



**BUREAU
VERITAS**

Certificate of compliance

Applicant: SMA Solar Technology AG
Sonnenallee 1
34266 Niestetal
Germany

Product: Photovoltaic (PV) inverter

Model: STP3.0-3AV-40
STP4.0-3AV-40
STP5.0-3AV-40
STP6.0-3AV-40
STP8.0-3AV-40
STP10.0-3AV-40

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with Engineering Recommendation G99/NI 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, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G99/NI-1:2019

Requirements for the connection of generation equipment in parallel with public distribution networks in Northern Ireland

DIN V VDE V 0126-1-1:2006-02 (4.1 Functional safety)

Automatic disconnection device between a generator and the public low-voltage grid

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.

Note:

Inverter current is below 16A per phase. Due to use of several inverters in one application is requested the 16A per phase can be exceeded. Therefore, testing according to G99/NI-1 was performed.

Report number: 18TH0325_G99/NI-1_0

Certification program: NSOP-0032-DEU-ZE-V01

Certificate number: U22-0261

Date of issue: 2022-06-09

Certification body



Thomas Lammel



Certification body Bureau Veritas Consumer Products Services Germany GmbH accredited according to DIN EN ISO/IEC 17065

Testing laboratory accredited according to DIN EN ISO/IEC 17025

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH



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Annex to the G99/NI certificate of compliance No. U22-0261

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99/NI.

| | | | |
|----------------------------------|---|-----------------|-----------------|
| PGM Technology: | Photovoltaic Inverter | | |
| Manufacturer / applicant: | SMA Solar Technology AG | | |
| Address: | Sonnenallee 1 34266 Niestetal Germany | | |
| Tel | +49 5619522-0 | Fax: | +49 5619522-100 |
| Email: | info@SMA.de | Website: | www.SMA.de |

| Rated values | STP3.0-3AV-40 | STP4.0-3AV-40 | STP5.0-3AV-40 | STP6.0-3AV-40 |
|-----------------------------------|---|---|---|---|
| MPP DC voltage range [V] | 140 - 800 | 175 - 800 | 215 - 800 | 260 - 800 |
| Input DC voltage range [V] | Max. 850 | Max. 850 | Max. 850 | Max. 850 |
| Input DC current [A] | 2 x 12 | 2 x 12 | 2 x 12 | 2 x 12 |
| Output AC voltage [V] | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 |
| Output AC current [A] | 4,5 | 5,8 | 7,6 | 9,1 |
| Output power [VA] | 3000 | 4000 | 5000 | 6000 |

| Rated values | STP8.0-3AV-40 | STP10.0-3AV-40 | -- | -- |
|-----------------------------------|---|---|----|----|
| MPP DC voltage range [V] | 260 - 800 | 320 - 800 | -- | -- |
| Input DC voltage range [V] | Max. 1000 | Max. 1000 | -- | -- |
| Input DC current [A] | 20 / 12 | 20 / 12 | -- | -- |
| Output AC voltage [V] | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 | 3/N/PE; 220 / 380 3/N/PE; 230 / 400 3/N/PE; 240 / 415 | -- | -- |
| Output AC current [A] | 12,1 | 14,5 | -- | -- |
| Output power [VA] | 8000 | 10000 | -- | -- |

| | |
|-------------------------|---|
| Firmware version | STP3.0-3AV-40, STP4.0-3AV-40, STP5.0-3AV-40 and STP6.0-3AV-40 = 03.10.19R STP8.0-3AV-40 and STP10.0-3AV-40 = 03.10.15R |
|-------------------------|---|

Description of the structure of the power generation unit:

The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

The above stated Generating Units are tested according to the requirements in the Engineering Recommendation G99/NI. 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 G99/NI.



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

| Operating Range. | |
|------------------|--|
| Test 1 | Voltage = 85% of nominal (195,5 V) Frequency = 47.5 Hz Power Factor = 1 Period of test 90 minutes |
| Connection: | Always connected |
| Limit: | Always connected |
| Test 2 | Voltage = 110% of nominal (253 V) Frequency = 51.5 Hz Power Factor = 1 Period of test 90 minutes |
| Connection: | Always connected |
| Limit: | Always connected |
| Test 3 | Voltage = 110% of nominal (253 V) Frequency = 52.0 Hz Power Factor = 1 Period of test 15 minutes |
| Connection: | Always connected |
| Limit: | Always connected |



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Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Protection. Voltage tests.

STP6.0-3AV-40

Phase 1

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 138,6 | 2,036 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,8 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |

Protection. Voltage tests.

Phase 2

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 137,5 | 2,026 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,8 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Protection. Voltage tests.

Phase 3

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 138,6 | 2,036 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,8 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |

Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. 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 $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Voltage tests.

STP10.0-3AV-40

Phase 1

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 137,5 | 2,026 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,8 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |



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Nr. 18TH0325_G99/NI-1_0

Protection. Voltage tests.

Phase 2

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 137,5 | 2,026 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,9 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |

Protection. Voltage tests.

Phase 3

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V stage 1 | 195,5 | 3,0 | 196,1 | 3,036 | 199,5V / 5s | No trip |
| U/V stage 2 | 138,0 | 2,0 | 137,6 | 2,036 | 142,0 / 2,5s | No trip |
| | | | | | 134V / 1,98s | No trip |
| O/V stage 1 | 262,2 | 0,5 | 254,8 | 0,526 | 249V 5,0s | No trip |
| | | | | | 257V 0,45s | No trip |

Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. 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 $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Protection. Frequency tests.

STP6.0.-3AV-40

| Function | Setting | | Trip test | | No trip test | |
|-------------|----------------|----------------|----------------|----------------|------------------|-----------------|
| | Frequency [Hz] | Time delay [s] | Frequency [Hz] | Time delay [s] | Frequency / time | Confirm no trip |
| U/F stage 1 | 48,0 | 0,5 | 48,00 | 0,583 | 48,2Hz / 25s | No trip |
| | | | | | 47,8Hz / 0,45s | No trip |
| O/F stage 1 | 52 | 1,0 | 52,05 | 1,076 | 51,8Hz / 120s | No trip |
| | | | | | 52,2Hz / 0,98s | No trip |

Note. For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1$ Hz. 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 $\pm 0,2$ Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Frequency tests.

