

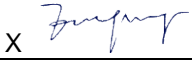



Prüfbericht-Nr.: Test report no.:	CN24GCU7 001	Auftrags-Nr.: Order no.:	244554199	Seite 1 von 18 Page 1 of 18
Kunden-Referenz-Nr.: Client reference no.:	2496578	Auftragsdatum: Order date:	26/10/2023	
Auftraggeber: Client:	Sany Silicon Energy (Zhuzhou) Co., Ltd. Room 518-50, Building 1, Longxin International, No.255, Tongxia Road, Tongtangwan Street, Shifeng District, Zhuzhou City, 412005, Hunan Province, P.R. China			
Prüfgegenstand: Test item:	Photovoltaic (PV) module			
Bezeichnung / Typ-Nr.: Identification / Type no.:	See module type designation on page 3			
Auftrags-Inhalt: Order content:	Cyclic(dynamic) mechanical load testing for photovoltaic (PV) modules			
Prüfgrundlage: Test specification:	IEC TS 62782:2016 Photovoltaic (PV) modules - Cyclic (dynamic) mechanical load testing			
Wareneingangsdatum: Date of sample receipt:	22/01/2024			
Prüfmuster-Nr.: Test sample no.:	See clause 6			
Prüfzeitraum: Testing period:	26/01/2024 - 21/03/2024			
Ort der Prüfung: Place of testing:	Refer to page 5			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date: 25/03/2024	Signed by: Anderson Ruan		Ausstellungsdatum: Issue date: 25/03/2024	Signed by: Eric Jiang
Stellung / Position:	Project Engineer		Stellung / Position:	Authorizer
Sonstiges / Other:	<ul style="list-style-type: none"> - Basic qualification for module types listed on page 3. - Valid only for the material combinations as listed on page 6-8. - The required tests were performed according to the standard IEC TS 62782: 2016 and the given pass criteria is according to IEC 61215-2:2016 & IEC 61730-2:2016. 			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet				
* Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>				

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 2 von 18
Page 2 of 18

Anmerkungen
Remarks

1	<p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p>
2	<p>Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. Informationen zur Verifizierung der Authentizität unserer Dokumente erhalten Sie auf folgender Webseite: go.tuv.com/digital-signature</p> <p><i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged. For information on verifying the authenticity of our documents, please visit the following website: go.tuv.com/digital-signature</i></p>
3	<p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.</p> <p>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p>
4	<p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p>

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 3 von 18
Page 3 of 18

Produktbeschreibung
Product description

1	Produktdetails <i>Product details</i>	
	<i>a) manufacturer's name, trademark or mark of origin (including address and contact information of the manufacturers)</i>	Sany Silicon Energy (Zhuzhou) Co., Ltd. Sany Energy Equipment Industrial Park, No.320 Qingshui Road, Shifeng District, Zhuzhou City, 412005, Hunan Province, P.R. China
	<i>b) type identification</i>	Max. System Voltage: up to 1500 VDC (Voc at STC): With ½ cut of mono c-Si cells: SYMN156TBDxxx (xxx=615-635, in steps of 5, 156 cells) SYMN144TBDxxx (xxx=555-585, in steps of 5, 144 cells) SYMN120TBDxxx (xxx=455-485, in steps of 5, 120 cells) SYMN108TBDxxx (xxx=415-440, in steps of 5, 108 cells) SYMN144R01TBDxxx (xxx=590-620, in steps of 5, 144 cells) SYMN120R01TBDxxx (xxx=490-520, in steps of 5, 120 cells) SYMN108R01TBDxxx (xxx=440-470, in steps of 5, 108 cells) xxx represents output power in Wp
	<i>c) technology</i>	c-Si module <input checked="" type="checkbox"/> thin film module <input type="checkbox"/>
	<i>d) maximum system voltage</i>	1000 V <input type="checkbox"/> 1500 V <input checked="" type="checkbox"/> Other <input type="checkbox"/> , _____
	<i>e) certified according to IEC 61215 / 61730</i>	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

Remarks:

Pass Criteria are not given in the published technical specifications (e.g. IEC TS 62782:2016) for power loss.

The given pass criteria are deduced from scientific publications IEC 61215-2:2016 comparing behavior in the field and in the lab and from inter-laboratory studies and own experiences.

