

TEST REPORT

IEC 62109

Safety of power converters for use in photovoltaic power systems –

Part 1: General requirements

Part 2: Particular requirements for inverters

Report Reference No. : B-S210234902

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Date of issue : Feb. 03, 2021

Testing laboratory Name : Beide (Shenzhen) Product Service Limited
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Report body : Beide (Shenzhen) Product Service Limited
Address : 6F, Bldg E, Hourui 3rd Ind Zone, Xixiang, Bao'an Dist, Shenzhen, China

Applicant's Name : Inti Photovoltaics S.L.
Address : Calle Provenza 275, Barcelona, 08037, Spain

Test specification

Standard : IEC 62109-1:2010,
IEC 62109-2:2011

Test procedure : N.A.

Non-standard test method : N.A.

Test item Description : Inverter Charger

Trademark : N.A.

Model and/or type reference : IIP-241000BFL, IIP-242000BFL, IIP-243000BFL, IIP-484000BFL, IIP-485000BFL, IIP-24500BFL

Manufacturer : Inti Photovoltaics S.L.

Rating(s) : Input: DC 24V
Output: 120VAC, 60Hz, 1000W

Test case verdicts

Test case does not apply to the test object : N(.A.)

Test item does meet the requirement..... : P(ass)

Test item does not meet the requirement : F(ail)

Testing

Date of receipt of test item : Jan. 25, 2021

Date(s) of performance of test : Jan. 25-Feb. 03, 2021

General remarks

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

The test results presented in this report relate only to the item(s) tested.

“(see appended table)” refers to a table appended to the report.

“(see remark #)” refers to a remark appended to the report.

“(see Annex #)” refers to an annex appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

General product information:

Copy of marking plate

Inverter Charger

Model No: IIP-241000BFL

Rating: Input: DC 24V

Output: 120VAC, 60Hz, 1000W

Inti Photovoltaics S.L.



| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|--------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |

| | | | |
|-----------|------------------------------------------|--------------------------|----|
| 4 | General testing requirements | | P |
| 4.1 | General | | P |
| 4.2 | General conditions for testing | | -- |
| 4.2.1 | Sequence of tests | | P |
| 4.2.2 | Reference test conditions | | P |
| 4.2.2.1 | Environmental conditions | 25°C, 48%, 98kPa | P |
| 4.2.2.2 | State of equipment | | P |
| 4.2.2.3 | Position of equipment | | P |
| 4.2.2.4 | Accessories | | P |
| 4.2.2.5 | Covers and removable parts | | P |
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| 4.2.2.7 | Supply ports other than the mains | | P |
| 4.2.2.7.1 | Photovoltaic supply sources | | P |
| 4.2.2.7.2 | Battery inputs | | P |
| 4.2.2.8 | Conditions of loading for output ports | | P |
| 4.2.2.9 | Earthing terminals | | P |
| 4.2.2.10 | Controls | | P |
| 4.2.2.11 | Available short circuit current | | P |
| 4.3 | Thermal testing | | P |
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| | Normal load condition | | P |
| 4.3.2 | Maximum temperatures | (see appended table 4.3) | P |
| 4.3.2.1 | General | | P |
| 4.3.2.2 | Touch temperatures | | P |
| 4.3.2.3 | Temperature limits for mounting surfaces | | P |
| 4.4 | Testing in single fault condition | | P |
| 4.4.1 | General | | P |