STP10.0.-3AV-40

| Function | Setting | | Trip test | | No trip test | |
|-------------|----------------|----------------|----------------|----------------|------------------|-----------------|
| | Frequency [Hz] | Time delay [s] | Frequency [Hz] | Time delay [s] | Frequency / time | Confirm no trip |
| U/F stage 1 | 48,0 | 0,5 | 47,96 | 0,584 | 48,2Hz / 25s | No trip |
| | | | | | 47,8Hz / 0,45s | No trip |
| O/F stage 1 | 52 | 1,0 | 52,05 | 1,085 | 51,8Hz / 120s | No trip |
| | | | | | 52,2Hz / 0,98s | No trip |

Note. For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1$ Hz. 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 $\pm 0,2$ Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.



Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Protection. Loss of Mains.

STP6.0.-3AV-40

Inverters tested according to BS EN 62116.

| 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 [s] | 0,335 | 0,306 | 0,339 | 0,355 | 0,338 | 0,360 |

Note. Trip time limit is 0,5s.

Protection. Loss of Mains.

STP10.0.-3AV-40

Inverters tested according to BS EN 62116.

| 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 [s] | 0,232 | 0,199 | 0,308 | 0,276 | 0,218 | 0,248 |

Note. Trip time limit is 0,5s.

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 10.1.

Over Voltage

Time delay setting

Measured delay

60s

67,80

Under Voltage

Time delay setting

Measured delay

60s

62,85

Over Frequency

Time delay setting

Measured delay

60s

67,64

Under Frequency

Time delay setting

Measured delay

60s

63,87

Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.

At 257,0V

At 191,5V

At 47,9Hz

At 52,1Hz

Confirmation that the Generating Unit does not re-connect.

No reconnection

No reconnection

No reconnection

No reconnection



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Protection. Frequency change, Stability test.

STP6.0-3AV-40, STP10.0-3AV-40

| | Start Frequency [Hz] | Change | Test Duration | Confirm no trip |
|--------------------------|----------------------|-------------|---------------|-----------------|
| Positive Vector Shift | 49,5 | +50 degrees | | No trip |
| Negative Vector Shift | 50,5 | -50 degrees | | No trip |
| Positive Frequency drift | 49,0 to 51,0 | +0,95Hz/sec | 2,1s | No trip |
| Negative Frequency drift | 51,0 to 49,0 | -0,95Hz/sec | 2,1s | No trip |

Limited Frequency Sensitive Mode – Over Frequency

STP6.0-3AV-40

| 1-min mean value [Hz]: | a) 50,00 | b) 50,25 | c) 50,70 | d) 51,15 | e) 50,70 | f) 50,25 | g) 50,00 |
|--|----------|----------|----------|----------|----------|----------|----------|
| 1. Measurement a) to g): Active power output > 80% Pn | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,25 | 50,70 | 51,15 | 50,70 | 50,25 | 50,00 |
| P _{expected} [W]: | 6001 | 5850 | 4500 | 3150 | 4500 | 5850 | N/A |
| P _{measured} [W]: | 6001 | 5874 | 4521 | 3166 | 4526 | 5879 | N/A |
| 2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% Pn | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,25 | 50,70 | 51,15 | 50,70 | 50,25 | 50,00 |
| P _{expected} [W]: | 2999 | 2923 | 2249 | 1574 | 2249 | 2923 | N/A |
| P _{measured} [W]: | 2999 | 2943 | 2264 | 1583 | 2272 | 2952 | N/A |

Limited Frequency Sensitive Mode – Over Frequency

STP10.0-3AV-40

| 1-min mean value [Hz]: | a) 50,00 | b) 50,25 | c) 50,70 | d) 51,15 | e) 50,70 | f) 50,25 | g) 50,00 |
|--|----------|----------|----------|----------|----------|----------|----------|
| 1. Measurement a) to g): Active power output > 80% Pn | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,25 | 50,70 | 51,15 | 50,70 | 50,25 | 50,00 |
| P _{expected} [W]: | 10072 | 9819 | 7553 | 5287 | 7553 | 9819 | N/A |
| P _{measured} [W]: | 10072 | 9761 | 7506 | 5251 | 7523 | 9780 | N/A |
| 2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% Pn | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,25 | 50,70 | 51,15 | 50,70 | 50,25 | 50,00 |
| P _{expected} [W]: | 4999 | 4874 | 3749 | 2624 | 3749 | 4878 | N/A |
| P _{measured} [W]: | 4999 | 4876 | 3747 | 2620 | 3764 | 4894 | N/A |



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Output Power with falling Frequency

STP6.0-3AV-40

| | | | | | | |
|--------------------------|-------|-------|-------|-------|-------|-------|
| Frequency setpoint [Hz]: | 50,00 | 49,50 | 49,00 | 48,00 | 47,60 | 47,10 |
| Frequency [Hz]: | 50,00 | 49,50 | 49,00 | 48,00 | 47,60 | 47,10 |
| Active power [W]: | 6049 | 6054 | 6054 | 6055 | 6055 | 6056 |

STP10.0-3AV-40

| | | | | | | |
|--------------------------|-------|-------|-------|-------|-------|-------|
| Frequency setpoint [Hz]: | 50,00 | 49,50 | 49,00 | 48,00 | 47,60 | 47,10 |
| Frequency [Hz]: | 50,00 | 49,50 | 49,00 | 48,00 | 47,60 | 47,10 |
| Active power [W]: | 10059 | 10059 | 10056 | 10053 | 10049 | 10050 |

Note.

Electronic inverter no power reduction take place.



