| | | | | |
|---|---|---|---|---|
| **Prüfbericht - Nr.:**<br>*Test Report No.:* | 50225111 001 | **Auftrags-Nr.:**<br>*Order No.:* | 164145334 | **Seite 1 von 26**<br>*Page 1 of 26* |

| | |
|---|---|
| **Kunden-Referenz-Nr.:**<br>*Client Reference No.:* | 632179 |
| **Auftragsdatum:**<br>*Order date:* | Oct. 22, 2018 |
| **Auftraggeber:**<br>*Client:* | EAST Group Co., Ltd. |
| **Prüfgegenstand:**<br>*Test item:* | Grid-tied PV Inverter |
| **Bezeichnung / Typ-Nr.:**<br>*Identification / Type No.:* | EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D,EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI |
| **Auftrags-Inhalt:**<br>*Order content:* | AK Certification |
| **Prüfgrundlage:**<br>*Test specification:* | UTE C 15-712-1: 2013<br>DIN VDE 0126-1-1(VDE V 0126-1-1): 2013-08/ VFR 2014<br>Enedis-NOI-RES_13E: 2016 |
| **Wareneingangsdatum:**<br>*Date of receipt::* | Oct. 22, 2018 |
| **Prüfmuster-Nr.:**<br>*Test sample No.:* | 1# |
| **Prüfzeitraum:**<br>*Testing period:* | Oct. 22, 2018 – Feb. 11, 2019 |
| **Ort der Prüfung:**<br>*Place of testing:* | See page 4 |
| **Prüflaboratorium:**<br>*Testing Laboratory:* | TÜV Rheinland (Shenzhen) Co., Ltd. |
| **Prüfergebnis*:**<br>*Test Result*:* | **Pass** |

**geprüft**/ *tested by:*

| Datum<br>*Date* | Name/Stellung<br>*Name/Position* | Unterschrift<br>*Signature* |
|---|---|---|
| Feb. 18, 2019 | **Corney Zhang / PE** | |

**kontrolliert**/ *reviewed by:*

| Datum<br>*Date* | Name/Stellung<br>*Name/Position* | Unterschrift<br>*Signature* |
|---|---|---|
| Feb. 18, 2019 | **Dean Cao/ Reviwer** | |

**Sonstiges**/ *Other Aspects:*

- See the following pages for General product information and comment.

**Zustand des Prüfgegenstandes bei Anlieferung:**
*Condition of test item at delivery:*
Prüfmuster vollständig und unbeschädigt
*Test item complete and undamaged*

| | | | | | |
|---|---|---|---|---|---|
| * Legende: | 1 = sehr gut | 2 = gut | 3 = befriedigend | 4 = ausreichend | 5 = mangelhaft |
| | P(ass) = entspricht o.g. Prüfgrundlage(n) | | F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | N/A = nicht anwendbar | N/T = nicht getestet |
| *Legend:* | *1 = very good* | *2 = good* | *3 = satisfactory* | *4 = sufficient* | *5 = poor* |
| | *P(ass) = passed a.m. test specification(s)* | | *F(ail) = failed a.m. test specification(s)* | *N/A = not applicable* | *N/T = not tested* |



V04

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TÜVRheinland®

# TEST REPORT
# UTE C 15-712-1
## LOW-VOLTAGE ELECTRICAL INSTALLATIONS
## PRACTICAL GUIDE
## Photovoltaic installations connected to the public distribution network

| | |
|---|---|
| Report Reference No. .....: | 50225111 001 |
| Tested by (name + signature) .....: | See cover page ..... |
| Approved by (name + signature)..: | See cover page ..... |
| Date of issue.....: | See cover page |
| Testing Laboratory .....: | TÜV Rheinland (Shenzhen) Co., Ltd. |
| Address .....: | 1F East & 2-4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, 518057, Shenzhen, China |
| Testing location/ procedure .....: | CBTL☐ TMP☐ WMT☒ SMT☐ RMT☐ CCATL ☐ |
| Testing location/ address .....: | See over page |
| Applicant's name .....: | EAST Group Co., Ltd. |
| Address .....: | No.6 Northern Industry Road, Songshan Lake Sci.& Tech. industrial zone, Dongguan City, Guangdong province, China |
| Test specification: | |
| Standard .....: | UTE C 15-712-1: 2013<br>DIN VDE 0126-1-1(VDE V 0126-1-1): 2013-08 |
| Reference standard.....: | Enedis-NOI-RES_13E: 2016 |
| Test procedure .....: | AK certificate |
| Non-standard test method……..: | N/A |
| Test Report Form No.....: | MS-0024998-appendix 34 V.0 |
| Test Report Form(s) Originator ...: | TÜV Rheinland Group |
| Master TRF.....: | 2013-03 |
| Test item description .....: | Photovaltaic grid-connected inverter |
| Trade Mark .....: | EAST |
| Manufacturer .....: | As applicant |
| Model/Type reference .....: | See rating label and model list for detail |
| Ratings .....: | See rating label and model list for detail |

| **Testing procedure and testing location:** | | |
|---|---|---|
| ☐ **CB Testing Laboratory:** | See cover page | |
| Testing location/ address ..... : | See cover page | |
| ☐ **Associated CB Test Laboratory:** | | |
| Testing location/ address ..... : | | |
| Tested by (name + signature) ..... : | See cover page | ..... |
| Approved by (+ signature) ..... : | See cover page | ..... |
| ☐ Testing procedure: TMP | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: WMT | | |
| Tested by (name + signature) ..... : | | |
| Witnessed by (+ signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: SMT | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Supervised by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: RMT | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Supervised by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |

**List of Attachments (including a total number of pages in each attachment):**

ATTACHMENT 1 – Test report for DIN VDE 0126-1-1: 2013 (27 pages)

ATTACHMENT 2 – Photo documents (8 pages)

**Summary of testing**

**Tests performed (name of test and test clause):**

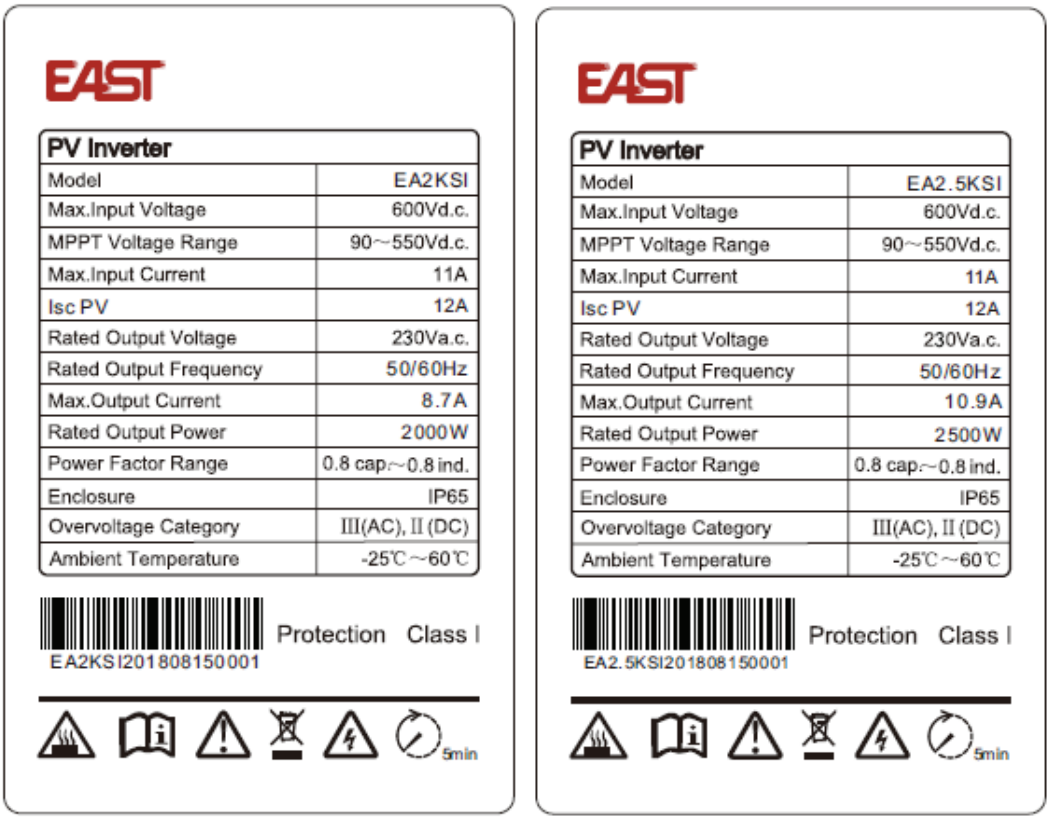
9. Frequency monitoring test

Remark: N/A

**Testing location:**

**CCIC Southern Electronic Product Testing(Shenzhen) Co., Ltd.**
Electronic Testing Building, Shahe Road 43 Xili, Nanshan District, Shenzhen, China

**Copy of marking plate:**



EAST

| PV Inverter | |
|---|---|
| Model | EA3KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A |
| Isc PV | 12A |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 13.0A |
| Rated Output Power | 3000W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA3KSI201808150001 Protection Class I

5min

EAST

| PV Inverter | |
|---|---|
| Model | EA3KSI-D |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 13.0A |
| Rated Output Power | 3000W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA3KSI-D201808150001 Protection Class I

5min

EAST

| PV Inverter | |
|---|---|
| Model | EA3.68KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 16.0A |
| Rated Output Power | 3680W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA3.68KSI201808150001 Protection Class I

5min

EAST

| PV Inverter | |
|---|---|
| Model | EA4KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 17.4A |
| Rated Output Power | 4000W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA4KSI201808150001 Protection Class I

5min

EAST

| PV Inverter | |
|---|---|
| Model | EA4.6KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 20.0A |
| Rated Output Power | 4600W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA4.6KSI201808150001 Protection Class I


EAST

| PV Inverter | |
|---|---|
| Model | EA5KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 21.8A |
| Rated Output Power | 5000W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA5KSI201808150001 Protection Class I


EAST

| PV Inverter | |
|---|---|
| Model | EA6KSI |
| Max.Input Voltage | 600Vd.c. |
| MPPT Voltage Range | 90~550Vd.c. |
| Max.Input Current | 11A*2 |
| Isc PV | 12A*2 |
| Rated Output Voltage | 230Va.c. |
| Rated Output Frequency | 50/60Hz |
| Max.Output Current | 26.1A |
| Rated Output Power | 6000W |
| Power Factor Range | 0.8 cap.~0.8 ind. |
| Enclosure | IP65 |
| Overvoltage Category | III(AC), II (DC) |
| Ambient Temperature | -25℃~60℃ |

EA6KSI201808150001 Protection Class I

| | |
|---|---|
| Equipment mobility ..... : | ☐ movable ☐ hand-held ☐ stationary<br>☒ fixed ☐ transportable ☐ for building-in |
| Connection to the mains ..... : | ☐ pluggable equipment ☐ direct plug-in<br>☒ permanent connection ☐ for building-in |
| Enviromental category ..... : | ☒ outdoor ☐ indoor ☐ indoor conditional |
| Operating condition ..... : | ☒ continuous ☐ short-time ☐ intermittent |
| Over voltage category mains ..... : | ☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV |
| Over voltage category PV ..... : | ☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV |
| Mains supply tolerance (%) ..... : | According to specified supply range |
| Tested for IT power systems ..... : | ☐ Yes ☒ No |
| IT testing, phase-phase voltage (V) ..... : | N/A |
| Class of equipment ..... : | ☒ Class I ☐ Class II<br>☐ Class III ☐ Not classified |
| Mass of equipment (kg) ..... : | See model list |
| Pollution degree ..... : | ☐ PD 1 ☒ PD 2 (inside) ☒ PD 3 (outside) |
| IP protection class ..... : | IP65 |

| | |
|---|---|
| Possible test case verdicts: | |
| - test case does not apply to the test object ..... : | N/A |
| - test object was not evaluated for the requirement ..... : | N/E |
| - test object does meet the requirement ..... : | Pass (P) |
| - test object does not meet the requirement ..... : | Fail (F) |

| | |
|---|---|
| Testing: | |
| Date of receipt of test items ..... : | See cover page |
| Date(s) of performance of tests ..... : | See cover page |

**General remarks:**

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

**Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:**

| | |
|---|---|
| **The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :** | ☐ Yes<br>☒ Not applicable |

| | | |
|---|---|---|
| **When differences exist; they shall be identified in the General product information section.** | | |
| **Name and address of factory (ies)** | : | **EAST Group Co., Ltd.**<br>NO.6 NORTHERN INDUSTRY No.6 Northern Industry Road, Songshan Lake Sci.& Tech. industrial zone, Dongguan City, Guangdong province, China |

**General product information:**

Brief description:

The equipment is single phase utility-interactive type PV inverter which will be installed and connected to the grid network after installation.

