Prüfbericht - Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.*:	**31985240 016** **ULR: TC568824400000123F**	**Auftrags-Nr.** *Order no.*:	146811381
Kunden-Referenz-Nr.: *Client reference no.*:	1078956	**Auftragsdatum:** *Order date:*	05/07/2023
Auftraggeber: *Client*:	Vikram Solar Ltd, The Chambers, 8th Floor, 1865, Rajdanga Main Road,Kolkata-700107, India		
Prüfgegenstand: *Test item*:	Photovoltaic (PV) module		
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	With Mono crystalline Topcon cells: HYPERSOL VSMDH. 72.AAA.05 and refer page 3 for other model numbers		
Auftrags-Inhalt: *Order content*:	Extension qualification to additional sets of components with certificate No. PV 60172740		
Prüfgrundlage: *Test specification*:	Photovoltaic (PV) modules IEC 61215-1:2021; IEC 61215-1-1:2021; IEC 61215-2:2021; EN IEC 61215-1-1:2021; EN IEC 61215-2:2021 CAN/CSA-C22.2 No. 61730-1:19, CAN/CSA-C22.2 No. 61730-2:19		
Wareneingangsdatum: *Date of sample receipt*:	23/07/2023 – 14/09/2023		
Prüfmuster-Nr.: *Test sample no:*	Refer List of Test samples		
Prüfzeitraum: *Testing period*:	28/07/2023 to 24/01/2024		
Ort der Prüfung: *Place of testing*:	#27/B, 2nd Cross Road, Electronics City Phase-1, 560100, Bengaluru, India		
Prüflaboratorium: *Testing laboratory:*	TUV Rheinland (India) Pvt. Ltd.		
Prüfergebnis*: *Test result*:*	Pass		

geprüft von: *tested by:* K.Ganesh Kamath	X	**genehmigt von:** *authorized by*: Johannes Stang	X 2024.04.15 21:32:28 +02'00'
Datum: *Date:* 28-02-2024		**Ausstellungsdatum:** *Issue date:*	
Stellung / Position:	Sr.Manager-Products(S&C)	**Stellung** / Position:	Reviewer

Sonstiges / *Other*:

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the 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*

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.
This test report only relates to the a. m. 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.
V05

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Anmerkungen
Remarks

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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen 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. *The decision rule for statements of conformity 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*

Produktbeschreibung
Product description

I	**General**	
1	**Product details**	
1.1	**Module type designation**	
	<u>with Topcon Bifacial Half cut 182x91mm(M10) cells :</u> **HYPERSOL VSMDH.72.AAA.05(with AAA= 565 - 580Wp in steps of 1 with 144 cells)** **HYPERSOL VSMDH.60.AAA.05(with AAA= 450 - 460Wp in steps of 1 with 120 cells)** **HYPERSOL VSMDH.54.AAA.05(with AAA= 400 - 425Wp in steps of 1 with 108 cells)** **<u>with Mono Bifacial Half cut 182x91mm(M10) cells :</u>** **PARADEA VSMDH.78.AAA.05(with AAA= 585 - 605Wp in steps of 1 with 156 cells)** PARADEA VSMDH.72.AAA.05(with AAA= 535 - 555Wp in steps of 1 with 144 cells) PARADEA VSMDH.60.AAA.05(with AAA= 420 - 440Wp in steps of 1 with 120 cells) PARADEA VSMDH.54.AAA.05(with AAA= 400 - 405Wp in steps of 1 with 108 cells) AAA represents output power in Wp Refer to Constructional Data Form (CDF) no. **31985240.016** for electrical ratings	
1.2	**Product safety ratings**	
	The modules are intended for a maximum operating altitude [meters above sea level] of [m]	≤ 2000
	Recommended maximum series/parallel module configurations	Series: Maximum of 30 modules in series There is no limit to the maximum number of strings combined in parallel. However each string must include over current protection
1.3	**Classification, applications and intended use**	
	The module has been evaluated for the following Class (IEC 61140):	☐ Class 0 ☒ Class II ☐ Class III

2	**Used materials** See Constructional Data Form (CDF) no. **31985240.016**
3	**Address(es) of the manufacturing site(s)** 1. Vikram Solar Limited (Unit-II), SEC-II, Falta, Special Economic Zone, Falta, District: South 24-Parganas, P. S.: Ramnagar,P. O.: Falta S.O, Pin: 743504, West Bengal, India Inspection Report.no: **19630409 018(October 2023)** 2. Vikram Solar Limited, B1000A,B 1100C, Indospace Industrial Park, Panruti Pvt Ltd, Survey No-2A, SRIPERUMBUDUR Taluk, Panaiyur Village, Kanchipuram. India Inspection Report.no: **19631957 007(December 2023)**