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| Clause | Requirement – Test | Result - Remark | Verdict |
| 4.4.2 | Test conditions and duration for testing under fault conditions | | P |
| 4.4.2.1 | General | | P |
| 4.4.2.2 | Duration of tests | | P |
| 4.4.3 | Pass/fail criteria for testing under fault conditions | | P |
| 4.4.3.1 | Protection against shock hazard | | P |
| 4.4.3.2 | Protection against the spread of fire | | P |
| 4.4.3.3 | Protection against other hazards | | P |
| 4.4.3.4 | Protection against parts expulsion hazards | | P |
| 4.4.4 | Single fault conditions to be applied | | P |
| 4.4.4.1 | Component fault tests | | P |
| 4.4.4.2 | Equipment or parts for short-term or intermittent operation | | P |
| 4.4.4.3 | Motors | | N |
| 4.4.4.4 | Transformer short circuit tests | | P |
| 4.4.4.5 | Output short circuit | | P |
| 4.4.4.6 | Backfeed current test for equipment with more than one source of supply | | P |
| 4.4.4.7 | Output overload | | P |
| 4.4.4.8 | Cooling system failure | | P |
| 4.4.4.9 | Heating devices | | N |
| 4.4.4.10 | Safety interlock systems | | N |
| 4.4.4.11 | Reverse d.c. connections | | P |
| 4.4.4.12 | Voltage selector mismatch | | N |
| 4.4.4.13 | Mis -wiring with incorrect phase sequence or polarity | | N |
| 4.4.4.14 | Printed wiring board short-circuit test | | P |
| 4.4.4.15 of 62109-2 | Fault-tolerance of protection for grid - interactive inverters | | P |
| 4.4.4.15.1 of 62109-2 | Fault-tolerance of residual current monitoring | | N |

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|-------------------------|--------------------------------------------------|--------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 4.4.4.15.2 of 62109-2 | Fault-tolerance of automatic disconnecting means | | N |
| 4.4.4.15.2.1 of 62109-2 | General | | N |
| 4.4.4.15.2.2 of 62109-2 | Design of insulation or separation | | N |
| 4.4.4.15.2.3 of 62109-2 | Automatic checking of the disconnect means | | N |
| 4.4.4.16 of 62109-2 | Stand - alone inverters – Load transfer test | | P |
| 4.4.4.17 of 62109-2 | Cooling system failure – Blanketing test | | P |
| 4.5 of 62109-2 | Humidity preconditioning | | P |
| 4.5.1 of 62109-2 | General | | P |
| 4.5.2 of 62109-2 | Conditions | Humidity:93%,Temperature:40 °C | P |
| 4.6 of 62109-2 | Backfeed voltage protection | | P |
| 4.6.1 of 62109-2 | Backfeed tests under normal conditions | | P |
| 4.6.2 of 62109-2 | Backfeed tests under single-fault conditions | | P |
| 4.6.3 of 62109-2 | Compliance with backfeed tests | | P |
| 4.7 of 62109-2 | Electrical ratings tests | | P |
| 4.7.1 of 62109-2 | Input ratings | | P |
| 4.7.1.1 of 62109-2 | Measurement requirements for DC input ports | | P |
| 4.7.2 of 62109-2 | Output ratings | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 4.7.3 of 62109-2 | Measurement requirements for AC output ports for stand- alone inverters | | P |
| 4.7.4 of 62109-2 | Stand - alone Inverter AC output voltage and frequency | | P |
| 4.7.4.1 of 62109-2 | General | | P |
| 4.7.4.2 of 62109-2 | Steady state output voltage at nominal DC input | >90%,<110% | P |
| 4.7.4.3 of 62109-2 | Steady state output voltage across the DC input range | >85%,<110% | P |
| 4.7.4.4 of 62109-2 | Load step response of the output voltage at nominal DC input | >85%,<110% | P |
| 4.7.4.5 of 62109-2 | Steady state output frequency | >- 6 %, <+4 % | P |
| 4.7.5 of 62109-2 | Stand - alone inverter output voltage waveform | | P |
| 4.7.5.1 of 62109-2 | General | | P |
| 4.7.5.2 of 62109-2 | Sinusoidal output voltage waveform requirements | | P |
| 4.7.5.3 of 62109-2 | Non- sinusoidal output waveform requirements | | N |
| 4.7.5.3.1 of 62109-2 | General | | N |
| 4.7.5.3.2 of 62109-2 | Total harmonic distortion | | N |
| 4.7.5.3.3 of 62109-2 | Waveform slope | | N |
| 4.7.5.3.4 of 62109-2 | Peak voltage | | N |
| 4.7.5.4 of 62109-2 | Information requirements for non- sinusoidal waveforms | | N |
| 4.7.5.5 of 62109-2 | Output voltage waveform requirements for inverters for dedicated loads | | N |
| 4.8 of 62109-2 | Additional tests for grid- interactive inverters | | N |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-----------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 4.8.1 of 62109-2 | General requirements regarding inverter isolation and array grounding | | N |
| 4.8.2 of 62109-2 | Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays | | N |
| 4.8.2.1 of 62109-2 | Array insulation resistance detection for inverters for ungrounded arrays | | N |
| 4.8.2.2 of 62109-2 | Array insulation resistance detection for inverters for functionally grounded arrays | | N |
| 4.8.3 of 62109-2 | Array residual current detection | | N |
| 4.8.3.1 of 62109-2 | General | | N |
| 4.8.3.2 of 62109-2 | 30 mA touch current type test for isolated inverters | | N |
| 4.8.3.3 of 62109-2 | Fire hazard residual current type test for isolated inverters | | N |
| 4.8.3.4 of 62109-2 | Protection by application of RCD's | | N |
| 4.8.3.5 of 62109-2 | Protection by residual current monitoring | | N |
| 4.8.3.5.1 of 62109-2 | General | | N |
| 4.8.3.5.2 of 62109-2 | Test for detection of excessive continuous residual current | | N |
| 4.8.3.5.3 of 62109-2 | Test for detection of sudden changes in residual current | | N |
| 4.8.3.6 of 62109-2 | Systems located in closed electrical operating areas | | N |