It contains filters for smoothing the output voltage and for EMC, switching and control circuits. Electronic circuits are mounted on a number of PCBs interconnected by appropriate connectors and wires. Power board including electronics components is mounted on the heat sink to earthing by metal screw and spring washer.

There are included a RS485 and two RJ45 communication ports which are connected to the monitors to monitor the status of the inverter by proprietary software.

The PV input combine with 1 or 2 string MPPT tracer and PV input terminals. AC output direct connected to grid and Protective Earthing are provided by dedicated earthing terminals. Grid is protected combination with a two series of relays as redundant build for ensure the inverter can independent disconnected from gird while a relay was fault.

During fault condition defined in this standard, after the DSP receives the abnormal signal from the relevant protective detection circuit, the relays will operate to disconnect the PV inverter line and neutral from grid automatically.

The master DSP and slaver DSP has capacity independent disconnected from gird, when any grid fault had happened.

operation conditions.

Block Diagram:

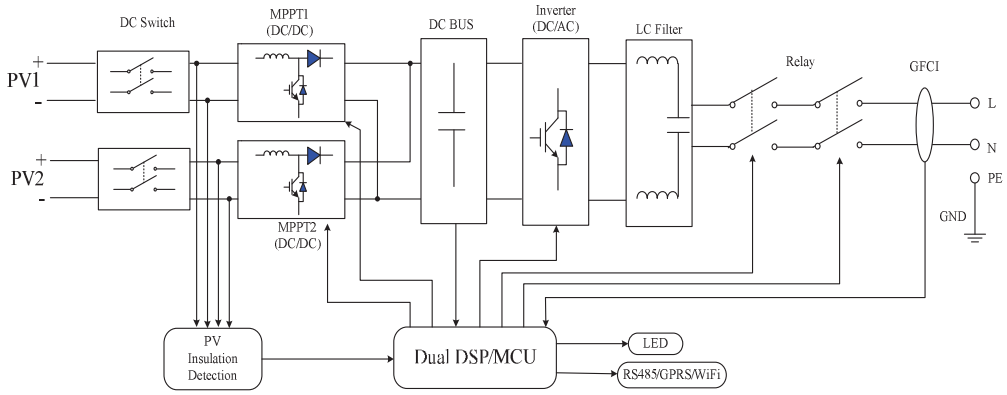



Figure 1. Block diagram

Model Difference:

The mdoels EA2KSI, EA2.5KSI, EA3KSI are identical to hardware and software, excepted the output power are different was adjusted by software.

The Models EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI are identical to hardware and software, excepted the output power are different was adjusted by software and internal cooling fan within EA6KSI.

The models EA2KSI, EA2.5KSI, EA3KSI and models EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI are same as software and hardware, excepted below components are different:

| Model / Components | EA2KSI, EA2.5KSI, EA3KSI | EA3KSI-D, EA3.68KSI, EA4KSI EA4.6KSI, EA5KSI, EA6KSI |
|---|---|---|
| Max. input current | 11A | 11A×2 |
| Output current sensor | HLSR 20-P/LEM | HLSR 32-P/LEM |
| MPPT string | 1 | 2 |
| Boost induct | 580uH(11A)*1 | 580uH(11A)*2 |
| BUS capacitor | 1200uF(315V)*4 | 1200uF(315V)*6 |
| IGBT/MOSFET | IKW40N65H5*5, IKW40N120H3*2 | IKW40N65H5*6, IKW40N120H3*2 |
| Power board size | 262mm*216mm | 322mm*231.5mm |
| Overall size (WxDxH) [mm] | 308x116.5x353 | 370x126.5x420 |

Model list:

| MODEL LIST 1 | | EA2KSI | EA2.5KSI | EA3KSI | EA3KSI-D |
|---|---|---|---|---|---|
| INPUT(PV) | $V_{MAX}$ PV [Vdc] | 600 | | | |
| | $I_{SC}$ PV [A] | 12 | | | 2x12 |
| | MPP Voltage Range $V_{MPP}$[Vdc] | 90-550 | | | |
| | Max. PV Input Current [A] | 11 | | | 11x2 |
| | MPP Full Power Voltage Range [Vdc] | 200-480 | 250-480 | 300-480 | 150-480 |
| | Input PV Operating Voltage Range [Vdc] | 90-600 | | | |
| | Start PV Voltage [Vdc] | 120 | | | |
| | Backfeed Current [A] | 0 | | | |
| | Overvoltage Category (OVC) | OVC II | | | |
| GRID CONNECTION | Rated Output Voltage Ur [Vac] | 230 | | | |
| | Normal Operating Voltage Range Un [Vac] | 180-280 | | | |
| | Rated Output Frequency $F_{NETZ}$ [Hz] | 50/60 | | | |
| | Normal Operating Frequency Range Fn [Hz] | 45 – 55 / 55 – 65 | | | |
| | Rated Output Power $P_E$ [W] | 2000 | 2500 | 3000 | 3000 |
| | Max. Output Current Imax [A] | 8.7 | 10.9 | 13 | 13 |
| | Power Factor cosφ [λ] | 0.8 cap-0.8ind adjustable (defaut: 1) | | | |
| | Efficiency max. $\eta_{max}$[%] | 97.8 | | | |
| | Night Power Consumption [W] | < 0.5 | | | |
| | THD [∀ / I] (100% full power) | < 3% | | | |
| | Acoustic Noise [dB] | < 40 | | | |

| | | | |
|---|---|---|---|
| | Overvoltage Category (OVC) | OVC III | |
| SYSTEM | Type of inverter | Non-transformer | |
| | Firmware [DSP/MCU] | MDSP: V009, MCU: V009 | |
| | Separated by | Transformerless | |
| | MPPT strings | 1 | 2 |
| | MPPT tracking | 1 | 2 |
| | Protective Class | 1 | |
| | Enclosure Protection (IP) | IP65 | |
| | Operating Temperature Range [ºC] | -25-60 | |
| | Pollution degree (PD) | PD3 for outside, PD2 for inside | |
| | Altitude [m] | 4000 (> 2000 derating power) | |
| | Weight [kg] | < 9 | < 11.5 |
| | Size (WxDxH) [mm] | 308x116.5x353 | 370x126.5x420 |
| Note: | | | |

| MODEL LIST 2 | | EA3.68KSI | EA4KSI | EA4.6KSI | EA5KSI | EA6KSI |
|---|---|---|---|---|---|---|
| INPUT(PV) | $V_{MAX}$ PV [Vdc] | 600 | | | | |
| | $I_{SC}$ PV [A] | 2x12 | | | | |
| | MPP Voltage Range $V_{MPP}$[Vdc] | 90-550 | | | | |
| | Max. PV Input Current [A] | 11x2 | | | | |
| | MPP Full Power Voltage Range [Vdc] | 200-480 | | 230-480 | 250-480 | 300-480 |
| | Input PV Operating Voltage Range [Vdc] | 90-600 | | | | |
| | Start PV Voltage [Vdc] | 120 | | | | |
| | Backfeed Current [A] | 0 | | | | |
| | Overvoltage Category (OVC) | OVC II | | | | |
| GRID CONNECTION | Rated Output Voltage Ur [Vac] | 230 | | | | |
| | Normal Operating Voltage Range Un [Vac] | 180-280 | | | | |
| | Rated Output Frequency $F_{NETZ}$ [Hz] | 50/60 | | | | |
| | Normal Operating Frequency Range Fn [Hz] | 45 – 55 / 55 – 65 | | | | |
| | Rated Output Power $P_E$ [W] | 3680 | 4000 | 4600 | 5000 | 6000 |
| | Max. Output Current Imax [A] | 16 | 17.4 | 20 | 21.8 | 26.1 |
| | Power Factor cosφ [λ] | 0.8 cap-0.8ind adjustable (defaut: 1) | | | | |

| | | |
|---|---|---|
| | Efficiency max. $\eta_{max}$[%] | 97.8 |
| | Night Power Consumption [W] | < 0.5 |
| | THD [V / I] (100% full power) | < 3% |
| | Acoustic Noise [dB] | < 40 |
| | Overvoltage Category (OVC) | OVC III |
| SYSTEM | Type of inverter | Non-transformer |
| | Firmware [DSP/MCU] | MDSP: V009, MCU: V009 |
| | Separated by | Transformerless |
| | MPPT strings | 2 |
| | MPPT tracking | 2 |
| | Protective Class | 1 |
| | Enclosure Protection (IP) | IP65 |
| | Operating Temperature Range [ºC] | -25-60 |
| | Pollution degree (PD) | PD3 for outside, PD2 for inside |
| | Altitude [m] | 4000 (> 2000 derating power) |
| | Weight [kg] | < 11.5 |
| | Size (WxDxH) [mm] | 370x126.5x420 |
| Note: | | |

Protection function of PGU:

1. Over & under grid voltage protection.
2. Over & under grid frequecny protection.
3. Anti-islanding protection.
4. NS & NA protection redundantly.
5. Relays used in series for grid auto-disconnection devices.
6. Short-circuit protection rely on exteranl circuits break which was specified in installation manual.
7. Over temperature derating and protection.
8. Over current protection.
9. Relay function self-check.