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| Power Quality. Harmonics. | | | | | | |
|--|------------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------------------------|---------|
| STP6.0-3AV-40 | | | | | | |
| Phase 1 | | | | | | |
| Generating Unit rating per phase (rpp) | | | | | | |
| | At 45-55% of rated output 990 W | | 100% of rated output 2000 W | | | |
| Harmonic | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Limit in BS EN61000-3-12 in % | |
| | | | | | 1 phase | 3 phase |
| 2nd | 0,025 | 0,285 | 0,008 | 0,095 | 8% | 8% |
| 3rd | 0,036 | 0,413 | 0,037 | 0,427 | 21,6% | N/A |
| 4th | 0,073 | 0,839 | 0,076 | 0,874 | 4% | 4% |
| 5th | 0,006 | 0,075 | 0,007 | 0,081 | 10,7% | 10,7% |
| 6th | 0,015 | 0,176 | 0,014 | 0,157 | 2,67% | 2,67% |
| 7th | 0,004 | 0,052 | 0,005 | 0,056 | 7,2% | 7,2% |
| 8th | 0,011 | 0,124 | 0,010 | 0,112 | 2% | 2% |
| 9th | 0,015 | 0,177 | 0,014 | 0,166 | 3,8% | N/A |
| 10th | 0,013 | 0,152 | 0,011 | 0,131 | 1,6% | 1,6% |
| 11th | 0,036 | 0,416 | 0,032 | 0,365 | 3,1% | 3,1% |
| 12th | 0,007 | 0,086 | 0,010 | 0,112 | 1,33% | 1,33% |
| 13th | 0,031 | 0,352 | 0,026 | 0,304 | 2% | 2% |
| 14th | 0,009 | 0,100 | 0,011 | 0,124 | N/A | N/A |
| 15th | 0,004 | 0,046 | 0,005 | 0,059 | N/A | N/A |
| 16th | 0,009 | 0,099 | 0,008 | 0,088 | N/A | N/A |
| 17th | 0,021 | 0,243 | 0,020 | 0,229 | N/A | N/A |
| 18th | 0,005 | 0,056 | 0,003 | 0,039 | N/A | N/A |
| 19th | 0,018 | 0,204 | 0,017 | 0,197 | N/A | N/A |
| 20th | 0,005 | 0,056 | 0,004 | 0,048 | N/A | N/A |
| 21th | 0,003 | 0,034 | 0,003 | 0,040 | N/A | N/A |
| 22th | 0,007 | 0,075 | 0,005 | 0,057 | N/A | N/A |
| 23th | 0,017 | 0,200 | 0,018 | 0,203 | N/A | N/A |
| 24th | 0,005 | 0,060 | 0,004 | 0,042 | N/A | N/A |
| 25th | 0,013 | 0,152 | 0,015 | 0,173 | N/A | N/A |
| 26th | 0,003 | 0,036 | 0,003 | 0,032 | N/A | N/A |
| 27th | 0,003 | 0,031 | 0,003 | 0,035 | N/A | N/A |
| 28th | 0,003 | 0,036 | 0,003 | 0,036 | N/A | N/A |
| 29th | 0,004 | 0,049 | 0,008 | 0,096 | N/A | N/A |
| 30th | 0,003 | 0,039 | 0,002 | 0,024 | N/A | N/A |
| 31th | 0,002 | 0,027 | 0,007 | 0,083 | N/A | N/A |
| 32th | 0,002 | 0,023 | 0,002 | 0,026 | N/A | N/A |
| 33th | 0,002 | 0,022 | 0,002 | 0,027 | N/A | N/A |
| 34th | 0,003 | 0,029 | 0,003 | 0,033 | N/A | N/A |
| 35th | 0,003 | 0,029 | 0,006 | 0,066 | N/A | N/A |
| 36th | 0,003 | 0,030 | 0,003 | 0,029 | N/A | N/A |
| 37th | 0,003 | 0,037 | 0,005 | 0,059 | N/A | N/A |
| 38th | 0,001 | 0,014 | 0,002 | 0,026 | N/A | N/A |
| 39th | 0,002 | 0,020 | 0,002 | 0,024 | N/A | N/A |
| 40th | 0,001 | 0,016 | 0,002 | 0,028 | N/A | N/A |
| THD ₄₀ [%] | 2,60 | | 1,37 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,04 | | 23% | 22% |

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Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Harmonics.