| | | | |
|-------|---------------------------|------------|---|
| 5 | Marking and documentation | | P |
| 5.1 | Marking | | P |
| 5.1.1 | General | | P |
| 5.1.2 | Durability of markings | | P |
| 5.1.3 | Identification | See page 2 | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | a) the name or trade mark of the manufacturer or supplier; | See page 2 | P |
| | b) a model number, name or other means to identify the equipment, | See page 2 | P |
| | c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period. | See page 2 | P |
| 5.1.4&5.1.4 of 62109-2 | Equipment ratings | | P |
| | PV input ratings, a.c. input ratings, d.c. input (other than PV) ratings | See page 2 | P |
| | a.c. output ratings | See page 2 | P |
| | Protective class (I, II, or III) | Class I | P |
| | the ingress protection (IP) rating as in 6.3 below. | | P |
| 5.1.5 | Fuse identification | | P |
| 5.1.6 | Terminals, connections and controls | | P |
| 5.1.6.1 | Protective conductor terminals | | P |
| 5.1.7 | Switches and circuit-breakers | | P |
| 5.1.8 | Class II equipment | | N |
| 5.1.9 | Terminal boxes for external connections | | N |
| 5.2 | Warning markings | | P |
| 5.2.1 | Visibility and legibility requirements for warning markings | | P |
| 5.2.2 | Content for warning markings | | P |
| 5.2.2.1 | Ungrounded heatsinks and similar parts | | P |
| 5.2.2.2 | Hot surfaces | | N |
| 5.2.2.3 | Coolant | | N |
| 5.2.2.4 | Stored energy | | P |
| 5.2.2.5 | Motor guarding | | N |
| 5.2.2.6 of 62109-2 | Inverters for closed electrical operating areas | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 5.2.3 | Sonic hazard markings and instructions | | P |
| 5.2.4 | Equipment with multiple sources of supply | | P |
| 5.2.5 | Excessive touch current | | P |
| 5.3 | Documentation | | P |
| 5.3.1 | General | | P |
| | a) explanations of equipment markings, including symbols used; | | P |
| | b) location and function of terminals and controls; | | P |
| | c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements: | | P |
| | – Environmental category as per 6.1 | | P |
| | – Wet locations classification as per 6.1 | | P |
| | – Pollution degree classification for the intended external environment as per 6.2 | | P |
| | – Ingress protection rating as per 6.3 | | P |
| | – Ambient temperature and relative humidity ratings | | P |
| | – Maximum altitude rating | | P |
| | – Overvoltage category assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories; | | P |
| | d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE. | | P |
| 5.3.1.1 | Language | English | P |
| 5.3.1.2 | Format | | P |
| 5.3.2 | Information related to installation | | P |
| 5.3.2.1 of 62109-2 | Ratings | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|---------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 5.3.2.2 of 62109-2 | Grid- interactive inverter setpoints | | N |
| 5.3.2.3 of 62109-2 | Transformers and isolation | | P |
| 5.3.2.4 of 62109-2 | Transformers required but not provided | | N |
| 5.3.2.5 of 62109-2 | PV modules for non- isolated inverters | | N |
| 5.3.2.6 of 62109-2 | Non-sinusoidal output waveform information | | N |
| 5.3.2.7 of 62109-2 | Systems located in closed electrical operating areas | | P |
| 5.3.2.8 of 62109-2 | Stand-alone inverter output circuit bonding | | P |
| 5.3.2.9 of 62109-2 | Protection by application of RCD's | | P |
| 5.3.2.10 of 62109-2 | Remote indication of faults | | P |
| 5.3.2.11 of 62109-2 | External array insulation resistance measurement and response | | P |
| 5.3.2.12 of 62109-2 | Array functional grounding information | | P |
| 5.3.2.13 of 62109-2 | Stand - alone inverters for dedicated loads | | P |
| 5.3.2.14 of 62109-2 | Identification of firmware version(s) | | P |
| 5.3.3 | Information related to operation | | P |
| 5.3.4 | Information related to maintenance | | P |
| 5.3.4.1 | Battery maintenance | | N |
| 6 | Environmental requirements and conditions | | P |
| | – Environmental category, as in 6.1 below | | P |
| | – Suitability for wet locations or not | | P |
| | – Pollution degree rating, as in 6.2 below | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|----------------------------------------------------------------------|------------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | – Ingress protection (IP) rating, as in 6.3 below | | P |
| | – Ultraviolet (UV) exposure rating, as in 6.4 below | | N |
| | – Ambient temperature and relative humidity ratings, as in 6.5 below | | P |
| 6.1 | Environmental categories and minimum environmental conditions | | P |
| 6.2 | Pollution degree | Pollution degree II | P |
| 6.3 | Ingress protection | IPX0 | P |
| 6.4 | UV exposure | | N |
| 6.5 | Temperature and humidity | - 20 °C to +50 °C, 20 % to 90 % | P |