Throughout the test report following abbreviations may be used:

- cl clearance
- dcr creepage distance
- dti distance through insulation
- int internal distance
- o-c open-circuit
- o-l overload

| | | | | | |
|---|---|---|---|---|---|
| • | PCE | Power Conversion Equipment | • | s-c | short-circuit |
| • | BI | basic insulation | • | SI | supplementary insulation |
| • | DI | double insulation | • | RI | reinforced insulation |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **5** | **Description of PV installations** | Must be taken under consideration for the installation. | N/A |

| | | | |
|---|---|---|---|
| **6.** | **Earthing of the installation** | See below | P |
| **6.1** | **Diagrams showing bonding of alternating current part with earth** | See below. | P |
| | Diagrams showing bonding of alternating current part with earth.The earthing system has been produced in accordance with the requirements of NF C 15-100. | Compliance. | P |
| **6.2** | **Earthing of one polarity in the d.c. part** | See below. | N/A |
| | In a PV installation, the protection devices against indirect contact are independent of the principle of the earthing systems. The direct current part is created in accordance with the rules for class II or equivalent isolation. | No polarity of dc part connected to the earth. | N/A |
| **6.3** | **Earthing of conductive masses and elements** | See below. | P |
| **6.3.1** | **Direct current part** | See below. | P |
| | To minimise the effects of induced overvoltages, the metal structures of the modules and the metal support structures (including the metal cable runs) must be connected to equipotential bonding, which in turn is connected to the earth. | All conductive parts of inverter case have connected to earth. | P |
| **6.3.2** | **Alternating current part** | See below. | P |
| | All chassis on the a.c. side must be connected to the earth via a protective conductor that meets the requirements of paragraph 411.3.1.2 and section 5-54 of NF C 15-100.<br>If a transformer is installed outside the inverter (low voltage/low voltage or high voltage/low voltage transformer), equipotential bonding is required between these items of equipment. | All conductive parts of inverter case have connected to earth. | P |
| **6.3.3** | **Inverter** | See below. | P |
| | The inverter body must be connected to the equipotential bonding via a conductor with a minimum cross-section of 6mm² Cu or equivalent and to the protective conductor of the a.c. part. | All conductive parts of inverter case have connected to earth. | P |

| | | | |
|---|---|---|---|
| **7.** | **Protection against electric shock** | See below. | P |
| **7.1** | **General points** | See below. | P |
| | The PV equipment of the direct current part must be treated as being under voltage, even if it is disconnected from the alternating current part. | Compliance. | P |
| **7.2** | **Protection against direct contact** | See below. | P |
| **7.2.1** | **General case** | See below. | P |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | Electrical equipment must be fitted with a form of protection either by insulation of the live parts or through a casing | Reinforce or double insulation are provided between accessible live parts and main circuits. | P |
| **7.2.2** | **Particular case of safety extra-low voltage and protective extra-low voltage** | See below. | N/A |
| | If the nominal voltage of the safety extra-low voltage circuit is less than or equal to 25 V rms a.c. or 60 V d.c. without ripple, protection against direct contact through insulation of the live parts or a casing is not necessary. | No extra-low voltage circuit. | N/A |
| **7.3** | **Protection against indirect contact** | See below. | P |
| **7.3.1** | **General points** | See below. | P |
| | The regulations for protection against indirect contact are set out in section 4-41 of NF C 15-100.<br>The circuits covered by 411.3.3 of standard NF C 15-100 and, in particular, circuits in residential buildings must be protected with a differential device with a sensitivity of 30 mA or less. | Compliance. | P |
| **7.3.2** | **Direct current part.** | See below. | P |
| | For the direct current part (PV modules, junction boxes, chain cables, group cables, marshalling boxes or cabinets, etc.), protection against indirect contact must be ensured | Double or reinforce insulation between direct current and accessible parts have been provided. | P |
| **7.3.2.1** | **Protection with safety extra-low voltage or protective extra-low voltage** | See below. | N/A |
| | The requirements of article 414 of standard NF C 15-100 must be applied. The voltage UocMAX must not exceed 120 V. | No extra-low voltage circuit. | N/A |
| **7.3.2.2** | **Protection with double or reinforced insulation** | See below. | P |
| | The requirements of article 412 of standard NF C 15-100 must be applied. | Double or reinforce insulation between direct current and accessible parts have been provided. | P |
| **7.3.3** | **Alternating current part** | See below. | P |
| | Protection against indirect contact is ensured through double or reinforced insulation or by an automatic cut-out of the supply, according to one of the following measures:<br>• In a TT system: cut-out on the first fault;<br>• In a TN system: cut-out on the first fault;<br>• In an IT system: cut-out on the second fault. | The unit is only intended for TT or TN systems. The residual current protection device is provided and compliant the requirements. | P |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **8** | **Overcurrent protection** | See below. | N/A |
| **8.1** | **Direct current part** | See below. | N/A |
| **8.1.1** | **General points** | See below. | N/A |
| | See figure 6 of this standard | Must be taken under consideration for the installation. | N/A |
| **8.1.2** | **Protection of PV modules** | See below. | N/A |
| | In an installation with several PV module chains in parallel, the modules must be protected against the effect of reverse currents that may be generated in the chains in the event of a fault. | Must be taken under consideration for the installation. | N/A |
| **8.1.3** | **Protection of PV chain cables** | See below. | N/A |
| | The sizing of the PV chain cables takes into account the choice of protection device for the PV modules adopted in 8.1.2. | Must be taken under consideration for the installation. | N/A |
| **8.1.4** | **Protection of PV group cables** | See below. | N/A |
| | In an installation with several PV groups in parallel, the cables for the groups must be protected against the effect of reverse currents caused by a short circuit in a group. | Must be taken under consideration for the installation. | N/A |
| **8.1.5** | **Protection of main PV cable** | See below. | N/A |
| | The main cable of a PV generator must be dimensioned with a permissible current Iz greater than or equal to 1.25 IscSTC_gen. | Must be taken under consideration for the installation. | N/A |
| **8.1.6** | **Characteristics of overcurrent protection devices** | See below. | N/A |
| | The overcurrent protection devices must be either fuses compliant with standard NF EN 60269-1 or circuit-breakers compliant with standard NF EN 60947-2. These devices must be implemented for both polarities, regardless of the configuration of the installation. | The dc circuit breaker is required to installed additionally in accordance to NF EN 60947-2. | N/A |
| **8.2** | **Alternating current part** | See below. | N/A |
| **8.2.1** | **General points** | See below. | N/A |
| | In the case of an installation connected to the network via a branch line with limited power, the minimum cross-section of the conductors connected to the terminals downstream of the general isolating and protection device is 10 mm2 Cu. | Must be taken under consideration for the installation. | N/A |
| **8.2.2** | **Overload protection** | See below. | N/A |
| | Alternating current circuits are protected against surges in accordance with the requirements of article 433 of standard NF C 15-100. | The ac circuit breaker is required t installed addtionally. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **8.2.3** | **Short-circuit protection** | See below. | N/A |
| | In the case of a short circuit in an inverter or its line, the inverter is regarded as the load and the public network as the source. | The ac circuit breaker is required t installed addtionally. | N/A |

| | | | |
|---|---|---|---|
| **9.** | **Tripping device** | See below. | P |
| | This protection device is designed to disconnect generators in the event of:<br>• a fault on the public distribution network;<br>• a failure in the supply from the public distribution network;<br>• fluctuations in the voltage or frequency greater than those specified by the distributor. | The unit provides a integrated disconnection facility according to VDE 0126-1-1 and it is rated below 250kW.<br>See test report No. 50225111 001 attachment 1 for detail.<br>See table 9 for the deviation of over frequency limit VDE 0126-1-1: 2013. | P |
| **10** | **Prevention of degradation of photovoltaic installations** | See below. | N/A |
| | In order to prevent the degradation of PV installations due to specific external influences and the presence of direct current, and despite the implementation of measures such as the installation of double insulation and monoconductor cables, additional measures must be implemented for the direct current part. | Must be taken under consideration for the installation. | N/A |

| | | | |
|---|---|---|---|
| **11** | **Voltage drop** | See below. | N/A |
| **11.1** | **General points** | See below. | N/A |
| | The objective of technical and commercial optimisations is to minimise voltage drops. | Must be taken under consideration for the installation. | N/A |
| **11.2** | **Direct current installation** | See below. | N/A |
| | The authorised maximum drop in voltage in the direct current part of the installation is between 3% and ImppSTC (STC: standard test conditions). | Must be taken under consideration for the installation. | N/A |
| **11.3** | **Alternating current installation** | See below. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | For PV installations connected directly to the LV public distribution network, the maximum authorised drop in voltage between the a.c. terminals of the inverter and the point of delivery (NF C 14-100) is 3% at the nominal power of the inverter(s). It is recommended to limit this drop in voltage to 1% in order to be able to limit energy losses on the one hand and momentary disconnection of the inverter on the other, maintaining a margin between the average operating voltage of the inverter and the setting of its protection at maximum voltage. | Must be taken under consideration for the installation. | N/A |
| **12.** | **Disconnectors and circuit-breakers** | See below. | P |
| **12.1** | **General points** | Must be taken under consideration for the installation. | P |
| | To allow maintenance of PV inverters, disconnecting means must be provided by UPS, near both the DC side and the AC side. | Must be taken under consideration for the installation. | P |
| **12.2** | **Disconnectors** | See below. | P |
| | To allow maintenance work, a disconnecting device must be provided for inside or near the junctions boxes equipped with protective devices. | Must be taken under consideration for the installation. | P |
| **12.3** | **Emergency circuit-breakers** | Must be taken under consideration for the installation. | P |
| **12.3.1** | **General points** | See below. | P |
| | In accordance with the regulations set down in articles 463 and 536.3 of standard NF C 15-100, emergency circuit-breakers must be fitted on both a.c. and d.c. sides in order to cut off the electricity supply in the event of an unexpected hazard. | Must be taken under consideration for the installation. | P |
| **12.3.2** | **Emergency cut-off device of DC part** | See below. | P |
| | A cut-off device must be provided upstream from the inverter and its control shall be located Nearby thereof. | Must be taken under consideration for the installation. | P |
| | The actuation of the emergency disconnection device may be provided by a manual control or via a remote-controlled action. | | N/A |
| **12.3.3** | **Emergency cut-off device of the AC part** | See below. | P |
| | The emergency disconnection can be ensured by manual control of the circuit-breaker or via a remote control action. | Must be taken under consideration for the installation. | P |
| **12.4** | **Disconnection for intervention of emergency services** | | **P** |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **12.4.1** | **General provisions** | | **P** |
| | If a break is required to allow the intervention of the emergency services, it must meet the following principles:<br>- cut off all sources of electric energy<br>- these devices are either switches or breakers or contactors, semiconductor devices not meet this requirement and each device must be in pole cut and simultaneous<br>- cutting the PV generator circuit is made closer to the photovoltaic modules, and in any case upstream of the rooms and passages accessible to the occupants | Must be taken under consideration for the installation. | P |
| **12.4.2** | **Additional provisions** | | **N/A** |
| | If it is required to decrease to a value below 60 V dc the voltage of the PV generator circuit upstream of the required break in the general provisions of 12.4.1 | | N/A |
| | The operational safety of these principles requires:<br>a failsafe control;<br>in the case of an electromechanical load cut off, the control must be carried out after opening of the support downstream switching device. Implementation<br>these materials must respect the rules of double insulation (or reinforced insulation) imposed in this part of the plant and this for a voltage corresponding to the Uocmax chain tension. | | N/A |