Phase 2

| Generating Unit rating per phase (rpp) | | | | | | |
|--|------------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------------------------|---------|
| | At 45-55% of rated output 900 W | | 100% of rated output 1998 W | | | |
| Harmonic | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Limit in BS EN61000-3-12 in % | |
| | | | | | 1 phase | 3 phase |
| 2nd | 0,068 | 0,790 | 0,067 | 0,774 | 8% | 8% |
| 3rd | 0,054 | 0,625 | 0,043 | 0,500 | 21,6% | N/A |
| 4th | 0,034 | 0,394 | 0,040 | 0,457 | 4% | 4% |
| 5th | 0,014 | 0,161 | 0,018 | 0,209 | 10,7% | 10,7% |
| 6th | 0,013 | 0,146 | 0,010 | 0,116 | 2,67% | 2,67% |
| 7th | 0,013 | 0,153 | 0,019 | 0,218 | 7,2% | 7,2% |
| 8th | 0,021 | 0,242 | 0,020 | 0,232 | 2% | 2% |
| 9th | 0,020 | 0,227 | 0,021 | 0,240 | 3,8% | N/A |
| 10th | 0,032 | 0,367 | 0,030 | 0,350 | 1,6% | 1,6% |
| 11th | 0,033 | 0,383 | 0,020 | 0,235 | 3,1% | 3,1% |
| 12th | 0,011 | 0,125 | 0,012 | 0,137 | 1,33% | 1,33% |
| 13th | 0,032 | 0,366 | 0,023 | 0,270 | 2% | 2% |
| 14th | 0,011 | 0,125 | 0,010 | 0,112 | N/A | N/A |
| 15th | 0,014 | 0,161 | 0,018 | 0,206 | N/A | N/A |
| 16th | 0,003 | 0,031 | 0,004 | 0,046 | N/A | N/A |
| 17th | 0,025 | 0,293 | 0,027 | 0,307 | N/A | N/A |
| 18th | 0,006 | 0,071 | 0,003 | 0,035 | N/A | N/A |
| 19th | 0,023 | 0,266 | 0,023 | 0,262 | N/A | N/A |
| 20th | 0,003 | 0,040 | 0,004 | 0,043 | N/A | N/A |
| 21th | 0,010 | 0,110 | 0,012 | 0,134 | N/A | N/A |
| 22th | 0,005 | 0,058 | 0,004 | 0,042 | N/A | N/A |
| 23th | 0,020 | 0,228 | 0,020 | 0,228 | N/A | N/A |
| 24th | 0,004 | 0,052 | 0,004 | 0,049 | N/A | N/A |
| 25th | 0,015 | 0,177 | 0,016 | 0,182 | N/A | N/A |
| 26th | 0,003 | 0,040 | 0,003 | 0,037 | N/A | N/A |
| 27th | 0,006 | 0,071 | 0,007 | 0,085 | N/A | N/A |
| 28th | 0,003 | 0,037 | 0,003 | 0,031 | N/A | N/A |
| 29th | 0,003 | 0,029 | 0,007 | 0,077 | N/A | N/A |
| 30th | 0,004 | 0,043 | 0,003 | 0,031 | N/A | N/A |
| 31th | 0,006 | 0,069 | 0,006 | 0,073 | N/A | N/A |
| 32th | 0,002 | 0,023 | 0,002 | 0,020 | N/A | N/A |
| 33th | 0,005 | 0,055 | 0,004 | 0,052 | N/A | N/A |
| 34th | 0,003 | 0,037 | 0,003 | 0,030 | N/A | N/A |
| 35th | 0,003 | 0,032 | 0,008 | 0,097 | N/A | N/A |
| 36th | 0,003 | 0,029 | 0,003 | 0,030 | N/A | N/A |
| 37th | 0,003 | 0,033 | 0,006 | 0,073 | N/A | N/A |
| 38th | 0,002 | 0,023 | 0,001 | 0,017 | N/A | N/A |
| 39th | 0,003 | 0,037 | 0,004 | 0,046 | N/A | N/A |
| 40th | 0,002 | 0,024 | 0,002 | 0,027 | N/A | N/A |
| THD ₄₀ [%] | 2,60 | | 1,37 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,04 | | 23% | 22% |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Harmonics.

Phase 3

Generating Unit rating per phase (rpp)

| Harmonic | At 45-55% of rated output 990 W | | 100% of rated output 2000 W | | Limit in BS EN61000-3-12 in % | |
|-----------------------|------------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------------------------|---------|
| | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | 1 phase | 3 phase |
| | | | | | | |
| 2nd | 0,071 | 0,815 | 0,068 | 0,785 | 8% | 8% |
| 3rd | 0,059 | 0,677 | 0,060 | 0,693 | 21,6% | N/A |
| 4th | 0,040 | 0,458 | 0,037 | 0,428 | 4% | 4% |
| 5th | 0,014 | 0,157 | 0,018 | 0,204 | 10,7% | 10,7% |
| 6th | 0,007 | 0,085 | 0,007 | 0,080 | 2,67% | 2,67% |
| 7th | 0,014 | 0,159 | 0,019 | 0,219 | 7,2% | 7,2% |
| 8th | 0,013 | 0,150 | 0,017 | 0,197 | 2% | 2% |
| 9th | 0,007 | 0,081 | 0,008 | 0,097 | 3,8% | N/A |
| 10th | 0,026 | 0,301 | 0,031 | 0,353 | 1,6% | 1,6% |
| 11th | 0,035 | 0,405 | 0,028 | 0,321 | 3,1% | 3,1% |
| 12th | 0,009 | 0,105 | 0,009 | 0,108 | 1,33% | 1,33% |
| 13th | 0,017 | 0,198 | 0,014 | 0,166 | 2% | 2% |
| 14th | 0,012 | 0,138 | 0,012 | 0,137 | N/A | N/A |
| 15th | 0,012 | 0,138 | 0,014 | 0,163 | N/A | N/A |
| 16th | 0,008 | 0,091 | 0,008 | 0,097 | N/A | N/A |
| 17th | 0,012 | 0,143 | 0,011 | 0,121 | N/A | N/A |
| 18th | 0,005 | 0,057 | 0,004 | 0,050 | N/A | N/A |
| 19th | 0,027 | 0,310 | 0,026 | 0,297 | N/A | N/A |
| 20th | 0,008 | 0,087 | 0,007 | 0,081 | N/A | N/A |
| 21th | 0,011 | 0,128 | 0,014 | 0,162 | N/A | N/A |
| 22th | 0,005 | 0,056 | 0,004 | 0,050 | N/A | N/A |
| 23th | 0,025 | 0,282 | 0,026 | 0,303 | N/A | N/A |
| 24th | 0,004 | 0,044 | 0,005 | 0,062 | N/A | N/A |
| 25th | 0,024 | 0,279 | 0,024 | 0,275 | N/A | N/A |
| 26th | 0,006 | 0,073 | 0,005 | 0,059 | N/A | N/A |
| 27th | 0,006 | 0,071 | 0,006 | 0,068 | N/A | N/A |
| 28th | 0,003 | 0,032 | 0,003 | 0,033 | N/A | N/A |
| 29th | 0,004 | 0,043 | 0,004 | 0,046 | N/A | N/A |
| 30th | 0,002 | 0,028 | 0,003 | 0,033 | N/A | N/A |
| 31th | 0,008 | 0,089 | 0,010 | 0,114 | N/A | N/A |
| 32th | 0,004 | 0,042 | 0,003 | 0,040 | N/A | N/A |
| 33th | 0,005 | 0,052 | 0,006 | 0,064 | N/A | N/A |
| 34th | 0,002 | 0,026 | 0,003 | 0,029 | N/A | N/A |
| 35th | 0,005 | 0,056 | 0,008 | 0,088 | N/A | N/A |
| 36th | 0,002 | 0,024 | 0,003 | 0,030 | N/A | N/A |
| 37th | 0,005 | 0,058 | 0,003 | 0,037 | N/A | N/A |
| 38th | 0,003 | 0,034 | 0,003 | 0,038 | N/A | N/A |
| 39th | 0,004 | 0,050 | 0,004 | 0,049 | N/A | N/A |
| 40th | 0,002 | 0,026 | 0,002 | 0,026 | N/A | N/A |
| THD ₄₀ [%] | 2,60 | | 1,37 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,04 | | 23% | 22% |



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Annex to the G99/NI certificate of compliance No. U22-0261

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Harmonics.