| | | | |
|-----------|-----------------------------------------------------------------|--|---|
| 7 | Protection against electric shock and energy hazards | | P |
| 7.1 | General | | P |
| 7.2 | Fault conditions | | P |
| 7.3 | Protection against electric shock | | P |
| 7.3.1 | General | | P |
| 7.3.2 | Decisive voltage classification | | P |
| 7.3.2.1 | Use of decisive voltage class (DVC) | | P |
| 7.3.2.2 | Limits of DVC | | P |
| 7.3.2.3 | Short-term limits of accessible voltages under fault conditions | | P |
| 7.3.2.4 | Requirements for protection | | P |
| 7.3.2.5 | Connection to PELV and SELV circuits | | P |
| 7.3.2.6 | Working voltage and DVC | | P |
| 7.3.2.6.1 | General | | P |
| 7.3.2.6.2 | AC working voltage | | N |
| 7.3.2.6.3 | DC working voltage | | P |
| 7.3.2.6.4 | Pulsating working voltage | | N |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 7.3.3 | Protective separation | | P |
| 7.3.4 | Protection against direct contact | | P |
| 7.3.4.1 | General | | P |
| 7.3.4.2 | Protection by means of enclosures and barriers | | P |
| 7.3.4.2.1 | General | | P |
| 7.3.4.2.2 | Access probe criteria | | P |
| 7.3.4.2.3 | Access probe tests | | P |
| | a) Inspection | | P |
| | b)Tests with the test finger (Figure D.1) and test pin (Figure D.2) of Annex D | | P |
| | c)Further tested by means of a straight unjointed test finger (Figure D.3 of Annex D), applied with a force of 30 N | | P |
| | d)tested with the IP3X probe of IEC 60529 | | N |
| 7.3.4.2.4 | Service access areas | | P |
| 7.3.4.3 | Protection by means of insulation of live parts | | P |
| 7.3.4.3 | Protection by means of insulation of live parts | | P |
| 7.3.5 | Protection in case of direct contact | | P |
| 7.3.5.1 | General | | P |
| 7.3.5.2 | Protection using decisive voltage class A | | P |
| 7.3.5.3 | Protection by means of protective impedance | | P |
| 7.3.5.3.1 | Limitation of current through protective impedance | ≤ 3,5 mA a.c.or 10 mA d.c. | P |
| 7.3.5.3.2 | Limitation of discharging energy through protective impedance | | P |
| 7.3.5.4 | Protection by means of limited voltages | | P |
| 7.3.6 | Protection against indirect contact | | P |
| 7.3.6.1 | General | | P |
| 7.3.6.2 | Insulation between live parts and accessible conductive parts | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 7.3.6.3 | Protective class I - Protective bonding and earthing | | P |
| 7.3.6.3.1 | General | | P |
| 7.3.6.3.2 | Requirements for protective bonding | | P |
| 7.3.6.3.3 | Rating of protective bonding | | P |
| | a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below. | | P |
| | b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below. | | P |
| 7.3.6.3.3.1 | Test current, duration, and acceptance criteria | | P |
| 7.3.6.3.4 | Protective bonding impedance (routine test) | | P |
| 7.3.6.3.5 | External protective earthing conductor | | P |
| 7.3.6.3.6 | Means of connection for the external protective earthing conductor | | P |
| 7.3.6.3.6.1 | General | | P |
| 7.3.6.3.7 | Touch current in case of failure of the protective earthing conductor | not exceed 3,5 mA a.c. or 10 mA d.c. | P |
| 7.3.6.4 | Protective class II - Double or reinforced insulation | | N |
| 7.3.7 | Insulation including clearance and creepage distances | | P |
| 7.3.7.1 | General | | P |
| 7.3.7.1.1 | Pollution degree | Pollution degree II | P |
| 7.3.7.1.2 | Overvoltage category and Impulse withstand voltage rating | | P |
| 7.3.7.1.3 | Supply earthing systems | | N |
| | TN system: | | N |
| | TT system: | | N |
| | IT system: | | N |