| | | | |
|---|---|---|---|
| **13** | **Protection from surges emanating from the atmosphere or caused by operations** | See below. | P |
| **13.1** | **General points** | See below. | P |
| | The information contained in this chapter refers to overvoltage protection for photovoltaic installations connected to the network and complements standard NF C 15-100 and guide UTE C 61-740-52. | Compliance. | P |
| **13.1.1** | **Types of protection** | See below. | N/A |
| **13.1.1.1** | **Protection through equipotential bonding** | See below. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | As described in section 6.3, an equipotential bonding conductor must connect all the metal structures of the modules and the metal structures of the supports of the PV installation (including the metal cable runs) whether or not lightning conductors are present. This conductor must be connected to the earth. | All conductive parts of inverter case are connected to earth. | N/A |
| **13.1.1.2** | **Protection by lightning arresters** | See below. | N/A |
| | The installation conditions are described in 13.2. | Must be taken under consideration for the installation. | N/A |
| **13.2** | **Installation conditions for lightning arresters** | See below. | N/A |
| **13.2.1** | **Installation conditions for lightning arresterson a.c. side** | See below. | N/A |
| | The provisions of Articles 443 and 534 of the NF C 15-100 apply. | Must be taken under consideration for the installation. | N/A |
| **13.2.2** | **Installation conditions for lightning arresters on d.c. side** | See below. | N/A |
| **13.2.2.1** | **Installation without lightning conductor** | See below. | N/A |
| | The length L is the cumulative distance between the (s) inverter (s) and the channels of the entry points further away, considering each way (see Figure 8). | Must be taken under consideration for the installation. | N/A |
| **13.2.2.2** | **Installation with lightning conductor** | See below. | N/A |
| | The implementation of SPD dc generator side is mandatory | Must be taken under consideration for the installation. | N/A |
| **13.3** | **Overvoltage protection for installations without lightning conductor** | See below. | N/A |
| **13.3.1** | **Choice and installation of lightning arresters on a.c. side** | See below. | N/A |
| | If a lightning arrester is prescribed for the a.c. part of a PV installation connected to the public low-voltage distribution network, it is always installed in the panel nearest to the installation origin of the installation. If this lightning arrester is located more than 10 metres away from the inverter, a second lightning arrester must be installed near the latter. | Must be taken under consideration for the installation. | N/A |
| **13.3.2** | **Choice and installation of lightning arresters on d.c. side** | See below. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | If a lightning arrester is prescribed for the d.c. part of a PV installation, it is always installed in the panel nearest to the inverter. If one of the chains is located more than 10 metres away from the inverter, the installation of a second lightning arrester near the chains is recommended. | Must be taken under consideration for the installation. | N/A |
| **13.3.3** | **Choice of $I_n$** | See below. | N/A |
| | The lightning arresters are type 2 with a minimum value for the nominal discharge current In of 5 kA.<br>A higher nominal discharge current than the required value will prolong the service life of the lightning arrester. | Must be taken under consideration for the installation. | N/A |
| **13.3.4** | **Choice of $I_{max}$** | See below. | N/A |
| | This parameter is used to coordinate the energy of the lightning arresters: please refer to information from the manufacturer. | Must be taken under consideration for the installation. | N/A |
| **13.3.5** | **Choice of $U_p$** | See below. | N/A |
| | The value of $U_p$ must be less than 80% of the surge withstand voltage of the equipment to be protected. | Must be taken under consideration for the installation. | N/A |
| **13.3.6** | **Choice of $U_{CPV}$** | See below. | N/A |
| | The value of the maximum permissible voltage from the lightning arrester UCPV must be selected according to the maximum open-circuit voltage of the PV generator corresponding to the voltage UocSTC specified by the manufacturers of the PV modules. The voltage UCPV must be greater than or equal to the maximum voltage UocMAX of the photovoltaic generator. Whatever the protection methods of the lightning arrester, it must also withstand the maximum voltage UocMAX between these live terminals (+ and - terminals) and the earth. | Must be taken under consideration for the installation. | N/A |
| **13.3.7** | **Choice of $I_{SCWPV}$ and protection device associated with the lightning arrester** | See below. | N/A |
| | The lightning arrester must be fitted with an external disconnection device, if specified by the manufacturer; this assembly must be sized to function regardless of the current produced by the PV modules. | Must be taken under consideration for the installation. | N/A |
| **13.4** | **Additional regulations for surge protection for installations with a lightning conductor** | See below. | N/A |
| | The regulations are set out in guide UTE C 61-740-52. | Must be taken under consideration for the installation. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **14.** | **Choice and installation of equipment** | See below. | P |
| 14.1 | General points | See below. | P |
| | The rated operating voltage of all the equipment of the d.c. part must be equal to or greater than the voltage UOCMAX.<br>In the case of buildings with multiple occupation (for tertiary or residential use) with photovoltaic production in communal parts, the lines coming from the PV modules must be routed round the outside of private areas to the junction boxes for the chain/group located in the communal areas or in the buildings or the electrical service site dedicated to this purpose.<br>The equipment installed outside must have a minimum degree of protection of IP44. The degree of protection against mechanical impacts must be at least IK07 in compliance with standard NF EN 62262 (C 20-015).<br>It must be possible to carry out work on the removable equipment, devices and connections in the utmost safety.<br>If a transformer is installed, the inverters and any general low-voltage panel must be installed close to the transformer in the same room or in adjoining rooms.<br>The location of equipment (junction box(es), inverter(s), cabinets with protection devices and meter cabinets etc.) must comply with article 513.1 of standard NF C 15-100. Special regulations for residential buildings are given in article 771. The equipment, including the ducts etc., must be arranged so that they can be operated, inspected and serviced easily and their connections can be accessed. | The inverter is rated IP65. | P |
| **14.2** | **Ducts etc.** | See below. | N/A |
| **14.2.1** | **Choice for the d.c. part** | See below. | P |
| | The ducts are sized in accordance with the regulations in standard NF C 15-100 on the basis of cables with reticulated polyethylene insulation. | Must be taken under consideration for the installation. | P |
| **14.2.2** | **Installation** | See below. | N/A |
| | The connections and the cables must be installed in a manner that will prevent any deterioration due to external influences. See the requirements set out in guide UTE C 15-520. | Must be taken under consideration for the installation. | P |
| **14.3** | **PV modules** | See below. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | The PV modules must comply with the standards in series NF EN 61730. | Must be taken under consideration for the installation. | N/A |
| **14.4** | **Inverters** | See below. | P |
| | The level of the current for the inverter must be based on $I_{mppSTC}$. | Must be taken under consideration for the installation. | P |
| **14.5** | **Equipment** | See below. | P |
| | All equipment installed in the d.c. part must be adapted for operation in direct current and be selected and installed in accordance with the manufacturer's instructions.<br>Equipment installed in the d.c. part must be of the industrial type, in other words compliant with the NF EN 60947 series of standards.<br>• The characteristics of switches, switch-disconnectors and fuse-combination units must conform to the operating category DC21B.<br>• The characteristics of disconnectors must conform to the operating category DC20.<br>• The characteristics of contactors must conform to the operating category DC1. | | P |
| **14.6** | **Equipment assemblies** | See below. | P |
| | The direct current and alternating parts of the installation can be accommodated in the same panel if there is a physical separation of these two parts.<br>For the d.c. part, it is imperative to protect all the connections or disconnection devices against accidental or unauthorised opening when live in accordance with 536.2.3 of standard NF C 15-100. To this end, a notice "Do not operate when live" must be placed inside the boxes or cabinets near these disconnection devices.<br>Furthermore, in premises accessible to persons other than those with the requisite authorisation or qualification (BA4 or BA5):<br>• The design or installation must be such that it is only possible to disassemble the connection devices with the aid of a tool;<br>• Equipment that does not have an under load circuit-breaking feature must require the either the use of a key or tool or the direct operation of a device with an under load circuit-breaking feature. | The PV input connectors can not be removed with out a aid of a tool. In addition there is a marking adjent the connectors with states "Do not operate when live" | P |
| **14.7** | **Connectors** | See below. | P |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | In the d.c. part, the connectors used must comply with the standard NF EN 50521. To guarantee the quality of the connection and limit the risks of an electric arc that could spark a fire, each pair of male and female connectors to be assembled must be of the same type and the same brand. | The unit provides only one type and brand of connectors for DC with male and female plugs, which are not interchangeable. The plugs are according to EN 50521. | P |
| **14.8** | **Lightning arresters** | | N/A |
| **14.8.1** | **Choice of lightning arresters** | | N/A |
| | The lightning arresters installed in the a.c. part of the PV installation must comply with standard NF EN 61643-11.<br>The lightning arresters installed in the d.c. part of the PV installation must meet the requirements of guide UTE C 61-740-51. | | N/A |
| **14.8.2** | **Installation of lightning arresters** | | N/A |
| | Alternating current and direct current lightning arresters are installed in accordance with the regulations set out in guide UTE C 61-740-52. | | N/A |
| **15** | **Markings** | See below. | P |
| **15.1** | **Identification of components** | See below. | P |
| | The main components comprising the photovoltaic installations must be identified and marked with clearly visible labels fixed permanently in accordance with the installation plans and diagrams: | The inverter provides permanent marking. | P |
| **15.2** | **Labelling** | See below. | P |
| | For safety reasons and to alert the different people carrying out work in and around the building (staff tasked with maintenance work, inspectors, public distribution network operators, emergency services, etc.), it is imperative that the presence of a photovoltaic installation on a building is indicated. | Compliance. | P |
| **15.2.1** | **Labelling on the a.c. part** | Must be taken under consideration for the installation. | N/A |
| **15.2.2** | **Labelling on the d.c. part** | See below. | N/A |
| | All the junction boxes (PV generator and PV groups) and d.c. ducts must carry a visible and permanent marking indicating that live parts within these boxes may remain under voltage even after the inverter has been disconnected on the direct current side. | Must be taken under consideration for the installation. | N/A |
| **15.3.2** | **Labelling on the inverter** | See below. | P |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | All inverters must bear a marking indicating that before any work is carried out, the two sources of voltage must be isolated. | The unit is provided with the applicabe marking | P |

| | | | |
|---|---|---|---|
| **16.** | **Technical file** | See below. | P |
| | The technical file must include the following items drawn up in French:<br>• A circuit diagram of the photovoltaic system;<br>• The list of installed equipment mentioning the characteristics and references to the replacement parts (fuses, lightning arrester cartridges etc.);<br>• An installation diagram for the various photovoltaic components and modules as well as the corresponding connections (ducts);<br>• A description of the procedure for working on the photovoltaic system and safety instructions. | The required information are stated in the manual. | P |

| | | | |
|---|---|---|---|
| **17.** | **Maintenance of photovoltaic installations** | See below. | N/A |
| **17.1** | **General points** | See below. | N/A |
| | The minimal technical maintenance work must be provided for during the life cycle of a photovoltaic installation to maintain or restore the installation to a state in which it can fulfil the function for which it was designed. | Must be taken under consideration for the installation. | N/A |
| **17.2** | **Levels and frequency of maintenance** | See below. | N/A |
| | A distinction is made between the following three levels of maintenance comprising:<br>• Conditional maintenance based on monitoring of the key parameters of the installation;<br>• Precautionary maintenance carried out according to the prognoses extrapolated from the analysis and evaluation of the key parameters concerning the degradation of the asset (e.g. corrosion);<br>• Systematic maintenance carried out at predetermined intervals and without a prior check of the state of the product or its constituent components. | Must be taken under consideration for the installation. | N/A |
| **17.3** | **Technical areas covered during maintenance** | See below. | N/A |

| UTE C 15-712-1 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | A distinction is made between operations relating to the safety of persons and property, and actions relating to functional reliability. | Must be taken under consideration for the installation. | N/A |

| 9 | TABLE: Frequency monitoring test | | | | | P |
|---|---|---|---|---|---|---|
| Rating frequency: 50Hz, speed: 1 Hz/s | | | | | | |
| For standard VDE 0126-1-1:2013/ VFR 2014 | | | | | | |
| UF/OF | Trip value [Hz] | | Trip time [ms] | | | |
| No. | Measurement | Limitation | Measurement | Limitation | Remark | |
| 1 | 47.49 | 47.5±0.05 | 74 | 200 | 48.0Hz -> __47__Hz<br>Delayed time:___510___ms is considered. | |
| 2 | 47.49 | | 75 | 200 | | |
| 3 | 47.49 | | 69 | 200 | | |
| 1 | 50.60 | 50.6±0.05 | 194 | 200 | 50.0Hz -> __51.0__Hz<br>Delayed time:__610____ms is considered. | |
| 2 | 50.59 | | 190 | 200 | | |
| 3 | 50.61 | | 190 | 200 | | |