STP10.0-3AV-40

Phase 1

| Generating Unit rating per phase (rpp) | | | | | | |
|--|-------------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------------------------|---------|
| | At 45-55% of rated output 1650 W | | 100% of rated output 3320 W | | | |
| Harmonic | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Limit in BS EN61000-3-12 in % | |
| | | | | | 1 phase | 3 phase |
| 2nd | 0,035 | 0,245 | 0,038 | 0,266 | 8% | 8% |
| 3rd | 0,040 | 0,278 | 0,066 | 0,459 | 21,6% | N/A |
| 4th | 0,065 | 0,450 | 0,085 | 0,590 | 4% | 4% |
| 5th | 0,022 | 0,150 | 0,022 | 0,156 | 10,7% | 10,7% |
| 6th | 0,007 | 0,051 | 0,013 | 0,092 | 2,67% | 2,67% |
| 7th | 0,023 | 0,158 | 0,024 | 0,170 | 7,2% | 7,2% |
| 8th | 0,008 | 0,053 | 0,007 | 0,047 | 2% | 2% |
| 9th | 0,019 | 0,135 | 0,019 | 0,130 | 3,8% | N/A |
| 10th | 0,005 | 0,032 | 0,006 | 0,042 | 1,6% | 1,6% |
| 11th | 0,011 | 0,079 | 0,039 | 0,272 | 3,1% | 3,1% |
| 12th | 0,004 | 0,026 | 0,005 | 0,035 | 1,33% | 1,33% |
| 13th | 0,029 | 0,202 | 0,050 | 0,350 | 2% | 2% |
| 14th | 0,003 | 0,022 | 0,005 | 0,037 | N/A | N/A |
| 15th | 0,012 | 0,082 | 0,012 | 0,084 | N/A | N/A |
| 16th | 0,003 | 0,022 | 0,004 | 0,030 | N/A | N/A |
| 17th | 0,016 | 0,114 | 0,034 | 0,234 | N/A | N/A |
| 18th | 0,002 | 0,017 | 0,003 | 0,023 | N/A | N/A |
| 19th | 0,011 | 0,080 | 0,019 | 0,132 | N/A | N/A |
| 20th | 0,002 | 0,017 | 0,003 | 0,024 | N/A | N/A |
| 21th | 0,007 | 0,050 | 0,007 | 0,050 | N/A | N/A |
| 22th | 0,002 | 0,014 | 0,003 | 0,024 | N/A | N/A |
| 23th | 0,011 | 0,076 | 0,018 | 0,123 | N/A | N/A |
| 24th | 0,002 | 0,014 | 0,002 | 0,017 | N/A | N/A |
| 25th | 0,004 | 0,026 | 0,012 | 0,084 | N/A | N/A |
| 26th | 0,002 | 0,012 | 0,002 | 0,016 | N/A | N/A |
| 27th | 0,005 | 0,034 | 0,005 | 0,034 | N/A | N/A |
| 28th | 0,002 | 0,012 | 0,003 | 0,018 | N/A | N/A |
| 29th | 0,005 | 0,036 | 0,012 | 0,087 | N/A | N/A |
| 30th | 0,002 | 0,011 | 0,002 | 0,013 | N/A | N/A |
| 31th | 0,008 | 0,058 | 0,010 | 0,068 | N/A | N/A |
| 32th | 0,002 | 0,011 | 0,002 | 0,012 | N/A | N/A |
| 33th | 0,004 | 0,028 | 0,004 | 0,025 | N/A | N/A |
| 34th | 0,002 | 0,011 | 0,002 | 0,014 | N/A | N/A |
| 35th | 0,008 | 0,053 | 0,008 | 0,054 | N/A | N/A |
| 36th | 0,001 | 0,010 | 0,002 | 0,011 | N/A | N/A |
| 37th | 0,003 | 0,024 | 0,007 | 0,047 | N/A | N/A |
| 38th | 0,001 | 0,009 | 0,001 | 0,010 | N/A | N/A |
| 39th | 0,004 | 0,030 | 0,005 | 0,032 | N/A | N/A |
| 40th | 0,001 | 0,009 | 0,001 | 0,010 | N/A | N/A |
| THD ₄₀ [%] | 1,81 | | 1,13 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,05 | | 23% | 22% |



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Annex to the G99/NI certificate of compliance No. U22-0261

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Harmonics.

Phase 2

Generating Unit rating per phase (rpp)