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|-------------------------|----------------------------------------------------------------------|---------------------------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 7.3.7.1.4 | Insulation voltages | | P |
| 7.3.7.2 | Insulation between a circuit and its surroundings | | P |
| 7.3.7.2.1 | General | | P |
| 7.3.7.2.2 | Circuits connected directly to the mains | | P |
| 7.3.7.2.3 | Circuits other than mains circuits | | P |
| 7.3.7.2.4 | Insulation between circuits | | P |
| 7.3.7.3 | Functional insulation | | P |
| 7.3.7.4 | Clearance distances | | P |
| 7.3.7.4.1 | Determination | | P |
| 7.3.7.4.2 | Electric field homogeneity | | P |
| 7.3.7.4.3 | Clearance to conductive enclosures | | P |
| 7.3.7.5 | Creepage distances | | P |
| 7.3.7.5.1 | General | | P |
| 7.3.7.5.2 | Voltage | | P |
| 7.3.7.5.3 | Materials | Insulating material group IIIa 400 > CTI ≥ 175 | P |
| 7.3.7.6 | Coating | | P |
| 7.3.7.7 | PWB spacings for functional insulation | | P |
| 7.3.7.8 | Solid insulation | | P |
| 7.3.7.8.1 | General | | P |
| 7.3.7.8.2 | Requirements for electrical withstand capability of solid insulation | | P |
| 7.3.7.8.2.1 | Basic, supplemental, reinforced, and double insulation | | P |
| 7.3.7.8.2.2 | Functional insulation | | P |
| 7.3.7.8.3 | Thin sheet or tape material | | P |
| 7.3.7.8.3.1 | General | | P |
| 7.3.7.8.3.2 | Material thickness not less than 0,2 mm | | P |
| 7.3.7.8.3.3 | Material thickness less than 0,2 mm | | N |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|---------------------------------------------------------------------------|-----------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 7.3.7.8.3.4 | Compliance | | P |
| 7.3.7.8.4 | Printed wiring boards (PWBs) | | P |
| 7.3.7.8.4.1 | General | | P |
| 7.3.7.8.4.2 | Use of coating materials | | P |
| 7.3.7.8.5 | Wound components | | P |
| 7.3.7.8.6 | Potting materials | | P |
| 7.3.7.9 | Insulation requirements above 30 kHz | | P |
| 7.3.8 | Residual Current Detection (RCD) or Monitoring (RCM) device compatibility | | P |
| 7.3.9 | Protection against shock hazard due to stored energy | | P |
| 7.3.9.1 | Operator access area | The discharge time<1S | P |
| 7.3.9.2 | Service access areas | The discharge time<1S | P |
| 7.3.10 of 62109-2 | Additional requirements for stand- alone inverters | | P |
| 7.3.11 of 62109-2 | Functionally grounded arrays | | P |
| 7.4 | Protection against energy hazards | | P |
| 7.4.1 | Determination of hazardous energy level | | P |
| 7.4.2 | Operator access areas | | P |
| 7.4.3 | Service access areas | | P |
| 7.5 | Electrical tests related to shock hazard | | P |
| 7.5.1 | Impulse voltage test (type test) | | P |
| 7.5.2 | Voltage test (dielectric strength test) (type test and routine test) | | P |
| 7.5.2.1 | Purpose of test | | P |
| 7.5.2.2 | Value and type of test voltage | | P |
| 7.5.2.3 | Humidity pre-conditioning | | P |
| 7.5.2.4 | Performing the voltage test | | P |
| 7.5.2.5 | Duration of the a.c. or d.c. voltage test | 60s | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|---------------------------------------------------|-------------------------------------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 7.5.2.6 | Verification of the a.c. or d.c. voltage test | No electrical breakdown occurs and no abnormal current flow | P |
| 7.5.3 | Partial discharge test (type test or sample test) | <10pC | P |
| 7.5.4 | Touch current measurement (type test) | | P |
| 7.5.5 | Equipment with multiple sources of supply | | N |