-End of test report-

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# TEST REPORT
# DIN VDE 0126-1-1: 2013
# Automatic disconnection device between a generator and the public low-voltage grid

| | |
|---|---|
| Report Reference No. ..... : | 50225111 001 Attachment 1 |
| Tested by (name + signature) ..... : | N/A |
| Witnessed by (name + signature) .... : | N/A |
| Supervised by (name + signature) ... : | N/A |
| Approved by (name + signature)..... : | N/A |
| Date of issue ..... : | See cover page |
| Testing Laboratory ..... : | TÜV Rheinland (Shenzhen) Co., Ltd. |
| Address ..... : | 1F East & 2-4F, Cybio Technology Building No.1, No.16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, 518057, Shenzhen, China |
| Testing location/ procedure..... : | CBTL☐ TMP☐ WMT☒ SMT☐ RMT☐ CCATL ☐ |
| Testing location/ address ..... : | See page 4 |
| Applicant's name..... : | EAST Group Co., Ltd. |
| Address ..... : | No.6 Northern Industry Road, Songshan Lake Sci.& Tech. industrial zone, Dongguan City, Guangdong province, China |
| Test specification: | |
| Standard..... : | DIN VDE 0126-1-1(VDE V 0126-1-1): 2013-08 |
| Test procedure ..... : | AK |
| Non-standard test method……..: | N/A |
| Test Report Form No..... : | DIN VDE V 0126-1-1/2013 |
| Test Report Form(s) Originator..... : | TÜV Rheinland Group |
| Master TRF ..... : | 2013-12 |



| | |
|---|---|
| Test item description ..... : | Photovaltaic grid-connected inverter |
| Trade Mark..... : | EAST |
| Manufacturer ..... : | As applicant |
| Model/Type reference ..... : | See rating label and model list for detail |
| Ratings ..... : | See rating label and model list for detail |

| **Testing procedure and testing location:** | | |
|---|---|---|
| ☐ **CB Testing Laboratory:** | See cover page | |
| Testing location/ address ..... : | See cover page | |
| ☐ **Associated CB Test Laboratory:** | | |
| Testing location/ address ..... : | | |
| Tested by (name + signature) ..... : | See cover page | ..... |
| Approved by (+ signature) ..... : | See cover page | ..... |
| ☐ Testing procedure: TMP | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: WMT | | |
| Tested by (name + signature) ..... : | | |
| Witnessed by (+ signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: SMT | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Supervised by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |
| ☐ Testing procedure: RMT | | |
| Tested by (name + signature) ..... : | | |
| Approved by (+ signature) ..... : | | |
| Supervised by (+ signature) ..... : | | |
| Testing location/ address ..... : | | |

**List of Attachments (including a total number of pages in each attachment):**

N/A

**Summary of testing:**
The test was performed on the model EA6KSI and valid for other models: EA2KSI, EA2.5KSI, EA3KSI-D, EA3KSI, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI.

**Tests performed (name of test and test clause):**

| Clause | Test description |
|---|---|
| ☒ 6.1 | Functional Safety |
| ☒ 6.2 | Connection Condition |
| ☒ 6.3 | Voltage Monitoring |
| ☒ 6.4 | Frequency Monitoring |
| ☒ 6.5 | Direct Current Monitoring |
| ☒ 6.6 | Detection Of Islanding Operation |
| ☒ Additional | Requirements for in photovolaic inverter integrated disconnector |

**Testing location:**

**CCIC Southern Electronic Product Testing(Shenzhen) Co., Ltd.**
Electronic Testing Building, Shahe Road 43 Xili, Nanshan District, Shenzhen, China

Remark:

**Copy of marking plate:**

See test report 50225111 001.

| | |
|---|---|
| Equipment mobility ..... : | ☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in |
| Connection to the mains..... : | ☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in |
| Enviromental category..... : | ☒ outdoor ☐ indoor conditional ☐ indoor unconditional |
| Operating condition ..... : | ☒ continuous ☐ short-time ☐ intermittent |
| Over voltage category mains..... : | ☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV |
| Over voltage category PV ..... : | ☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV |
| Mains supply tolerance (%) ..... : | According to specified supply range |
| Tested for IT power systems ..... : | ☐ Yes ☒ No |
| IT testing, phase-phase voltage (V) ..... : | N/A |
| Class of equipment ..... : | ☒ Class I ☐ Class II ☐ Class III ☐ Not classified |
| Mass of equipment (kg)..... : | See model list |
| Pollution degree ..... : | ☐ PD 1 ☐ PD 2 ☒ PD 3 (outside) |
| IP protection class ..... : | IP65 |

| | |
|---|---|
| Possible test case verdicts: | |
| - test case does not apply to the test object..... : | N/A |
| - test object was not evaluated for the requirement..... : | N/E |
| - test object does meet the requirement..... : | Pass (P) |
| - test object does not meet the requirement..... : | Fail (F) |

| | |
|---|---|
| Testing: | |
| Date of receipt of test items ..... : | See cover page |
| Date(s) of performance of tests ..... : | See cover page |

**General remarks:**

"(see Attachment #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
The tests results presented in this report relate only to the object tested.
This report shall not be reproduced except in full without the written approval of the testing laboratory.
List of test equipment must be kept on file and available for review.
Additional test data and/or information provided in the attachments to this report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

**Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:**

**The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :** ☐ Yes ☒ Not applicable

**When differences exist; they shall be identified in the General product information section.**

**Name and address of factory (ies) : EAST Group Co., Ltd.**
NO.6 NORTHERN INDUSTRY No.6 Northern Industry

Road, Songshan Lake Sci.& Tech. industrial zone,
Dongguan City, Guangdong province, China

**General product information:**

See report 50225111 001.

Protection function of PGU:

1. PV array insulation resistance detecting.
2. Residual current monitoring.
3. Over & under grid voltage protection.
4. Over & under grid frequecny protection.
5. Anti-islanding protection.
6. Over DC injection current protection.
7. NS & NA protection redundantly.
8. Relays used in series for grid auto-disconnection devices.
9. Short-circuit protection rely on exteranl circuits break which was specified in installation manual.
10. Over temperature derating and protection.
11. Over current protection.
12. Relay function self-check.
13. RCM function self-check.

Throughout the test report following abbreviations may be used:

| | | | | | |
|---|---|---|---|---|---|
| • | cl | clearance | • | int | internal distance |
| • | dcr | creepage distance | • | o-c | open-circuit |
| • | dti | distance through insulation | • | o-l | overload |
| • | PCE | Power Conversion Equipment | • | s-c | short-circuit |
| • | BI | basic insulation | • | SI | supplementary insulation |
| • | DI | double insulation | • | RI | reinforced insulation |

| This test report includes the following Appendixes: | | |
|---|---|---|
| Appendix No. | Description | Page(s) |
| A | TABLE: Insulation resistance measurement | 1 |
| B | TABLE: Residual current monitoring test | 2 |
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| DIN VDE 0126-1-1: 2013 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| **4** | **Requirements** | | **P** |
| 4.0 | General | | P |
| | The disconnection device must disconnect the generator unit from the grid on the AC side due to<br>– voltage and/or frequency fluctuations in the low voltage grid<br>– d.c. feed into the low voltage grid<br>– unintended islanding and<br>– intended islanding with standby generating units | The disconnection device of relay could automaticlly disconnect from grid, switch off and show the fault status in the event of faults from grid. | P |
| | by means of two switches arranged in series. | Two switches in series. | P |
| 4.1 | Functional safety | See descriptions of PGU protection funcion in page 4.<br>Refer to subclause 6.1. | P |
| 4.1.1 | Safety against single faults | NS protection: single fault safe | P |
| | The switches must fulfill the requirements of single fault according to VDE-AR-N 4105: 2011-08, A.6. | | P |
| 4.1.2 | Disconnection equipment | | P |
| | The disconnection equipment must fulfill the requirements according to DIN EN 62109-2:2012-04, 4.4.4.15.2 in case of one integrated in a PV inverter and the requirements according to VDE-AR-N 4105:2011-08, 6.4 in all other cases. | Two all-phases relays in series as reliable grid disconnection interface switch. | P |
| 4.2 | Connection condition | See subclause 6.2 | P |
| | The connection, reconnection after a grid fault and the reconnection after a short interruption must act according to VDE-AR-N 4105: 2011-08, 8.3.1. | | P |
| 4.3 | Voltage monitoring | See subclause 6.3 | P |
| 4.3.1 | Voltage decrease U< | | P |
| | The disconnection caused by a slow voltage drop must act according to VDE-AR-N 4105: 2011-08, 6.5.1. | | P |
| 4.3.2 | Voltage increase U>> | | P |
| | The disconnection caused by a voltage increase must act according to VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2. | | P |
| 4.3.3 | Voltage increase U> | | P |
| | The disconnection caused by a slow voltage increase (10-min-average) must act according to VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2. | | P |
| 4.4 | Frequency monitoring | See subclause 6.4. | P |

| DIN VDE 0126-1-1: 2013 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | The disconnection caused by a frequency decrease or frequency increase must act according to VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2. | | P |
| 4.5 | Direct current monitoring | See subclause 6.6. | P |
| | A direct current feed to the low voltage grid due to a defective generator operation must lead ot a disconnection within 0.2 s. For this, either the malfunction itself or a measured d.c. component of the current of more than 1 A can serve as a criterion. | Complies. | p |
| 4.6 | Detection of islanding | See subclause 6.6. | P |
| | The disconnection caused by a detection of an unintentionally islanding operation must act according to VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.3. | Complies. | P |
| 4.7 | Identification | Complies. | P |
| | A generator with automatic switching must have the outer visible claim “VDE V 0126-1-1”. It’s can by e.g.<br>- the labelling or<br>- a showing on the display of switches or<br>- a separate marking<br>act. | Complies. | P |
| 4.8 | Requirements for in photovoltaic inverter integrated switches | Complies. | P |
| | The requirements according to DIN EN 62109-2:2012-04, 4.8, on the residual current monitoring and on the isolation monitoring of PV generators must be fulfilled. | See subclause Annex B | P |

| **5** | **General requirements** | | **P** |
|---|---|---|---|
| | It’s the limitation according to DIN EN 61000-6-3 regarding to the radio disturbance to compliant.<br>For the immunity are the test disturb variant according to DIN EN 61000-6-2 to be used. | Complied. | P |

| **6** | **Type test** | | **P** |
|---|---|---|---|
| 6.0 | General | | P |
| | The following tests shall apply, unless otherwise mentioned, for integrated and separate switches. A separate switch is together tested with a suitable feeder. This is to ensure, that the disconnection signal isn’t made from the feeder but from the switch. | The integrated switch is together tested with suitable feeder. | P |
| 6.1 | Functional safety | | P |

| DIN VDE 0126-1-1: 2013 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | The test of the single fault safety and the fault indication with followed disconnection performs according to DIN VDE V 0124-100:2012-07, 5.4.5.2. | Two DSP controller for controlling grid isconnection, with two all-phases relay in series as reliable grid disconnection interface swich, to assure single fault safe of NS protection function.<br>See appended table, failures evaluation and risk analysis in case of single fault conditions, even software failure. | P |
| 6.2 | Connection condition | See appendix table 6.2 | P |
| | The test of connection and reconnection performed according to DIN VDE V 0124-100:2012-07, 5.5.1 and 5.5.2. | | P |
| 6.3 | Voltage monitoring | See appendix table 6.3 | P |
| | The test of voltage monitoring performed according to DIN VDE V 0124-100:2012-07, 5.4.5.3. | | P |
| 6.4 | Frequency monitoring | See appendix table 6.4 | P |
| | The test of frequency monitoring performed according ot DIN VDE V 0124: 2012-07, 5.4.5.4 | | P |
| 6.5 | DC current monitoring | See appendix table 6.5 | P |
| | The test of the disconnection as a result of direct current feed in perform optional according to a) or b):<br>a) In the measure circuit of the switch (e.g. current transducer, sampling resister) is a direct current of 1A injected. The disconnection must within 0,2s acted.<br>b) By a fault simulation is the measure ensure directly, if a disturbed device running with a direct part of current more than 1 A to disconnection in 0,2s result. | | P |
| 6.6 | Detection of islanding | See appendix table 6.6 | P |
| | The test of disconnection as result of unintentional islanding running act according to DIN VDE V 0124-100:2012-07, 5.4.6. | | P |