At 45-55% of rated output
1660 W

100% of rated output
3320 W

| Harmonic | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Limit in BS EN61000-3-12 in % | |
|-----------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|----------------------------------|---------|
| | | | | | 1 phase | 3 phase |
| 2nd | 0,049 | 0,340 | 0,071 | 0,492 | 8% | 8% |
| 3rd | 0,014 | 0,098 | 0,025 | 0,171 | 21,6% | N/A |
| 4th | 0,045 | 0,314 | 0,045 | 0,309 | 4% | 4% |
| 5th | 0,008 | 0,057 | 0,009 | 0,062 | 10,7% | 10,7% |
| 6th | 0,009 | 0,061 | 0,013 | 0,087 | 2,67% | 2,67% |
| 7th | 0,008 | 0,057 | 0,011 | 0,078 | 7,2% | 7,2% |
| 8th | 0,008 | 0,056 | 0,006 | 0,044 | 2% | 2% |
| 9th | 0,006 | 0,042 | 0,009 | 0,061 | 3,8% | N/A |
| 10th | 0,005 | 0,035 | 0,006 | 0,040 | 1,6% | 1,6% |
| 11th | 0,025 | 0,171 | 0,053 | 0,369 | 3,1% | 3,1% |
| 12th | 0,004 | 0,029 | 0,006 | 0,042 | 1,33% | 1,33% |
| 13th | 0,016 | 0,108 | 0,039 | 0,272 | 2% | 2% |
| 14th | 0,003 | 0,022 | 0,004 | 0,031 | N/A | N/A |
| 15th | 0,004 | 0,025 | 0,005 | 0,034 | N/A | N/A |
| 16th | 0,003 | 0,021 | 0,004 | 0,025 | N/A | N/A |
| 17th | 0,009 | 0,061 | 0,027 | 0,187 | N/A | N/A |
| 18th | 0,003 | 0,018 | 0,004 | 0,026 | N/A | N/A |
| 19th | 0,005 | 0,038 | 0,018 | 0,126 | N/A | N/A |
| 20th | 0,002 | 0,016 | 0,003 | 0,021 | N/A | N/A |
| 21th | 0,002 | 0,017 | 0,003 | 0,024 | N/A | N/A |
| 22th | 0,002 | 0,015 | 0,003 | 0,020 | N/A | N/A |
| 23th | 0,006 | 0,041 | 0,016 | 0,114 | N/A | N/A |
| 24th | 0,002 | 0,014 | 0,003 | 0,019 | N/A | N/A |
| 25th | 0,005 | 0,036 | 0,012 | 0,083 | N/A | N/A |
| 26th | 0,002 | 0,012 | 0,002 | 0,016 | N/A | N/A |
| 27th | 0,002 | 0,013 | 0,003 | 0,017 | N/A | N/A |
| 28th | 0,002 | 0,012 | 0,002 | 0,016 | N/A | N/A |
| 29th | 0,007 | 0,047 | 0,012 | 0,087 | N/A | N/A |
| 30th | 0,002 | 0,011 | 0,002 | 0,014 | N/A | N/A |
| 31th | 0,005 | 0,033 | 0,008 | 0,055 | N/A | N/A |
| 32th | 0,002 | 0,011 | 0,002 | 0,014 | N/A | N/A |
| 33th | 0,002 | 0,011 | 0,002 | 0,015 | N/A | N/A |
| 34th | 0,002 | 0,012 | 0,002 | 0,015 | N/A | N/A |
| 35th | 0,005 | 0,032 | 0,006 | 0,045 | N/A | N/A |
| 36th | 0,001 | 0,010 | 0,002 | 0,011 | N/A | N/A |
| 37th | 0,005 | 0,033 | 0,007 | 0,049 | N/A | N/A |
| 38th | 0,001 | 0,009 | 0,001 | 0,010 | N/A | N/A |
| 39th | 0,001 | 0,010 | 0,002 | 0,013 | N/A | N/A |
| 40th | 0,002 | 0,011 | 0,002 | 0,012 | N/A | N/A |
| THD ₄₀ [%] | 1,81 | | 1,13 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,05 | | 23% | 22% |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

| Power Quality. Harmonics. | | | | | | |
|--|-------------------------------------|-------------------------------|--------------------------------|-------------------------------|----------------------------------|---------|
| Phase 3 | | | | | | |
| Generating Unit rating per phase (rpp) | | | | | | |
| | At 45-55% of rated output 1650 W | | 100% of rated output 3310 W | | | |
| Harmonic | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Limit in BS EN61000-3-12 in % | |
| | | | | | 1 phase | 3 phase |
| 2nd | 0,031 | 0,217 | 0,040 | 0,279 | 8% | 8% |
| 3rd | 0,031 | 0,216 | 0,044 | 0,309 | 21,6% | N/A |
| 4th | 0,074 | 0,514 | 0,080 | 0,554 | 4% | 4% |
| 5th | 0,023 | 0,158 | 0,022 | 0,156 | 10,7% | 10,7% |
| 6th | 0,009 | 0,060 | 0,011 | 0,077 | 2,67% | 2,67% |
| 7th | 0,017 | 0,121 | 0,017 | 0,120 | 7,2% | 7,2% |
| 8th | 0,007 | 0,048 | 0,007 | 0,049 | 2% | 2% |
| 9th | 0,017 | 0,118 | 0,017 | 0,117 | 3,8% | N/A |
| 10th | 0,005 | 0,035 | 0,007 | 0,052 | 1,6% | 1,6% |
| 11th | 0,023 | 0,159 | 0,049 | 0,342 | 3,1% | 3,1% |
| 12th | 0,004 | 0,029 | 0,006 | 0,040 | 1,33% | 1,33% |
| 13th | 0,021 | 0,149 | 0,039 | 0,268 | 2% | 2% |
| 14th | 0,003 | 0,024 | 0,006 | 0,039 | N/A | N/A |
| 15th | 0,013 | 0,088 | 0,013 | 0,088 | N/A | N/A |
| 16th | 0,003 | 0,022 | 0,005 | 0,033 | N/A | N/A |
| 17th | 0,019 | 0,131 | 0,036 | 0,254 | N/A | N/A |
| 18th | 0,003 | 0,020 | 0,004 | 0,029 | N/A | N/A |
| 19th | 0,013 | 0,092 | 0,025 | 0,173 | N/A | N/A |
| 20th | 0,003 | 0,019 | 0,004 | 0,029 | N/A | N/A |
| 21th | 0,008 | 0,053 | 0,008 | 0,055 | N/A | N/A |
| 22th | 0,002 | 0,017 | 0,004 | 0,024 | N/A | N/A |
| 23th | 0,007 | 0,048 | 0,011 | 0,078 | N/A | N/A |
| 24th | 0,002 | 0,016 | 0,004 | 0,025 | N/A | N/A |
| 25th | 0,003 | 0,020 | 0,008 | 0,056 | N/A | N/A |
| 26th | 0,002 | 0,015 | 0,003 | 0,023 | N/A | N/A |
| 27th | 0,005 | 0,034 | 0,005 | 0,035 | N/A | N/A |
| 28th | 0,002 | 0,015 | 0,003 | 0,021 | N/A | N/A |
| 29th | 0,009 | 0,061 | 0,015 | 0,106 | N/A | N/A |
| 30th | 0,002 | 0,014 | 0,003 | 0,021 | N/A | N/A |
| 31th | 0,009 | 0,060 | 0,012 | 0,083 | N/A | N/A |
| 32th | 0,002 | 0,014 | 0,003 | 0,020 | N/A | N/A |
| 33th | 0,004 | 0,029 | 0,004 | 0,030 | N/A | N/A |
| 34th | 0,002 | 0,014 | 0,003 | 0,019 | N/A | N/A |
| 35th | 0,005 | 0,035 | 0,004 | 0,031 | N/A | N/A |
| 36th | 0,002 | 0,013 | 0,003 | 0,019 | N/A | N/A |
| 37th | 0,002 | 0,015 | 0,004 | 0,028 | N/A | N/A |
| 38th | 0,002 | 0,013 | 0,003 | 0,019 | N/A | N/A |
| 39th | 0,004 | 0,030 | 0,004 | 0,031 | N/A | N/A |
| 40th | 0,002 | 0,014 | 0,003 | 0,019 | N/A | N/A |
| THD ₄₀ [%] | 1,81 | | 1,13 | | 23% | 13% |
| PWHD [%] | 0,04 | | 0,05 | | 23% | 22% |



