57Hz	90,5s	51,3Hz / 95s	No trip
O/F stage 2	52Hz	0,5s	52,02Hz	0,566s	51,8Hz / 89,98s	No trip
					52,2Hz / 0,48s	No trip
Note: For Frequency Trip tests the Frequency required to trip is the setting ±0,1Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No-trip tests” need to be carried out at the setting ±0,2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Protection. Loss of Mains.

PRO-33.0-TL-OUTD-400, PRO-33.0-TL-OUTD-S-400, PRO-33.0-TL-OUTD-SX-400

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.

Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time. Ph1 fuse removed	47,0	171ms	164ms	67,0	149ms	192ms
Trip time. Ph2 fuse removed	47,0	171ms	164ms	67,0	149ms	192ms
Trip time. Ph3 fuse removed	47,0	171ms	164ms	67,0	149ms	192ms

Note for technologies which have a substantial shut down time this can be added to the 0,5 seconds in establishing that the trip occurred in less than 0,5s. Maximum shut down time could therefore be up to 1,0 seconds for these technologies.

Indicate additional shut down time included in above results. (Integrated interface switch)	Type of switching equipment 1: Relay RS50 with 40ms Type of switching equipment 2: Relay AZSR250 with 40ms

Note. All relays are direct coupled and open directly by receiving the islanding signal from the controller. Therefore the measured disconnection time on all phase is valid for three phases of the inverter.

Appendix 13.1 Type Testing a Generating Unit	
Extract from test report according the Engineering Recommendation G59/3	**Nr. 13TH0463**

Protection. Re-connection timer.				
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 10.5.7.1.				
Voltage				
Time delay setting	**Measured delay**			
20s	36,2s			
Frequency				
Time delay setting	**Measured delay**			
20s	36,2s			
	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	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

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

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Phase 1						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 10,9kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit inBS EN61000-3-12 in %**	
					1 phase	**3 phase**
2nd	0,072	0,146	0,105	0,212	8%	8%
3rd	0,071	0,144	0,063	0,128	21,6%	N/A
4th	0,091	0,182	0,079	0,158	4%	4%
5th	1,151	2,319	1,563	3,149	10,7%	10,7%
6th	0,020	0,041	0,034	0,068	2,67%	2,67%
7th	0,287	0,579	0,429	0,864	7,2%	7,2%
8th	0,014	0,029	0,034	0,069	2%	2%
9th	0,013	0,027	0,016	0,033	3,8%	N/A
10th	0,020	0,039	0,012	0,025	1,6%	1,6%
11th	0,027	0,054	0,105	0,211	3,1%	3,1%
12th	0,010	0,019	0,005	0,011	1,33%	1,33%
13th	0,172	0,347	0,162	0,326	2%	2%
14th	0,004	0,007	0,005	0,011	N/A	N/A
15th	0,006	0,013	0,012	0,023	N/A	N/A
16th	0,008	0,016	0,005	0,011	N/A	N/A
17th	0,066	0,133	0,076	0,154	N/A	N/A
18th	0,004	0,009	0,003	0,007	N/A	N/A
19th	0,063	0,127	0,059	0,119	N/A	N/A
20th	0,004	0,008	0,005	0,010	N/A	N/A
21th	0,004	0,008	0,012	0,024	N/A	N/A
22th	0,004	0,009	0,003	0,007	N/A	N/A
23th	0,032	0,065	0,062	0,126	N/A	N/A
24th	0,002	0,005	0,003	0,006	N/A	N/A
25th	0,010	0,020	0,047	0,094	N/A	N/A

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 10,9kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit inBS EN61000-3-12 in %**	
					1 phase	**3 phase**
26th	0,002	0,004	0,002	0,004	N/A	N/A
27th	0,004	0,007	0,003	0,005	N/A	N/A
28th	0,002	0,004	0,002	0,004	N/A	N/A
29th	0,013	0,027	0,032	0,065	N/A	N/A
30th	0,002	0,003	0,002	0,004	N/A	N/A
31th	0,009	0,018	0,019	0,039	N/A	N/A
32th	0,002	0,004	0,002	0,004	N/A	N/A
33th	0,002	0,004	0,002	0,003	N/A	N/A
34th	0,002	0,003	0,002	0,004	N/A	N/A
35th	0,006	0,012	0,012	0,025	N/A	N/A
36th	0,003	0,006	0,003	0,005	N/A	N/A
37th	0,006	0,011	0,011	0,022	N/A	N/A
38th	0,012	0,024	0,012	0,025	N/A	N/A
39th	0,003	0,006	0,003	0,006	N/A	N/A
40th	0,010	0,020	0,012	0,024	N/A	N/A
THD	5,11%		3,31%		23%	13%
PWHD	0,455%		0,147%		23%	22%