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| **7** | **Routine test** | Complies. | P |
| | Each manufacturer execute the routine test about the safety related parameter before delivery of an automatic switch. | | P |

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| **8** | **Specification of the device** | Complies. | P |
| | Initial and periodic testing of the automatic disconnection of the routine test may also be omitted.<br>If the automatic disconnection device running as a standalone device, it may not in the TN-C system be used. It is to create a TN-CS system in this area. | | P |

| 6.1 | TABLE: Functional Safety | | | | | | P |
|---|---|---|---|---|---|---|---|
| No. | Component no. | Fault | Test voltage (V) | Test time | Fuse no. | Fuse current (A) | Result |
| 1. | PV1 voltage monitoring defect R241 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 2. | PV1 voltage monitoring defect C235 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 3. | Boost1 circuit monitoring defect R244 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally.<br>(PV inverter restart. Error message: PV Curr Channel Err1)<br>No damaged, no hazard. |
| 4. | Boost1 circuit monitoring defect R245 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally .<br>(PV inverter restart. Error message: PV Curr Channel Err1)<br>No damaged, no hazard. |
| 5. | PV2 voltage monitoring defect R248 | o-c | 400 | 3min | -- | -- | Error message: PV Above BUS Err<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 6. | PV2 voltage monitoring defect C244 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 7. | BUS voltage monitoring defect R252 | o-c | 400 | 3min | -- | -- | Error message: Boost SelfChk Err1<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 8. | BUS voltage monitoring defect C246 | s-c | 400 | 3min | -- | -- | Error message: BUS Volt Low Err, PV Above BUS Err<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |

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|---|---|---|---|---|---|---|---|
| 9. | BUS overvoltage protection defect R259 | o-c | 400 | 3min | -- | -- | Error message: BUS Over VoltHW Err<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 10. | Boost2 circuit monitoring defect R476 | s-c | 400 | 3min | -- | -- | Error message: PV Over Curr HWErr, PV Curr Channel Err2.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 11. | Boost2 circuit monitoring defect C247 | s-c | 400 | 3min | -- | -- | Error message: PV Curr Channel Err2.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 12. | ISO monitoring defect R227 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally .<br>No damaged, no hazard. |
| 13. | ISO monitoring defect R81 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally .<br>(PV inverter restart. Error message: ISO Err)<br>No damaged, no hazard. |
| 14. | ISO monitoring defect C239 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally .<br>(PV inverter restart. Error message: ISO Err)<br>No damaged, no hazard. |
| 15. | INV voltage monitoring defect R457 | s-c | 400 | 3min | -- | -- | Error message: Output Relay Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 16. | INV voltage monitoring defect R275 | o-c | 400 | 3min | -- | -- | Error message: Output Relay Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 17. | Grid voltage monitoring(MCU) defect R470 | s-c | 400 | 3min | -- | -- | Error message: DCI High Err, SMCU Grid Volt Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |

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|---|---|---|---|---|---|---|---|
| 18. | Grid voltage monitoring(MCU) defect<br>C263 | s-c | 400 | 3min | -- | -- | Error message: SMCU Grid Volt Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 19. | Grid voltage monitoring(DSP) defect<br>R290 | o-c | 400 | 3min | -- | -- | Error message: Grid Volt Loss Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 20. | Grid frequency monitoring defect<br>R293 | o-c | 400 | 3min | -- | -- | Error message: Grid Under Freq Err2.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 21. | Grid frequency monitoring defect<br>R172 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter restart. Error message: SMCU Grid Freq Err)<br>No damaged, no hazard. |
| 22. | AC current monitoring defect<br>R308 | o-c | 400 | 3min | -- | -- | Error message: Inv Over Curr HWErr, AD Inv Curr Channel Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 23. | DCI monitoring defect<br>R306 | o-c | 400 | 3min | -- | -- | Error message: DCI High Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 24. | Earth monitoring defect<br>R273 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>No damaged, no hazard. |
| 25. | Earth monitoring defect<br>R283 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>No damaged, no hazard. |
| 26. | Leakage current monitoring defect<br>R307 | o-c | 400 | 3min | -- | -- | Error message: Leak Curr Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 27. | Leakage current monitoring defect<br>R312 | o-c | 400 | 3min | -- | -- | Error message: Leak Curr Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |

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| 28. | Leakage current monitoring defect<br>C290 | s-c | 400 | 3min | -- | -- | Error message: Leak Curr Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 29. | MCU controller defect<br>CY4 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter is on standby, when it restart.)<br>No damaged, no hazard. |
| 30. | MCU controller defect<br>SPISTEB | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter is on standby, when it restart.)<br>No damaged, no hazard. |
| 31. | MCU controller defect<br>SPISMOB | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter is on standby, when it restart.)<br>No damaged, no hazard. |
| 32. | MCU controller defect<br>SPISMIB | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter is on standby, when it restart.)<br>No damaged, no hazard. |
| 33. | MCU controller defect<br>SPICLKB | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter runs normally.<br>(PV inverter is on standby, when it restart.)<br>No damaged, no hazard. |
| 34. | Reference power supply defect<br>C150 | s-c | 400 | 3min | -- | -- | Error message: PV Over Volt Err, Ambient Over Temp Err, Grid Over Volt Err2.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 35. | MCU power supply defect<br>C227 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>Q1, Q2, Q5, Q6 and K1, K2, K4 has be damaged, no hazard. |
| 36. | MCU power supply defect<br>C120 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>Q1, Q2, Q5, Q6 and K1, K2, K4 has be damaged, no hazard. |

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| 37. | DSP controller defect CY3 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately. Q3, Q4 and K1, K2, K3, K4 has be damaged, no hazard. |
| 38. | Relay defect RELAY1 (1-2pin) | s-c before start up | 400 | 3min | -- | -- | Error message: Output Relay Err. PV inverter does not start up. No damaged, no hazard. |
| 39. | Relay defect RELAY2 (1-2pin) | s-c before start up | 400 | 3min | -- | -- | Error message: Output Relay Err. PV inverter does not start up. No damaged, no hazard. |
| 40. | Relay defect RELAY3 (1-2pin) | s-c before start up | 400 | 3min | -- | -- | Error message: Output Relay Err. PV inverter does not start up. No damaged, no hazard. |
| 41. | Relay defect RELAY4 (1-2pin) | s-c before start up | 400 | 3min | -- | -- | Error message: Output Relay Err. PV inverter does not start up. No damaged, no hazard. |
| 42. | Earth1 monitoring defect R338 | s-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 43. | Earth1 monitoring defect R380 | o-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 44. | Earth1 monitoring defect R53 | o-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 45. | Earth1 monitoring defect R384 | s-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 46. | Earth2 monitoring defect R335 | s-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 47. | Earth2 monitoring defect R125 | o-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |
| 48. | Earth2 monitoring defect R336 | o-c before start up | 400 | 3min | -- | -- | No message. PV inverter can start up. No damaged, no hazard. |

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| 49. | Earth2 monitoring defect R337 | s-c before start up | 400 | 3min | -- | -- | No message.<br>PV inverter can start up.<br>No damaged, no hazard. |
| 50. | ISO monitoring defect R166 | s-c before start up | 400 | 3min | -- | -- | No message.<br>PV inverter can start up.<br>No damaged, no hazard. |
| 51. | ISO monitoring defect R104 | o-c before start up | 400 | 3min | -- | -- | No message.<br>PV inverter can start up.<br>No damaged, no hazard. |
| 52. | ISO monitoring defect R150 | s-c before start up | 400 | 3min | -- | -- | No message.<br>PV inverter can start up.<br>No damaged, no hazard. |
| 53. | ISO monitoring defect R151 | o-c before start up | 400 | 3min | -- | -- | No message.<br>PV inverter can start up.<br>No damaged, no hazard. |
| 54. | ISO monitoring defect R141 | o-c before start up | 400 | 3min | -- | -- | Error message: ISO Err.<br>PV inverter does not start up.<br>No damaged, no hazard. |
| 55. | Vpv1 sampling defect R83 | s-c | 400 | 3min | -- | -- | Error message: PV Above BUS Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 56. | Vpv1 sampling defect R77 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 57. | Vpv2 sampling defect R84 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 58. | Vpv2 sampling defect R88 | s-c | 400 | 3min | -- | -- | Error message: PV Above BUS Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 59. | Vbus sampling defect R93 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally.<br>No damaged, no hazard. |

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| 60. | Vbus sampling defect<br>R89 | o-c | 400 | 3min | -- | -- | Error message: BUS Volt Low Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 61. | Vac sampling defect<br>R99 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: Inv SelfChk Err)<br>No damaged, no hazard. |
| 62. | Vac sampling defect<br>R103 | s-c | 400 | 3min | -- | -- | Error message: Output Relay Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 63. | Vac sampling defect<br>R97 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: Output Relay Err)<br>No damaged, no hazard. |
| 64. | Vac sampling defect<br>R101 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: Output Relay Err)<br>No damaged, no hazard. |
| 65. | Vgrid sampling (DSP) defect<br>R119 | s-c | 400 | 3min | -- | -- | Error message: DCI High Err, Grid Over Volt Err1.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 66. | Vgrid sampling (DSP) defect<br>R123 | s-c | 400 | 3min | -- | -- | Error message: DCI High Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 67. | Vgrid sampling (DSP) defect<br>R116 | o-c | 400 | 3min | -- | -- | Error message: Grid Volt Loss Err, DCI High Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 68. | Vgrid sampling (DSP) defect<br>R120 | o-c | 400 | 3min | -- | -- | Error message: DCI High Err.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |