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 4 von 18
Page 4 of 18

Produktbeschreibung
Product description

2 Zusammenfassung der Prüfergebnisse
Summary of test results

According to the inquiry, the cyclic (dynamic) mechanical load testing for photovoltaic (PV) modules should be assessed in accordance with IEC TS 62782:2016.

The tests of the requirements of IEC TS 62782:2016 were all fulfilled according to its regulations of the pass criteria. The above listed module types have been fully certified according to the IEC 61215-1:2016, IEC 61215-2:2016 and IEC 61730-1:2016, IEC 61730-2:2016 standards and it is the prerequisite to be certified cyclic (dynamic) mechanical load.

The tests have been performed on SYMN156TBD625 (BOM1) and SYMN156TBD620 (BOM2) as representative models. The test results are presented within this test report.

The differences are as below:

1. SYMN156TBDxxx are for modules with 156 pcs 182mm x 91mm Topcon solar cells;
2. SYMN144R01TBDxxx are for modules with 144 pcs half-cut 182.2mm x 95.8mm Topcon solar cells;
3. SYMN120R01TBDxxx are for modules with 120 pcs half-cut 182.2mm x 95.8mm Topcon solar cells;
4. SYMN108R01TBDxxx are for modules with 108 pcs half-cut 182.2mm x 95.8mm Topcon solar cells;

Critical materials of SYMN156TBDxxx and SYMN144R01TBDxxx keep the same with previously approved module type SYMN144TBDxxx based on test report CN23M7KD 001. No additional tests need to be considered necessary

The materials and combinations in below table have been approved on module in main license with certificate PV 50587008. No additional testing is considered necessary.

Object	Manufacturer / trademark	Type / model	Technical data / ratings	Representative model for testing
Solar cell	Sany Silicon Energy (Zhuzhou) Co., Ltd.	SYCN18AT16	N type mono c-Si cell with 16 dotted busbars 182.2mm×95.8mm±0.25mm Thickness=130μm±15μm	Compare the alternative materials have been approved, the only difference is the size changed. The declaraiion is in Annex 5 for details.

Remark:

This solar cell SYCN18AT16 can be only used with encapsulation material B602M (between front glass and cell) / B601HP (between cell and back glass) from CHANGZHOU BETTERIAL FILM TECHNOLOGIES CO., LTD. and EP304 (between front glass and solar cell) & F406PS (between solar cell and rear glass) from HANGZHOU FIRST APPLIED MATERIAL CO., LTD.

The test report is valid only for the materials as listed in annex 1 Constructional Data Form (CDF) of this test report.

The appendix of this test report includes the following annexes (16 pages in total):

Annex 1: Construction Date Form(CDF)

Annex 2: Photos documentation

Annex 3: EL images

Annex 4: IR images

Annex 5: Declaration

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 5 von 18
Page 5 of 18

Produktbeschreibung
Product description

Summary of test locations:

All the tests were performed at TÜV Rheinland (Suzhou) Co., Ltd., which is located at No.14 building and north half of No.10 workshop building, No.525, Yuewang Lingang South Road, Pingqian (Taicang) Modern Industrial Park, Shaxi Town, Taicang City, Jiangsu Province, P.R. China

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 6 von 18
Page 6 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
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—	List of test samples		
<input type="checkbox"/>	Random sampling from production (e.g. during factory audit or inline inspection)		—
<input type="checkbox"/>	Random sampling from the warehouse, container or transportation boxes		—
<input checked="" type="checkbox"/>	Modules have been submitted by the manufacturer/ client without random sampling by TÜV Rheinland		—
Sample no.	Sample SN	Remarks / constructional characteristics (e.g. cell, backsheet, frame type)	—
Module type: SYMN156TBD625 (BOM1)			
1-1	312012090004	Front cover: 2.0mm Semi-tempered AR coated glass from Hunan Kibing Solar Technology Co., Ltd. Encapsulation material: B602M (between front glass and cell) / B601HP (between cell and back glass) from CHANGZHOU BETTERIAL FILM TECHNOLOGIES CO., LTD Rear cover: 2.0mm Semi-Tempered back glass from Hunan Kibing Solar Technology Co., Ltd. Solar Cell: SYCN182T16 from Sany Silicon Energy (Zhuzhou) Co., Ltd. Frame: 30mm, 6005-T6 from CHANGSHU DONGNENG SOLAR TECHNOLOGY CO., LTD Adhesive of frame sealing: 1527 from H.B.Fuller (Suzhou) Advanced Material Co., Ltd. Cell connector: Φ0.26mm Sn60/Pb40 from Suzhou YourBest New-type Materials Co., Ltd.	