| | | | |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---|
| 8 | Protection against mechanical hazards | | P |
| 8.1 | General | | P |
| 8.2 | Moving parts | | P |
| 8.2.1 | Protection of service persons | | P |
| | a) access is not possible without the use of a tool; | | P |
| | b) the instructions for the responsible body include a statement that operators must be trained before being allowed to perform the hazardous operation; | | P |
| | c) there are warning markings (see 5.2) on any covers or parts which have to be removed to obtain access, prohibiting access by untrained operators. | | P |
| | test finger of Figure D.1 of Annex D | Can not touch hazardous moving part | P |
| 8.3 | Stability | | P |
| | a) Equipment other than hand-held equipment, is tilted in each direction to an angle of 10° from its normal position. | | P |
| | b) Equipment which has both a height of 1 m or more and a mass of 25 kg or more, and all floor-standing equipment, has a force applied at its top, or at a height of 2 m if the equipment has a height of more than 2 m. The force is 250 N, or 20 % of the weight of the equipment, whichever is less, and is applied in all directions except upwards. Jacks used in normal use, and doors, drawers, etc., intended to be opened by an operator, are in their least favourable positions. | | N |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | c) Floor-standing equipment has a force of 800 N applied downwards at the point of maximum moment to | | N |
| | 1) all horizontal working surfaces; | | P |
| | 2) other surfaces providing an obvious ledge and which are not more than 1 m above floor level. | | P |
| 8.4 | Provisions for lifting and carrying | | P |
| 8.5 | Wall mounting | | N |
| 8.6 | Expelled parts | | N |