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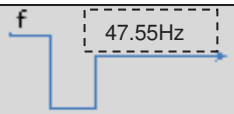
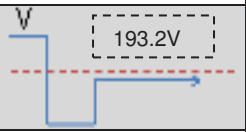
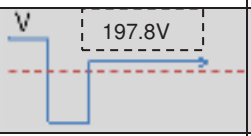
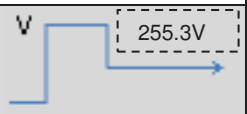
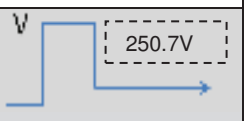
|---|---|---|---|---|---|---|---|
| 69. | Vgrid sampling（MCU）defect R126 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally.<br>No damaged, no hazard. |
| 70. | Vgrid sampling（MCU）defect R337 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally.<br>No damaged, no hazard. |
| 71. | Vgrid sampling（MCU）defect R124 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: SMCU Grid Volt Err)<br>No damaged, no hazard. |
| 72. | Vgrid sampling（MCU）defect R128 | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally.<br>No damaged, no hazard. |
| 73. | C91 | s-c | 400 | 3min | -- | -- | No message.<br>PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 74. | D38 | s-c | 300 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>Q7，D1 has be damaged, no hazard. |
| 75. | CT1 AGND | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: PV Curr Channel Err1)<br>No damaged, no hazard. |
| 76. | CT2 AGND | o-c | 400 | 3min | -- | -- | No message.<br>PV inverter run normally<br>(PV inverter restart. Error message: PV Curr Channel Err2)<br>No damaged, no hazard. |
| 77. | Q7(D-S) | s-c | 300 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>Q7 has be damaged, no hazard. |
| 78. | C84 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>C84 has be damaged, no hazard. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 79. | C166 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>Q1, Q2, Q5, Q6 has been damaged, no hazard. |
| 80. | Q1(D-S) | s-c | 400 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>Q1, Q5 has been damaged, no hazard. |
| 81. | Q1(D-G) | s-c | 400 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>Q1, Q5has be damaged, no hazard. |
| 82. | Q6(D-G) | s-c | 400 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>Q2, Q6 has be damaged, no hazard. |
| 83. | C504 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>D501, R503 has be damaged, no hazard. |
| 84. | Q500(D-S) | s-c | 400 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>R503, D501 has be damaged, no hazard. |
| 85. | Q500(D-G) | s-c | 400 | 10min | -- | -- | PV inverter disconnected from grid immediately.<br>R503, D501, Q500 has be damaged, no hazard. |
| 86. | C500 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>R153 has be damaged, no hazard. |
| 87. | C590 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>R157has be damaged, no hazard. |
| 88. | C44 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 89. | C63 | s-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |
| 90. | R530 | o-c | 400 | 3min | -- | -- | PV inverter disconnected from grid immediately.<br>No damaged, no hazard. |

| 6.2 | TABLE: Reconnection condition | | | | P |
|---|---|---|---|---|---|
| Conditions |  |  |  |  | |
| Reconnection | ☐ Yes/ ☒ No | ☒ Yes/ ☐ No | ☐ Yes/ ☒ No | ☒ Yes/ ☐ No | |
| Conditions |  |  |  |  | |
| Reconnection | ☐ Yes/ ☒ No | ☒ Yes/ ☐ No | ☐ Yes/ ☒ No | ☒ Yes/ ☐ No | |

| 6.3 | TABLE: line to neutral voltage monitoring | | | | | P |
|---|---|---|---|---|---|---|
| | Rated voltage Un: 230V | | | | | |
| No. | Set value [V] | Threshold value [V] | | | Limitation VDE 4105 | Remark |
| | | L1 | L2 | L3 | | |
| 1 | 184 | 185 | -- | -- | 80%$U_n$±1% | Decreasing value ramp of 0.1V. |
| 2 | | 185 | -- | -- | | |
| 3 | | 185 | -- | -- | | |
| 1 | 264.5 | 265 | -- | -- | 110%Un-115%$U_n$±1% | Increasing value ramp of 0.1V. |
| 2 | | 265 | -- | -- | | |
| 3 | | 264 | -- | -- | | |

| UV / OV | Trip time [ms] | | | |
|---|---|---|---|---|
| | Measurement | | | Limitation VDE 4105 |
| | L1 | L2 | L3 | |
| Un to 77%Un | 115 | -- | -- | 200 |
| | 115 | -- | -- | 200 |
| | 117 | -- | -- | 200 |
| Un to 118%Un | 120 | -- | -- | 200 |
| | 125 | -- | -- | 200 |
| | 126 | -- | -- | 200 |
| Rated: 230Vac, 50Hz. Recover time | | | | |

| 6.3 | TABLE: over voltage protection as sliding 10-min-average value | | | | P |
|---|---|---|---|---|---|
| | Rated voltage Un: 230V | | | | |
| No. | $U_{start}$ [V] | $U_{end}$ [V] | Limitation T [min] | Trigger time [min] | Recover time [s] |
| 1 | 230 | 259 | 10 | 7min58s | 164 |
| 2 | 230 | 248.0 | No disconnected | No disconnected | N/A |
| 3 | 244.0 | 262.0 | 5 | 5min41s | 164 |
| Note: | | | | | |

| 6.4 | TABLE: Frequency monitoring test | | | | P |
|---|---|---|---|---|---|
| Rating frequency: 50Hz, speed: 1 Hz/s | | | | | |
| UF/OF | Trip value [Hz] | | Trip time [ms] | | |
| No. | Measurement | Limitation | Measurement | Limitation | Remark |
| 1 | 47.49 | 47.5 | 74 | 200 | 48.0Hz -> _47_Hz<br>Delayed time:__510___ms is considered. |
| 2 | 47.49 | | 75 | 200 | |
| 3 | 47.49 | | 69 | 200 | |
| 1 | 51.50 | 51.5 | 136 | 200 | 51.0Hz -> __52__Hz<br>Delayed time:___510___ms is considered. |
| 2 | 51.50 | | 127 | 200 | |
| 3 | 51.50 | | 132 | 200 | |
| Note: | | | | | |

| 6.5 | TABLE: DC current monitoring test | P |
|---|---|---|

| DC current ≥ 1A | Trip time [ms] | |
|---|---|---|
| | Measurement | Limitation |
| $I_D$ ≥1A | | |
| L1 Phase | 145 | 200 |
| L2 Phase | -- | -- |
| L3 Phase | -- | -- |
| $I_D$ ≤ -1A | | |
| L1 Phase | 134 | 200 |
| L2 Phase | -- | -- |
| L3 Phase | -- | -- |
| Note: 100% output power | | |

| 6.6 | TABLE: Detection of island operation test | P |
|---|---|---|

Rated voltage: 230V/N/PE

| Test Condition | | Trip time | | | |
|---|---|---|---|---|---|
| P/Pn | **100%** | Measurement [ms] | | | Limit [ms] |
| RLC Load | | L1 | L2 | L3 | |
| P, $P_Q$ - 5% | | 185 | -- | -- | 5000 |
| P, $P_Q$ - 4% | | 167 | -- | -- | 5000 |
| P, $P_Q$ - 3% | | 164 | -- | -- | 5000 |
| P, $P_Q$ - 2% | | 169 | -- | -- | 5000 |
| P, $P_Q$ - 1% | | 169 | -- | -- | 5000 |
| **P, $P_Q$** | | 177 | -- | -- | 5000 |
| P, $P_Q$ + 1% | | 173 | -- | -- | 5000 |
| P, $P_Q$ +2% | | 152 | -- | -- | 5000 |
| P, $P_Q$ +3% | | 162 | -- | -- | 5000 |
| P, $P_Q$ +4% | | 136 | -- | -- | 5000 |
| P, $P_Q$ +5% | | 152 | -- | -- | 5000 |

| Test Condition | | Trip time | | | |
|---|---|---|---|---|---|
| P/Pn | **50%** | Measurement [ms] | | | Limit [ms] |
| RLC Load | | L1 | L2 | L3 | |
| P, $P_Q$ - 5% | | 151 | -- | -- | 5000 |
| P, $P_Q$ - 4% | | 152 | -- | -- | 5000 |

| | | | | |
|---|---|---|---|---|
| P, $P_Q$ - 3% | 148 | -- | -- | 5000 |
| P, $P_Q$ - 2% | 154 | -- | -- | 5000 |
| P, $P_Q$ - 1% | 141 | -- | -- | 5000 |
| **P, $P_Q$** | 146 | -- | -- | 5000 |
| P, $P_Q$ + 1% | 164 | -- | -- | 5000 |
| P, $P_Q$ +2% | 162 | -- | -- | 5000 |
| P, $P_Q$ +3% | 150 | -- | -- | 5000 |
| P, $P_Q$ +4% | 146 | -- | -- | 5000 |
| P, $P_Q$ +5% | 149 | -- | -- | 5000 |

| Test Condition | | Trip time | | | |
|---|---|---|---|---|---|
| P/Pn | **25%** | Measurement [ms] | | | Limit [ms] |
| RLC Load | | L1 | L2 | L3 | |
| P, $P_Q$ - 5% | | 151 | -- | -- | 5000 |
| P, $P_Q$ - 4% | | 157 | -- | -- | 5000 |
| P, $P_Q$ - 3% | | 160 | -- | -- | 5000 |
| P, $P_Q$ - 2% | | 145 | -- | -- | 5000 |
| P, $P_Q$ - 1% | | 149 | -- | -- | 5000 |
| **P, $P_Q$** | | 160 | -- | -- | 5000 |
| P, $P_Q$ + 1% | | 145 | -- | -- | 5000 |
| P, $P_Q$ +2% | | 126 | -- | -- | 5000 |
| P, $P_Q$ +3% | | 134 | -- | -- | 5000 |
| P, $P_Q$ +4% | | 141 | -- | -- | 5000 |
| P, $P_Q$ +5% | | 143 | -- | -- | 5000 |
| Note: | | | | | |

| Additional A | TABLE: Insulation resistance measurement | | | | | P |
|---|---|---|---|---|---|---|
| Conditions | Measurement [I.F. / N.O.] | | | | | Identification |
| | PV / DC Supply Voltage [Vdc] | | | | | |
| | $V_{mpp\ lowest}$ | $1/4V_{mpp}$ | $1/2\ V_{mpp}$ | $3/4\ V_{mpp}$ | $V_{mpp\ highest}$ | |
| PV+ to PE: 18[kΩ] | I.F | I.F | I.F | I.F | I.F | I.F.: Isolation Fault N.O.: Normal Operation |
| PV- to PE: 18[kΩ] | I.F | I.F | I.F | I.F | I.F | |
| PV+ to PE: 22[kΩ] | N.O. | N.O. | N.O. | N.O. | N.O. | |
| PV- to PE: 22[kΩ] | N.O. | N.O. | N.O. | N.O. | N.O. | |
| Note:<br>Array Insulation Resistance Threshold Value R =20 [kΩ] (Should be larger than R = $V_{MAX\ PV}$ / 30mA.)<br>The accuracy of resistance measurement △R =2 [kΩ] (the value declared by manufacturer) | | | | | | |

| Additional B | TABLE: Residual current trip value test | P |
|---|---|---|

| Test Conditions | Steadily Residual current threshold value | |
|---|---|---|
| | Measurement [mA] | Limitation [mA] |
| | $U_N$ | |
| PV+ to Neutral | 280.68 | 300 |
| | 277.92 | 300 |
| | 280.19 | 300 |
| | 278.13 | 300 |
| | 280.53 | 300 |
| PV- to Neutral | 279.29 | 300 |
| | 280.31 | 300 |
| | 277.77 | 300 |
| | 281.27 | 300 |
| | 277.53 | 300 |

Note:

| Additional B | TABLE: Residual current monitoring test | P |
|---|---|---|

| Conditions | Trigger disconnection maximum time | |
|---|---|---|
| | Measurement [ms] | Limit [ms] |
| Sudden residual current ≥ 30mA | | |
| PV- to Neutral | 158.4 | 300 |
| | 159.2 | 300 |
| | 170.8 | 300 |
| | 166.4 | 300 |
| | 170.8 | 300 |
| PV+ to Neutral | 165.5 | 300 |
| | 171.1 | 300 |
| | 155.1 | 300 |
| | 158.3 | 300 |
| | 169.4 | 300 |
| Sudden residual current ≥ 60mA | | |
| PV- to Neutral | 19.6 | 150 |
| | 11.6 | 150 |

| | | |
|---|---|---|
| | 26.2 | 150 |
| | 24.4 | 150 |
| | 37.4 | 150 |
| PV+ to Neutral | 102.2 | 150 |
| | 44.6 | 150 |
| | 53.8 | 150 |
| | 58.6 | 150 |
| | 57.8 | 150 |
| Sudden residual current ≥ 150mA | | |
| PV- to Neutral | 16.4 | 40 |
| | 23.0 | 40 |
| | 19.0 | 40 |
| | 15.0 | 40 |
| | 21.6 | 40 |
| PV+ to Neutral | 7.7 | 40 |
| | 14.6 | 40 |
| | 13.6 | 40 |
| | 26.3 | 40 |
| | 27.2 | 40 |
| Note: 100% output power and Vmppmax input voltage | | |