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 7 von 18
Page 7 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
1-2	312012090005	<p>String connector: 6.0mm x 0.3mm, 4.0mm x 0.3mm Sn60/Pb40 from Suzhou YourBest New-type Materials Co., Ltd.</p> <p>Fluxing agent: SF180 from ASAHI SOLDER TECHNOLOGY(WUXI) CO., LTD</p> <p>Fixing Tape: HZ UV-100 from Guangdong Sunrui New Material Co., Ltd.</p> <p>Junction box: PV-XT1609Nxyz from Suzhou Xiong Photovoltaic Technologies Co., Ltd.</p> <p>Cable: 62930 IEC 131 1 x 4.0mm² from Suzhou Xiong Photovoltaic Technologies Co., Ltd.</p> <p>Connector: PV-XT101.2 from Suzhou Xiong Photovoltaic Technologies Co., Ltd.</p> <p>Bypass diode: XT4050M-B from Suzhou Xiong Photovoltaic Technologies Co., Ltd.</p> <p>Adhesive of J-Box sealing: 1527 from H.B.Fuller (Suzhou) Advanced Material Co., Ltd.</p> <p>Potting Material in junction box: 1533 from H.B.Fuller (Suzhou) Advanced Material Co., Ltd.</p>	
Module type: SYMN156TBD620 (BOM2)			
2-1	2311012100003	<p>Front cover: 2.0mm Semi-tempered AR coated glass from CSG HOLDING CO., LTD.</p> <p>Encapsulation material: EP304 (between front glass and cell) / F406PS (between cell and back glass) from HANGZHOU FIRST APPLIED MATERIAL CO., LTD</p> <p>Rear cover: 2.0mm Semi-Tempered back glass from CSG HOLDING CO., LTD.</p> <p>Solar Cell: SYCN182T16 from Sany Silicon Energy (Zhuzhou) Co., Ltd.</p> <p>Frame: 30mm, 6005-T6 from Jiangsu Jiachen Aluminium Technology Co., Ltd</p> <p>Adhesive of frame sealing: HT906Z from Shanghai Huitian New Material Co., Ltd.</p> <p>Cell connector: Φ0.26mm Sn60/Pb40 from Changzhou Sheng Yue metal new material Co., Ltd.</p>	

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 8 von 18
Page 8 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
2-2	2311012100004	<p>String connector: 6.0mm x 0.3mm, 4.0mm x 0.3mm Sn60/Pb40 from Changzhou Sheng Yue metal new material Co., Ltd.</p> <p>Fluxing agent: CX700 from Zhuhai Changxian New Materials Technology Co., Ltd.</p> <p>Fixing Tape: D60F6-2 from SuZhou Rongzhi Electronic Technology Co., Ltd</p> <p>Junction box: 3Qxy from QC Solar (Suzhou) Corporation</p> <p>Cable: 62930 IEC 131 1 x 4.0mm² from QC Solar (Suzhou) Corporation</p> <p>Connector: QC4.10-cds from QC Solar (Suzhou) Corporation</p> <p>Bypass diode: QCM4045 from QC Solar (Suzhou) Corporation</p> <p>Adhesive of J-Box sealing: HT906Z from Shanghai Huitian New Material Co., Ltd.</p> <p>Potting Material in junction box: 5299W-S from Shanghai Huitian New Material Co., Ltd.</p>	
Supplementary information: N/A			

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 9 von 18
Page 9 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
------------------	---	--	-------------------------