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Annex to the G99/NI certificate of compliance No. U22-0261

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Power factor.

STP6.0-3AV-40

| Output power | 216,2V | 230V | 253V | Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1,5\%$ of the stated level during the test. |
|--------------|--------|-------|-------|---|
| 20% | 0,997 | 0,998 | 0,993 | |
| 50% | 1,000 | 1,000 | 0,999 | |
| 75% | 1,000 | 1,000 | 0,999 | |
| 100% | 1,000 | 1,000 | 1,000 | |
| Limit | >0,95 | >0,95 | >0,95 | |

Power Quality. Power factor.

STP10.0-3AV-40

| Output power | 216,2V | 230V | 253V | Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1,5\%$ of the stated level during the test. |
|--------------|--------|-------|-------|---|
| 20% | 1,000 | 0,999 | 0,999 | |
| 50% | 1,000 | 1,000 | 1,000 | |
| 75% | 1,000 | 1,000 | 1,000 | |
| 100% | 1,000 | 1,000 | 1,000 | |
| Limit | >0,95 | >0,95 | >0,95 | |

Power Quality. Voltage fluctuation and Flicker.

STP6.0-3-AV-40

| Phase 1 | | | | | | | | |
|---------------------------------------|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,10 | 0,00 | 0,00 | 0,10 | 0,00 | 0,00 | 0,064 | 0,064 |
| Measured values at standard impedance | 0,10 | 0,00 | 0,00 | 0,10 | 0,00 | 0,00 | 0,064 | 0,064 |
| Values for maximum impedance | 1,02 | 0,00 | 0,00 | 1,02 | 0,00 | 0,00 | 0,650 | 0,650 |
| 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 | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 2,438 | Ω | XI | 1,523 | Ω | | |
| | Zmax | 2,874 | Ω | | | | | |



Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Voltage fluctuation and Flicker.

STP6.0-3-AV-40

Phase 2

| | Starting | | | Stopping | | | Running | |
|--|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,12 | 0,00 | 0,00 | 0,12 | 0,00 | 0,00 | 0,064 | 0,064 |
| Measured values at standard impedance | 0,12 | 0,00 | 0,00 | 0,12 | 0,00 | 0,00 | 0,064 | 0,064 |
| Values for maximum impedance | 1,22 | 0,00 | 0,00 | 1,22 | 0,00 | 0,00 | 0,650 | 0,650 |
| Limits set under BS EN 61000-3-11 | 4% | 3,3% | 3,3% 500ms | 4% | 3,3% | 3,3% 500ms | 1,0 | 0,65 |
| Impedance | | | | | | | | |
| Test impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 2,438 | Ω | XI | 1,523 | Ω | | |
| | Zmax | 2,874 | Ω | | | | | |



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Voltage fluctuation and Flicker.

STP6.0-3-AV-40

Phase 3

| | Starting | | | Stopping | | | Running | |
|---------------------------------------|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,11 | 0,00 | 0,00 | 0,11 | 0,00 | 0,00 | 0,064 | 0,064 |
| Measured values at standard impedance | 0,11 | 0,00 | 0,00 | 0,11 | 0,00 | 0,00 | 0,064 | 0,064 |
| Values for maximum impedance | 1,12 | 0,00 | 0,00 | 1,12 | 0,00 | 0,00 | 0,650 | 0,650 |
| 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 | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 2,438 | Ω | XI | 1,523 | Ω | | |
| | Zmax | 2,874 | Ω | | | | | |

Power Quality. Voltage fluctuation and Flicker.

STP10.0-3-AV-40

Phase 1

| | Starting | | | Stopping | | | Running | |
|---------------------------------------|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,20 | 0,00 | 0,00 | 0,20 | 0,00 | 0,00 | 0,132 | 0,105 |
| Measured values at standard impedance | 0,20 | 0,00 | 0,00 | 0,20 | 0,00 | 0,00 | 0,132 | 0,105 |
| Values for maximum impedance | 0,20 | 0,00 | 0,00 | 0,20 | 0,00 | 0,00 | 0,820 | 0,650 |
| 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 | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 1,486 | Ω | XI | 0,928 | Ω | | |
| | Zmax | 1,752 | Ω | | | | | |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

| Power Quality. Voltage fluctuation and Flicker. | | | | | | | | |
|---|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| STP10.0-3-AV-40 | | | | | | | | |
| Phase 2 | | | | | | | | |
| | Starting | | | Stopping | | | Running | |
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,22 | 0,00 | 0,00 | 0,22 | 0,00 | 0,00 | 0,149 | 0,107 |
| Measured values at standard impedance | 0,22 | 0,00 | 0,00 | 0,22 | 0,00 | 0,00 | 0,149 | 0,107 |
| Values for maximum impedance | 1,34 | 0,00 | 0,00 | 1,34 | 0,00 | 0,00 | 0,905 | 0,650 |
| 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 | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 1,458 | Ω | XI | 0,911 | Ω | | |
| | Zmax | 1,719 | Ω | | | | | |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Power Quality. Voltage fluctuation and Flicker.