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Phase 2						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 11,0kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit in BS EN61000-3-12 in %**	
					1 phase	**3 phase**
2nd	0,062	0,126	0,040	0,081	8%	8%
3rd	0,025	0,050	0,072	0,146	21,6%	N/A
4th	0,089	0,179	0,032	0,064	4%	4%
5th	1,179	2,383	1,562	3,159	10,7%	10,7%
6th	0,021	0,042	0,065	0,132	2,67%	2,67%
7th	0,306	0,619	0,423	0,856	7,2%	7,2%
8th	0,014	0,028	0,013	0,026	2%	2%
9th	0,015	0,030	0,012	0,025	3,8%	N/A
10th	0,009	0,018	0,010	0,021	1,6%	1,6%
11th	0,033	0,066	0,098	0,199	3,1%	3,1%
12th	0,009	0,018	0,007	0,014	1,33%	1,33%
13th	0,158	0,320	0,171	0,346	2%	2%
14th	0,004	0,008	0,004	0,008	N/A	N/A
15th	0,007	0,013	0,009	0,018	N/A	N/A
16th	0,003	0,006	0,006	0,012	N/A	N/A
17th	0,053	0,107	0,061	0,123	N/A	N/A
18th	0,003	0,006	0,004	0,008	N/A	N/A
19th	0,056	0,113	0,052	0,105	N/A	N/A
20th	0,005	0,011	0,002	0,005	N/A	N/A
21th	0,007	0,014	0,003	0,006	N/A	N/A
22th	0,003	0,006	0,003	0,007	N/A	N/A
23th	0,027	0,054	0,052	0,106	N/A	N/A
24th	0,003	0,007	0,002	0,004	N/A	N/A
25th	0,006	0,013	0,043	0,088	N/A	N/A

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 11,0kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit in BS EN61000-3-12 in %**	
					1 phase	**3 phase**
26th	0,004	0,007	0,002	0,004	N/A	N/A
27th	0,002	0,004	0,003	0,006	N/A	N/A
28th	0,002	0,005	0,002	0,004	N/A	N/A
29th	0,012	0,024	0,029	0,058	N/A	N/A
30th	0,002	0,004	0,002	0,003	N/A	N/A
31th	0,009	0,018	0,020	0,040	N/A	N/A
32th	0,002	0,004	0,001	0,003	N/A	N/A
33th	0,003	0,006	0,002	0,005	N/A	N/A
34th	0,002	0,004	0,002	0,004	N/A	N/A
35th	0,006	0,012	0,011	0,023	N/A	N/A
36th	0,003	0,006	0,002	0,004	N/A	N/A
37th	0,003	0,006	0,011	0,021	N/A	N/A
38th	0,011	0,022	0,011	0,022	N/A	N/A
39th	0,003	0,006	0,003	0,007	N/A	N/A
40th	0,011	0,023	0,009	0,019	N/A	N/A
THD	5,26%		3,31%		23%	13%
PWHD	0,330%		0,105%		23%	22%