- End of test report -

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI


Figure 1. Front view for model: EA2KSI, EA2.5KSI, EA3KSI

Figure 2. Rear view for model: EA2KSI, EA2.5KSI, EA3KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Figure 3. Terminal panel view for model: EA2KSI, EA2.5KSI, EA3KSI

Figure 4. Internal view-1 for model: EA2KSI, EA2.5KSI, EA3KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Figure 5. Component side view of Main board for model: EA2KSI, EA2.5KSI, EA3KSI

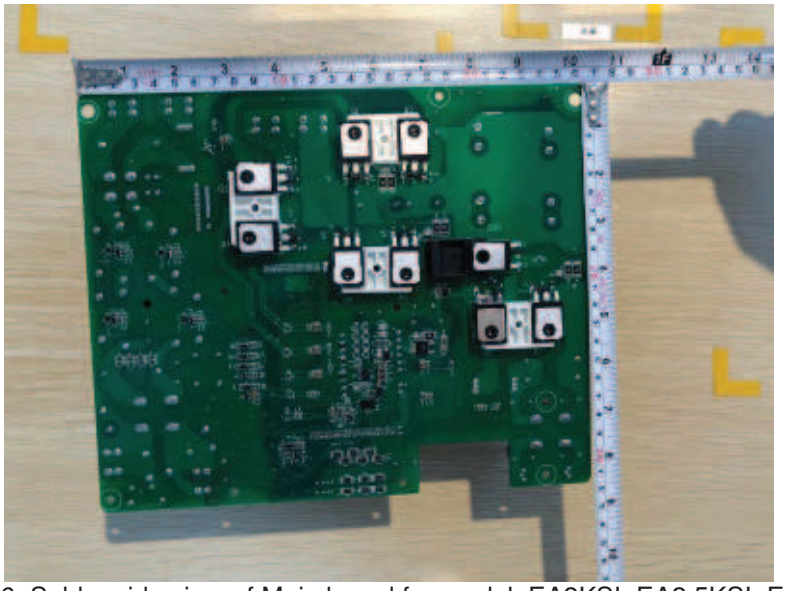


Figure 6. Solder side view of Main board for model: EA2KSI, EA2.5KSI, EA3KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Figure 7. Front view for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

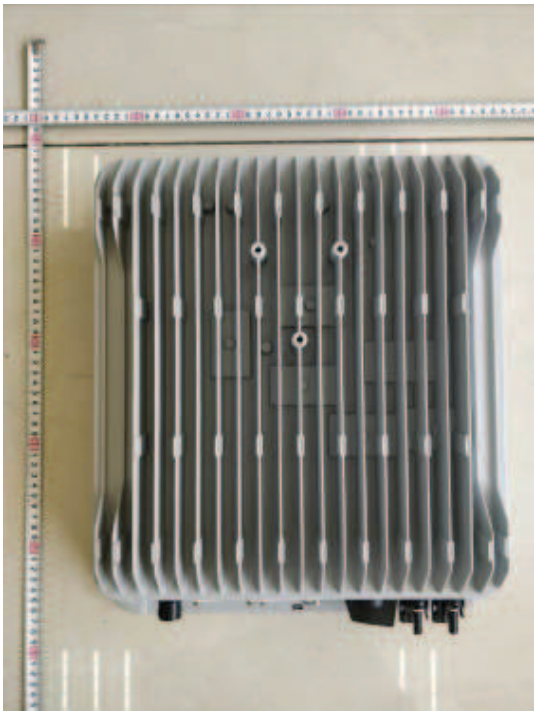


Figure 8. Rear view for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Figure 9. Terminal panel view for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

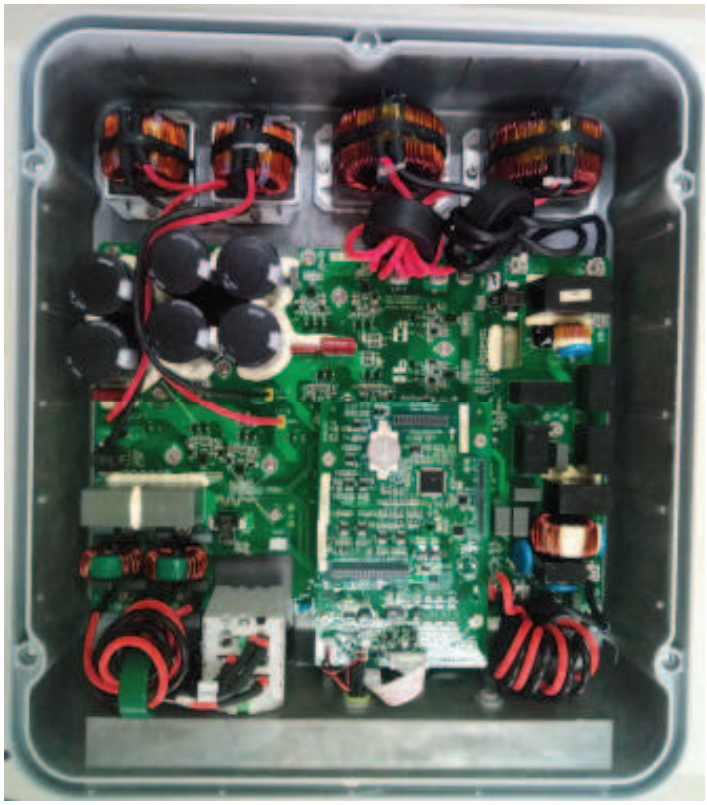


Figure 10. Internal view-1 for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

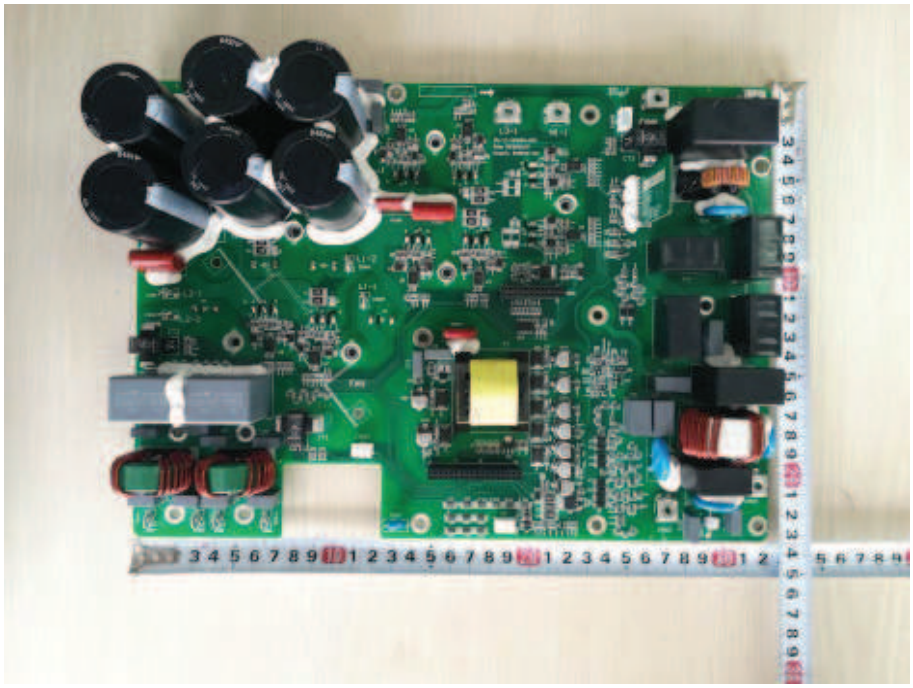


Figure 11. Component side view of Main board for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

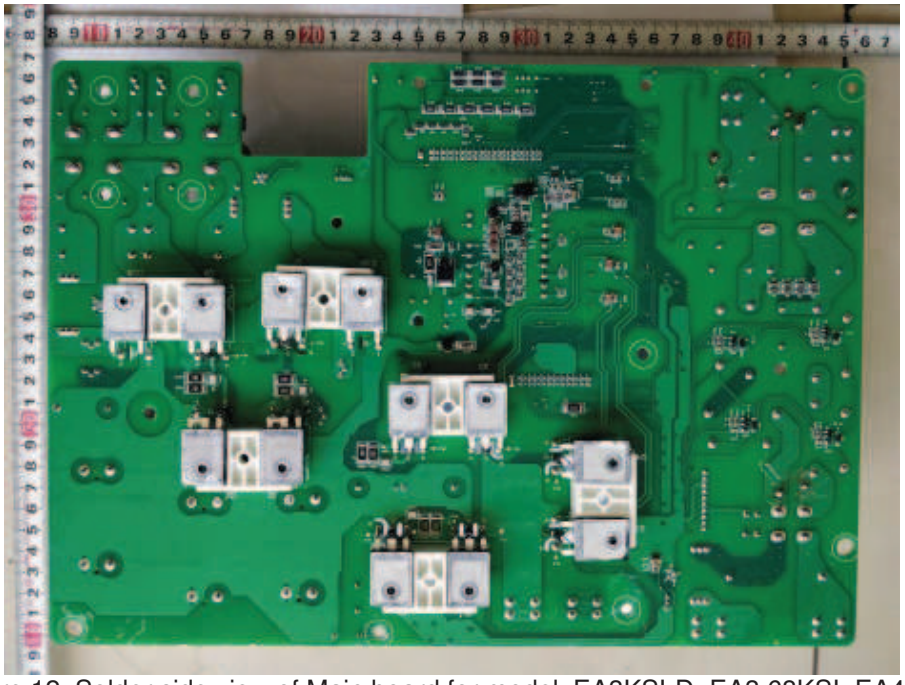


Figure 12. Solder side view of Main board for model: EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

Figura 13. Component side view of Control board

Product: Grid-tied PV Inverter

Type: EA2KSI, EA2.5KSI, EA3KSI, EA3KSI-D, EA3.68KSI, EA4KSI, EA4.6KSI, EA5KSI, EA6KSI

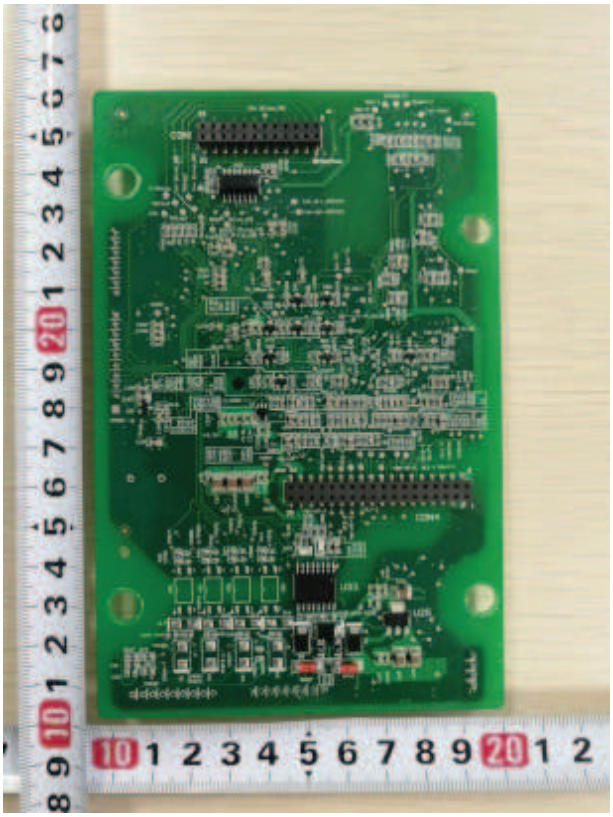


Figure 14. Solder side view of Control board

Figure 15. Internal view-2 for model: EA6KSI