5	Initial measurements		
a)	Visual inspection in accordance with IEC 61215-2:2016 MQT 01.	See table "Visual inspection" 5 a)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
b)	Initial module stabilization procedure in accordance with IEC 61215-2 MQT 19.1.	See table "Initial stabilization" 5 b)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
c)	Maximum power performance in accordance with IEC 61215-2:2016 MQT 02.	See table "Maximum power determination" 5 c)	—
d)	Insulation test in accordance with IEC 61215-2:2016 MQT 03.	See table "Insulation test" 5 d)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
e)	Wet leakage current test in accordance with IEC 61215-2: 2016 MQT 15.	See table "Wet leakage current test" 5 e)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
f)	Electroluminescence (EL) scan using a forward bias current between 0.1*Isc and 1*Isc.	See table "Electroluminescence (EL) images" 5 f)	—
g)	Infrared Thermography (IR) scan using a forward bias current between 1*Imp and 2*Imp	See table "Infrared Thermography (IR) images" 5 g)	—
6	Procedure		
	Cyclic(dynamic) mechanical load test		
	1000 cycles with the positive and negative load application of 1000 Pa(±100Pa) and a rate of 3-7 cycles per minute. Monitor continuity throughout the test.	See table "Cyclic (dynamic) mechanical load test"	—
7	Final measurement		
a)	Visual inspection in accordance with IEC 61215-2:2016 MQT 01.	See table "Visual inspection" 7 a)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
b)	Final module stabilization procedure in accordance with IEC 61215-2 MQT 19.2.	See table "Final stabilization" 7 b)	P <input type="checkbox"/> F <input type="checkbox"/> N/A <input checked="" type="checkbox"/> N/T <input type="checkbox"/>

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 10 von 18
Page 10 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
------------------	---	--	-------------------------

c)	Maximum power performance in accordance with IEC 61215-2:2016 MQT 02. The degradation of maximum output power between initial and final power measurement does not exceed 5 %.	See table "Maximum power determination" 7 c)	—
d)	Insulation test in accordance with IEC 61215-2:2016 MQT 03.	See table "Insulation test" 7 d)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
e)	Wet leakage current test in accordance with IEC 61215-2: 2016 MQT 15.	See table "Wet leakage current test" 7 e)	P <input checked="" type="checkbox"/> F <input type="checkbox"/> N/A <input type="checkbox"/> N/T <input type="checkbox"/>
f)	Electroluminescence (EL) scan using a forward bias current between 0.1*Isc and 1*Isc.	See table "Electroluminescence (EL) images" 7 f)	—
g)	Infrared Thermography (IR) scan using a forward bias current between 1*Imp and 2*Imp	See table "Infrared Thermography (IR) images" 7 g)	—
	Annex A		
	Thermal cycling test (50 cycles) and Humidity freeze test in accordance with IEC 61215-2:2016 MQT 11 and MQT 12.	See table "Stress test a)"	P <input type="checkbox"/> F <input type="checkbox"/> N/A <input checked="" type="checkbox"/> N/T <input type="checkbox"/>
	Damp heat test in accordance with IEC 61215-2:2016 MQT 12	See table "Stress test b)"	P <input type="checkbox"/> F <input type="checkbox"/> N/A <input checked="" type="checkbox"/> N/T <input type="checkbox"/>

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 11 von 18
Page 11 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
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5 a)	Visual inspection (initial) – IEC 61215-2:2016 MQT 01		
Test date (DD/MM/YYYY)		26/01/2024	—
Sample no.	Requirement	Nature and position of initial findings	—
1-1	No major visual defects	No major visual defects	P
1-2		No major visual defects	P
2-1	No major visual defects	No major visual defects	P
2-2		No major visual defects	P
Supplementary information:			

5 b)	Initial stabilization – IEC 61215-2:2016 MQT 19.1				
<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight <input type="checkbox"/> Other stabilization procedures					
Test date (DD/MM/YYYY)			21/02/2024		—
Irradiance [W/m²]			1000		
Module temperature [°C]			50		
Sample no.	Test	Integrated irradiation [kWh/m²]	P _{max} [W]	Stabilization [%]*	—
1-1	Initial	—	627.9	0.06	P
	Light-soaking 1	5	628.0		
	Light-soaking 2	5	627.6		
1-2	Initial	—	626.9	0.14	P
	Light-soaking 1	5	627.1		
	Light-soaking 2	5	626.2		
2-1	Initial	—	622.0	0.06	P
	Light-soaking 1	5	621.9		
	Light-soaking 2	5	621.6		
2-2	Initial	—	621.4	0.64	P
	Light-soaking 1	5	621.8		
	Light-soaking 2	5	617.8		
Supplementary information:					
* Stabilization criterion: (P _{max} -P _{min})/P _{avg} ≤ 1 % for three consecutive measurements.					
Initial measurement corresponds to MQT 02 of IEC 61215.					