| | | | |
|---------|-----------------------------------------------------------------|--|---|
| 9 | Protection against fire hazards | | P |
| 9.1 | Resistance to fire | | P |
| 9.1.1 | Reducing the risk of ignition and spread of flame | | P |
| 9.1.2 | Conditions for a fire enclosure | | P |
| 9.1.2.1 | Parts requiring a fire enclosure | | P |
| 9.1.2.2 | Parts not requiring a fire enclosure | | P |
| 9.1.3 | Materials requirements for protection against fire hazard | | P |
| 9.1.3.1 | General | | P |
| 9.1.3.2 | Materials for fire enclosures | | P |
| 9.1.3.3 | Materials for components and other parts inside fire enclosures | | P |
| 9.1.3.4 | Materials for air filter assemblies | | N |
| 9.1.4 | Openings in fire enclosures | | N |
| 9.1.4.1 | General | | N |
| 9.1.4.2 | Side openings treated as bottom openings | | N |
| 9.1.4.3 | Openings in the bottom of a fire enclosure | | N |
| 9.1.4.4 | Equipment for use in a closed electrical operating area | | N |
| 9.1.4.5 | Doors or covers in fire enclosures | | N |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-----------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 9.1.4.6 | Additional requirements for openings in transportable equipment | | N |
| 9.2 | Limited power sources | | N |
| 9.2.1 | General | | N |
| 9.2.2 | Limited power source tests | | N |
| 9.3 | Short-circuit and overcurrent protection | | P |
| 9.3.1 | General | | P |
| 9.3.2 | Number and location of overcurrent protective devices | | P |
| 9.3.3 | Short-circuit co-ordination (backup protection) | | P |
| 9.3.4 of 62109-2 | Inverter backfeed current onto the array | | P |
| 10 | Protection against sonic pressure hazards | | P |
| 10.1 | General | | P |
| 10.2 | Sonic pressure and sound level | | P |
| 10.2.1 | Hazardous noise levels | | P |
| 11 | Protection against liquid hazards | | N |
| 11.1 | Liquid containment, pressure and leakage | | N |
| 11.2 | Fluid pressure and leakage | | N |
| 11.2.1 | Maximum pressure | | N |
| 11.2.2 | Leakage from parts | | N |
| 11.2.3 | Overpressure safety device | | N |
| 11.3 | Oil and grease | | N |
| 12 | Chemical hazards | | N |
| 13 | Physical requirements | | P |
| 13.1 | Handles and manual controls | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|--------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| | a)The shape of these parts is such that an axial pull is unlikely to be applied in normal use, the force is: | | P |
| | - 15 N for the operating means of electrical components | | P |
| | - 20 N in other cases | | P |
| | b)the shape is such that an axial pull is likely to be applied, the force is: | | N |
| | – 30 N for the operating means of electrical components | | N |
| | – 50 N in other cases | | N |
| 13.1.1 | Adjustable controls | | P |
| 13.2 | Securing of parts | | P |
| 13.3 | Provisions for external connections | | P |
| 13.3.1 | General | | P |
| 13.3.2 | Connection to an a.c. mains supply | | N |
| 13.3.2.1 | General | | N |
| 13.3.2.2 | Permanently connected equipment | | N |
| 13.3.2.3 | Appliance inlets | | N |
| 13.3.2.4 | Power supply cords | | N |
| 13.3.2.5 | Cord anchorages and strain relief | | N |
| 13.3.2.6 | Protection against mechanical damage | | N |
| 13.3.3 | Wiring terminals for connection of external conductors | | P |
| 13.3.3.1 | Wiring terminals | | P |
| 13.3.3.2 | Screw terminals | | P |
| 13.3.3.3 | Wiring terminal sizes | | P |
| 13.3.3.4 | Wiring terminal design | | P |
| 13.3.3.5 | Grouping of wiring terminals | | P |
| 13.3.3.6 | Stranded wire | | P |
| 13.3.4 | Supply wiring space | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-------------------------------------------------------------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 13.3.5 | Wire bending space for wires 10 mm ² and greater | | P |
| 13.3.6 | Disconnection from supply sources | | P |
| 13.3.7 | Connectors, plugs and sockets | | P |
| 13.3.8 | Direct plug-in equipment | | N |
| 13.4 | Internal wiring and connections | | P |
| 13.4.1 | General | | P |
| 13.4.2 | Routing | | P |
| 13.4.3 | Colour coding | | P |
| 13.4.4 | Splices and connections | | P |
| 13.4.5 | Interconnections between parts of the PCE | | P |
| 13.5 | Openings in enclosures | | P |
| 13.5.1 | Top and side openings | | P |
| 13.6 | Polymeric materials | | N |
| 13.6.1 | General | | N |
| 13.6.1.1 | Thermal index or capability | | N |
| 13.6.2 | Polymers serving as enclosures or barriers preventing access to hazards | | N |
| 13.6.2.1 | Stress relief test | | N |
| 13.6.3 | Polymers serving as solid insulation | | N |
| 13.6.3.1 | Resistance to arcing | | N |
| 13.6.4 | UV resistance | | N |
| 13.7 | Mechanical resistance to deflection, impact, or drop | | P |
| 13.7.1 | General | | P |
| 13.7.2 | 250 N deflection test for metal enclosures | | P |
| 13.7.3 | 7 J impact test for polymeric enclosures | | N |
| 13.7.4 | Drop test | | P |
| 13.8 | Thickness requirements for metal enclosures | | P |
| 13.8.1 | General | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |
| 13.8.2 | Cast metal | | P |
| 13.8.3 | Sheet metal | | P |
| 13.9 | Fault indication | | P |
| 14 | Components | | P |
| 14.1 | General | Components, which are certified to IEC or national standards, are applied correctly within their ratings. Components not covered by IEC standards are tested under the conditions present in the equipment. | P |
| 14.2 | Motor overtemperature protection | | N |
| 14.3 | Overtemperature protection devices | No overtemperature protection devices | N |
| 14.4 | Fuse holders | | P |
| 14.5 | Mains voltage selecting devices | | P |
| 14.6 | Printed circuit boards | | P |
| 14.7 | Circuits or components used as transient overvoltage limiting devices | | P |
| 14.8 | Batteries | | N |
| 14.8.1 | Battery enclosure ventilation | | N |
| 14.8.1.1 | Ventilation requirements | | N |
| 14.8.1.2 | Ventilation testing | | N |
| 14.8.1.3 | Ventilation instructions | | N |
| 14.8.2 | Battery mounting | | N |
| 14.8.3 | Electrolyte spillage | | N |
| 14.8.4 | Battery connections | | N |
| 14.8.5 | Battery maintenance instructions | | N |
| 14.8.6 | Battery accessibility and maintainability | | N |
| 15 | Software and firmware performing safety functions | | P |