STP10.0-3-AV-40

Phase 3

| | Starting | | | Stopping | | | Running | |
|---------------------------------------|----------|-------|---------------|----------|-------|---------------|---------|-------------|
| | dmax | dc | d(t) | dmax | dc | d(t) | Pst | Plt 2 hours |
| Measured values at test impedance | 0,20 | 0,00 | 0,00 | 0,20 | 0,00 | 0,00 | 0,141 | 0,105 |
| Measured values at standard impedance | 0,20 | 0,00 | 0,00 | 0,20 | 0,00 | 0,00 | 0,141 | 0,105 |
| Values for maximum impedance | 1,24 | 0,00 | 0,00 | 1,24 | 0,00 | 0,00 | 0,873 | 0,650 |
| 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 | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Standard impedance | R | 0,240 | Ω | XI | 0,150 | Ω | | |
| | Z | 0,280 | Ω | | | | | |
| Maximum impedance | R | 1,486 | Ω | XI | 0,928 | Ω | | |
| | Zmax | 1,752 | Ω | | | | | |

Power Quality. DC injection.

STP6.0-3AV-40

Phase 1

| | | | |
|----------------------|------|------|------|
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 1,11 | 1,91 | 4,59 |
| Recorded value [%] | 0,01 | 0,02 | 0,05 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Power Quality. DC injection.

Phase 2

| | | | |
|----------------------|-------|-------|-------|
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 11,96 | 13,66 | 13,88 |
| Recorded value [%] | 0,13 | 0,15 | 0,15 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

| Power Quality. DC injection. | | | |
|------------------------------|-------|------|------|
| Phase 3 | | | |
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 10,83 | 9,43 | 6,01 |
| Recorded value [%] | 0,12 | 0,10 | 0,07 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Note. DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.

| Power Quality. DC injection. | | | |
|------------------------------|------|------|------|
| STP10.0-3AV-40 | | | |
| Phase 1 | | | |
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 9,24 | 6,07 | 2,67 |
| Recorded value [%] | 0,07 | 0,04 | 0,02 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Note. DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.

| Power Quality. DC injection. | | | |
|------------------------------|-------|------|-------|
| Phase 2 | | | |
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 11,09 | 9,45 | 11,38 |
| Recorded value [%] | 0,08 | 0,07 | 0,08 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Note. DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.

| Power Quality. DC injection. | | | |
|------------------------------|------|------|------|
| Phase 3 | | | |
| Test level power [%] | 10 | 55 | 100 |
| Recorded value [mA] | 2,53 | 6,90 | 9,82 |
| Recorded value [%] | 0,02 | 0,05 | 0,07 |
| Limit [%] | 0,25 | 0,25 | 0,25 |

Note. DC-injection is tested at each phase of the inverter and a limit of 0,25% per phase was used as pass criteria.



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Fault level Contribution.

STP6.0-3AV-40

Phase 1

| For a directly coupled SSEG | | | For a Inverter SSEG | | |
|--|----------|-------|---------------------|-----------|----------|
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 90,2 | 9,4 |
| Initial Value of aperiodic current | A | N/A | 100ms | 47,6 | 9,1 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 37,3 | 9,1 |
| Decaying (aperiodic) component of short circuit current* | i_{dc} | N/A | 500ms | 33,1 | 6,7 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,266 | |

Fault level Contribution.

Phase 2

| For a directly coupled SSEG | | | For a Inverter SSEG | | |
|--|----------|-------|---------------------|-----------|----------|
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 28,1 | 8,3 |
| Initial Value of aperiodic current | A | N/A | 100ms | 28,2 | 8,9 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 28,3 | 9,0 |
| Decaying (aperiodic) component of short circuit current* | i_{dc} | N/A | 500ms | 28,3 | 7,1 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,299 | |



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Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

Fault level Contribution.

Phase 3

| For a directly coupled SSEG | | | For a Inverter SSEG | | |
|--|----------|-------|---------------------|-----------|----------|
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 32,9 | 10,2 |
| Initial Value of aperiodic current | A | N/A | 100ms | 29,3 | 9,0 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 28,8 | 9,1 |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500ms | 28,5 | 7,1 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,296 | |

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.

Fault level Contribution.

STP10.0-3AV-40

Phase 1

| For a directly coupled SSEG | | | For a Inverter SSEG | | |
|--|----------|-------|---------------------|-----------|----------|
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 28,6 | 2,5 |
| Initial Value of aperiodic current | A | N/A | 100ms | 28,3 | 1,2 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 28,3 | 0,8 |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500ms | 28,3 | 1,9 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,361 | |

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99/NI

Nr. 18TH0325_G99/NI-1_0

| Fault level Contribution. | | | | | |
|--|----------|-------|---------------------|-----------|----------|
| Phase 2 | | | | | |
| For a directly coupled SSEG | | | For a Inverter SSEG | | |
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 38,4 | 2,4 |
| Initial Value of aperiodic current | A | N/A | 100ms | 40,2 | 2,6 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 33,5 | 1,8 |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500ms | 31,0 | 2,5 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,364 | |

| Fault level Contribution. | | | | | |
|--|----------|-------|---------------------|-----------|----------|
| Phase 3 | | | | | |
| For a directly coupled SSEG | | | For a Inverter SSEG | | |
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20ms | 39,3 | 10,6 |
| Initial Value of aperiodic current | A | N/A | 100ms | 30,8 | 14,7 |
| Initial symmetrical short-circuit current* | I_k | N/A | 250ms | 29,3 | 15,2 |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500ms | 28,8 | 13,1 |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [s] | 0,367 | |

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 Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds. | (No solid-state switching device) |
| 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 (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1). | |

| Logic Interface (input port) | P |
|---|-----|
| Confirm that an input port is provided and can be used to shut down the module. | Yes |