Absatz <i>Clause</i>	Anforderungen - Prüfungen / <i>Requirements - Tests</i>	Messergebnisse – Bemerkungen / <i>Measuring results - Remarks</i>	Bewertung <i>Evaluation</i>
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5 c)	Maximum power determination (initial) – IEC 61215-2:2016 MQT 02						
Test method			<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight				—
Test date (DD/MM/YYYY)			21/02/2024				
Ambient temperature [°C]			25 ± 2				
Irradiance [W/m²]			1000*				
Module temperature [°C]			25 ± 1				
Sample no.	P _{max} [W]	V _{mpp} [V]	I _{mpp} [A]	V _{oc} [V]	I _{sc} [A]	FF [%]	
1-1	626.6	48.12	13.022	56.59	13.722	80.7	—
1-2	627.6	48.05	13.061	56.62	13.752	80.6	—
2-1	621.6	47.92	12.970	56.58	13.667	80.4	—
2-2	617.8	47.78	12.929	56.53	13.677	79.9	—
*A pulse solar simulator class AAA conforming to the requirements of IEC 60904-9 is used.							
Supplementary information: -							

5 d)	Insulation test (initial) – IEC 61215-2:2016 MQT 03					
Test date (DD/MM/YYYY)				23/02/2024		—
Maximum system voltage [V _{DC}]				1500		
High voltage applied [V _{DC}]				4000/8000		
Insulation resistance measured at [V _{DC}]				1500		
Sample no.	R _{iso}	A	R _{iso} ·A	Dielectric breakdown		—
	[GΩ]	[m²]	[GΩ·m²]	Yes (description)	No	
1-1	8.65	2.80	24.22	-	No	P
1-2	8.63	2.80	24.16	-	No	P
2-1	13.30	2.80	37.24	-	No	P
2-2	13.40	2.80	37.52	-	No	P
Supplementary information:						
Minimum requirement is 0.04 GΩ·m² for A > 0.1 m² and 0.4 GΩ for A ≤ 0.1 m².						

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 13 von 18
Page 13 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
------------------	---	--	-------------------------

5 e)	Wet leakage current test (initial) – IEC 61215-2:2016 MQT 15			
Test date (DD/MM/YYYY)		23/02/2024		—
Insulation resistance measured at [V _{DC}]		1500		
Solution resistivity [Ω•cm]		≤ 3500		
Solution temperature [°C]		22 ± 2		
Sample no.	R _{iso}	A	R _{iso} · A	—
	[MΩ]	[m²]	[MΩ·m²]	
1-1	4190.0	2.80	11732.0	P
1-2	3750.0	2.80	10500.0	P
2-1	4190.0	2.80	11732.0	P
2-2	3890.0	2.80	10892.0	P
Supplementary information: Minimum requirement is 40 MΩ·m².				

5 f)	Electroluminescence (EL) images (Initial)		
Test date (DD/MM/YYYY)		23/02/2024	—
Forward bias current [A]		13.63	—
Serial no.	Remarks		—
1-1	N/A		—
1-2	N/A		—
2-1	N/A		—
2-2	N/A		—
Supplementary information: Refer to annex 3: EL images of the appendix for more details.			

5 g)	Infrared Thermography (IR) images (Initial)		
Test date (DD/MM/YYYY)		23/02/2024	—
Forward bias current [A]		13.62	—
Serial no.	Remarks		—
1-1	N/A		—
1-2	N/A		—
2-1	N/A		—
2-2	N/A		—
Supplementary information: Refer to annex 4: IR-images of the appendix for more details.			

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 14 von 18
Page 14 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
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6	Cyclic (dynamic) mechanical load test		
Test date (DD/MM/YYYY)		19/03/2024	—
Pressure mechanical load applied [Pa]		1000±100	—
Tensile mechanical load applied [Pa]		1000±100	—
Cycles		1000	—
Speed of each cycle [cycles/minute]		7	—
Module temperature [°C]		25 ± 2	—
Monitoring current [A]		0.5	—
Mounting method		4 clamps and 2 rails	—
Sample #		Electrical continuity of module during the test (open circuits: yes/no)	—
1-2		no	P
2-2		no	P
Supplementary information: Load was applied pneumatically.			