| IEC 62109-1+IEC 62109-2 | | | |
|-------------------------|--------------------|-----------------|---------|
| Clause | Requirement – Test | Result - Remark | Verdict |

| | | | |
|---------|--------------------------------------------------------------|--|---|
| Annex B | Programmable equipment | | N |
| B.1 | Software or firmware that performs safety critical functions | | N |
| B.2 | Evaluation of controls employing software | | N |
| B.2.1 | Risk analysis | | N |

| | | | |
|---------|-----------------------------------------------------------------------------------|--|---|
| Annex G | Clearance and creepage distance determination for frequencies greater than 30 kHz | | P |
| G.1 | Clearances | | P |
| G.2 | Creepage distances : | | P |

| | | | |
|---------|-------------------------------------------------|--|---|
| Annex J | Ultraviolet light conditioning test(see 13.6.4) | | N |
| J.1 | General | | N |
| J.2 | Mounting of test samples: | | N |
| J.3 | Carbon-arc light-exposure apparatus | | N |
| J.4 | Xenon-arc light-exposure apparatus | | N |

| | | | | |
|--------------------|--------------------------------------------------|------------|--------------------|----------------------------|
| K | ANNEX K: list of critical components | | | P |
| object/part No. | manufacturer/ trademark | type/model | technical data | mark(s) of conformity1) |
| Terminal Blocks | 3M COMPANY COMMUNICATION MARKETS DIV (CMD) | -- | 600V; 130 degree C | UL |

| | | | | |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------|--------|---|
| 4.3 | Table: THERMAL TEST (NORMAL OPERATION) | | | P |
| VOLTAGE (V) | A | | | |
| DURATION | | | | |
| test until steady condition – temperature change not more than + /-1K/hour | | | | |
| Supply voltage within $\pm 1\%$ of the test voltage. | | | | |
| OPERATION MODE / TEST CONDITION: | | | | |
| 1.It shall not vary by more than ± 1 °C during measurements and during a preceding period long enough to affect the results. | | | | |
| 2. a) Supplied by photovoltaic supply sources | | | | |
| b) Supplied by other d.c sources | | | | |
| c) The test voltage is 0.9 and 1.1 times t the rated voltage range if supplied at mains supply. | | | | |
| 3 Performed under the least favorable loading conditions. | | | | |
| AMB. TEMP. | t1 = 25.1 °C (before test) | t2 = 25.0 °C (after test) | | |
| Location / Part (by thermocouple) | Temp. (°C) | Limit (°C) | Result | |
| | A | | | |
| Internal wire | 65.3 | 85 | P | |
| Input terminal | 72.3 | 85 | P | |
| Output terminal | 68.2 | 85 | P | |

| | | | | |
|------------------------------------------|-----------------------------------------------------------------------------|------------------------|-----------------------|---|
| 7.5.2 | TABLE: Voltage test (dielectric strength test) (type test and routine test) | | | P |
| Test voltage applied between: From/To | Working voltage | Test voltage (V/AC) | Breakdown Yes / No | |
| Live parts to Output | < 600 | 1400VAC | No | |
| Remark: Test time is 60s | | | | |

Photo documentation

Photo 1

View:
IIP-241000BFL



Photo 2

View:
IIP-241000BFL