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Phase 3						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 11,0kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit in BS EN61000-3-12 in %**	
					1 phase	**3 phase**
2nd	0,037	0,076	0,124	0,251	8%	8%
3rd	0,087	0,176	0,110	0,223	21,6%	N/A
4th	0,085	0,172	0,090	0,182	4%	4%
5th	1,205	2,433	1,584	3,198	10,7%	10,7%
6th	0,017	0,035	0,046	0,094	2,67%	2,67%
7th	0,327	0,660	0,409	0,827	7,2%	7,2%
8th	0,016	0,032	0,029	0,059	2%	2%
9th	0,011	0,021	0,015	0,030	3,8%	N/A
10th	0,024	0,049	0,010	0,020	1,6%	1,6%
11th	0,023	0,046	0,092	0,187	3,1%	3,1%
12th	0,011	0,023	0,006	0,013	1,33%	1,33%
13th	0,172	0,348	0,180	0,364	2%	2%
14th	0,004	0,008	0,005	0,009	N/A	N/A
15th	0,005	0,010	0,011	0,022	N/A	N/A
16th	0,007	0,014	0,004	0,009	N/A	N/A
17th	0,055	0,112	0,060	0,121	N/A	N/A
18th	0,004	0,008	0,003	0,006	N/A	N/A
19th	0,061	0,123	0,067	0,135	N/A	N/A
20th	0,006	0,011	0,005	0,010	N/A	N/A
21th	0,007	0,013	0,012	0,023	N/A	N/A
22th	0,004	0,008	0,003	0,005	N/A	N/A
23th	0,028	0,057	0,052	0,106	N/A	N/A
24th	0,004	0,007	0,002	0,004	N/A	N/A
25th	0,009	0,019	0,051	0,102	N/A	N/A

Appendix 13.1 Type Testing a Generating Unit

Extract from test report according the Engineering Recommendation G59/3 **Nr. 13TH0463**

Power Quality. Harmonics.						
Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)						
	At 45-55% of rated ouput 5,5kW		**100% of rated output 11,0kW**			
Harmonic	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Measured Value (MV) in Amps**	**Measured Value (MV) in %**	**Limit inBS EN61000-3-12 in %**	
					1 phase	**3 phase**
26th	0,004	0,007	0,002	0,004	N/A	N/A
27th	0,003	0,007	0,003	0,006	N/A	N/A
28th	0,002	0,003	0,002	0,005	N/A	N/A
29th	0,014	0,028	0,028	0,057	N/A	N/A
30th	0,002	0,004	0,002	0,003	N/A	N/A
31th	0,010	0,020	0,023	0,046	N/A	N/A
32th	0,001	0,003	0,002	0,004	N/A	N/A
33th	0,002	0,005	0,002	0,004	N/A	N/A
34th	0,002	0,004	0,002	0,003	N/A	N/A
35th	0,007	0,014	0,010	0,020	N/A	N/A
36th	0,002	0,005	0,002	0,004	N/A	N/A
37th	0,005	0,010	0,011	0,022	N/A	N/A
38th	0,011	0,022	0,011	0,022	N/A	N/A
39th	0,002	0,004	0,003	0,006	N/A	N/A
40th	0,021	0,043	0,021	0,042	N/A	N/A
THD	5,39%		3,36%		23%	13%
PWHD	0,381%		0,127%		23%	22%

Appendix 13.1 Type Testing a Generating Unit	
Extract from test report according the Engineering Recommendation G59/3	**Nr. 13TH0463**

Power Quality. Power factor.				
	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1.5% of the stated level during the test.
Measured value	0,9998	0,9998	0,9997	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,33%	3,3%	3,3%	0,33%	3,3%	3,3%	0,086	0,086
Normalised to standard impedance	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

Test impedance	R	0,13	Ω	Xl	0,08	Ω
Standard impedance	R	0,24* 0,4^	Ω	Xl	0,15* 0,25^	Ω

Power Quality. DC injection.			
Test level power	10%	55%	100%
Recorded value	1,93mA	56,02mA	34,10mA
As % of rated AC current	0,00%	0,12%	0,07%
Limit	0,25%	0,25%	0,25%

Appendix 13.1 Type Testing a Generating Unit	
Extract from test report according the Engineering Recommendation G59/3	**Nr. 13TH0463**

Fault level Contribution.					
For a directly coupled SSEG			**For a Inverter SSEG**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts**	**Amps**
Peak Short Circuit current	I_p	N/A	20ms	86,5	56,3
Initial Value of aperiodic current	A	N/A	100ms	58,5	51,9
Initial symmetrical short-circuit current*	I_k	N/A	250ms	53,7	33,9
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	52,1	24,0
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to trip**	0,119	In seconds
For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.					

Self Monitoring – Solid state switching.	**N/A**
It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	
Note: Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open.	