Absatz <i>Clause</i>	Anforderungen - Prüfungen / <i>Requirements - Tests</i>	Messergebnisse – Bemerkungen / <i>Measuring results - Remarks</i>	Bewertung <i>Evaluation</i>
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7 a)	Visual inspection (final) – IEC 61215-2:2016 MQT 01		
Test date (DD/MM/YYYY)		21/03/2024	—
Sample no.	Requirement	Nature and position of initial findings	—
1-2	No major visual defects	No major visual defects	P
2-2	No major visual defects	No major visual defects	P
Supplementary information: -			

7 c)	Maximum power determination (final) – IEC 61215-2:2016 MQT 02							
Test method				<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight				—
Test date (DD/MM/YYYY)				21/03/2024				
Ambient temperature [°C]				25 ± 2				
Irradiance [W/m²]				1000*				
Module temperature [°C]				25 ± 1				
Sample No.	P _{max} [W]	V _{mpp} [V]	I _{mpp} [A]	V _{oc} [V]	I _{sc} [A]	FF [%]	Degradation [%]	—
1-2	626.2	48.01	13.051	56.52	13.742	80.5	-0.22	P
2-2	616.6	47.68	12.919	56.51	13.657	79.8	-0.19	P
*A pulse solar simulator class AAA conforming to the requirements of IEC 60904-9 is used.								
Supplementary information: <i>Negative</i> degradation means power <i>loss</i> .								

Absatz <i>Clause</i>	Anforderungen - Prüfungen / <i>Requirements - Tests</i>	Messergebnisse – Bemerkungen / <i>Measuring results - Remarks</i>	Bewertung <i>Evaluation</i>
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7 d)	Insulation test (final) – IEC 61215-2:2016 MQT 03					
Test date (DD/MM/YYYY)				21/03/2024		—
Maximum system voltage [V _{DC}]				1500		
High voltage applied [V _{DC}]				4000/8000		
Insulation resistance measured at [V _{DC}]				1500		
Sample no.	R _{iso}	A	R _{iso} ·A	Dielectric breakdown		—
	[GΩ]	[m²]	[GΩ·m²]	Yes (description)	No	
1-2	8.25	2.80	23.10	-	No	P
2-2	12.90	2.80	36.12	-	No	P
Supplementary information:						
Minimum requirement is 0.04 GΩ·m² for A > 0.1 m² and 0.4 GΩ for A ≤ 0.1 m².						

7 e)	Wet leakage current test (final) – IEC 61215-2:2016 MQT 15			
Test date (DD/MM/YYYY)		21/03/2024		—
Insulation resistance measured at [V _{DC}]		1500		
Solution resistivity [$\Omega \cdot \text{cm}$]		≤ 3500		
Solution temperature [$^{\circ}\text{C}$]		22 \pm 2		
Sample no.	R _{iso}	A	R _{iso} ·A	—
	[M Ω]	[m ²]	[M $\Omega \cdot \text{m}^2$]	
1-2	3710.0	2.80	10388.0	P
2-2	4150.0	2.80	11620.0	P
Supplementary information: Minimum requirement is 40 M $\Omega \cdot \text{m}^2$.				

7 f)	Electroluminescence (EL) images (final)		
Test date (DD/MM/YYYY)		21/03/2024	—
Forward bias current [A]		13.64	—
Serial no.		Remarks	—
1-2		N/A	—
2-2		N/A	—
Supplementary information: Refer to annex 3: EL images of the appendix for more details.			

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 17 von 18
Page 17 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen / Measuring results - Remarks	Bewertung Evaluation
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7 g)	Infrared Thermography (IR) images (final)		
Test date (DD/MM/YYYY)		21/03/2024	—
Forward bias current [A]		13.63	—
Serial no.	Remarks		—
1-2	N/A		—
2-2	N/A		—
Supplementary information: Refer to annex 4: IR-images of the appendix for more details.			

Prüfbericht-Nr.: CN24GCU7 001
Test report no.:

Seite 18 von 18
Page 18 of 18

Anmerkungen
Remarks

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