Produktbeschreibung
Product description

4 Summary of test results

According to the inquiry of the customer for an Extension qualification for the already certified module types of PARADEA VSMDH series according to IEC 61215-1:2021/ EN IEC 61215-1: 2021 and CSA C22.2 NO. 61730, with a Topcon cell types, a full test sequence was conducted on HYPERSOL VSMDH.72.575.05 and a test sequence of Visual Inspection, Initial stabilization, Insulation test, Wet leakage current test, Hotspot Endurance test,TC-50, HF-10, TC-200, DH-1000, PID tests were conducted on the module types HYPERSOL VSMDH. 72.575.05 and PARADEA VSMDH. 72.590.05 for additional component changes

All of the required tests of the standards IEC 61215/ EN 61215 and CSA C22.2 NO. 61730 were passed according to its regulations of the pass criteria. It is therefore declared, that the photovoltaic modules of the above mentioned types fulfil the requirements of the standards and it is recommended that certification should be granted.

The Static mechanical load test was performed with 3600Pa positive (downward) load and with 1600Pa negative (upward) load with safety factor of 1.5

Note:

1. *The labels were modified for the updation on BNPI values and both the initial and modified final labels were documented in Annexure of this report*
2. *Only the results of CSA C22.2 NO. 61730, tests were used for certification and the additional data/results are acc. IEC 61215:2021 and are informative*

Test failures: None

Listing of new material or process tested within this project and relevant combination (if applicable):

Retesting for all listed additional materials is done acc. IEC TS 62915 Ed. 2 (2023) covering IEC 61215:2021 and CSA C22.2 NO. 61730, requirements.

Set-01-Full qualification testing

Extension qualification to additional cell:

1. JTPV - Mono Crystalline Bi-facial-16BB Topcon cell

Extension qualification to additional front cover:

1. Gujarat Borosil Limited – 2mm, Semi Tempered Front AR Coated Glass

Extension qualification to additional Back cover:

1. Gujarat Borosil Limited – 2mm, Semi Tempered Glass

Extension qualification to additional Cell connector Type:

1. Shanghai SunBy Solar Technology Co.,Ltd. - Ø=0.26/ Sn60Pb40

Extension qualification to additional Flux Type:

1. Arbital Solutions Private Limited - ARSOL- 313

Extension qualification to additional Junction box along with cable & Connector

1. Zhejiang Renhe Photovoltaic Technology Co., Ltd, - FT50xy

Extension qualification to additional Encapsulation type:

1. Hangzhou First PV Material Co., Ltd - EP304(Front Side) & F406PS (Back Side)

Set-02

Extension qualification to additional cell:

1. Solar space Technology Co., Ltd- Mono Crystalline Bi-facial Topcon cell -16BB

Extension qualification to additional Cell connector Type:

1. Vidhya wires. - Ø=0.26/ Sn60Pb40

Set -03

Extension qualification to additional cell:

1. JTPV- 182 mono-crystalline Bifacial solar cell-10bb

This test report includes a history of reporting and certification and photo documentation in the appendix.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
5	**Test specification**		
	IEC 61215-1:2021/EN IEC 61215-1: 2021: Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements	applicable	—
	IEC 61215-1-1:2021/ EN IEC 61215-1-1:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules	applicable	
	IEC 61215-1-2:2021/EN IEC 61215-1-2:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules	not applicable	
	IEC 61215-1-3:2021/EN IEC 61215-1-3:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules	not applicable	
	IEC 61215-1-4:2021/EN IEC 61215-1-4:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)2 based photovoltaic (PV) modules	not applicable	
	IEC 61215-2:2021/EN IEC 61215-2:2021 Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test procedures	applicable	
	CSA C22.2 NO. 61730-1:19 Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction	applicable	
	CSA C22.2 NO. 61730-2:19 Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing	applicable	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

6	**List of test samples**

☐ The modules tested were taken at random from a production batch and subjected to manufacturer's normal quality control and inspection for safety testing	—
☒ The modules tested were prototypes of a new design and not taken from a production batch.	

Sample no.	Sample SN	Test sequence	Model	(e.g. cell, back sheet, frame type) Remarks / constructional characteristics
A003527777-001	1024580002	A	HYPERSOL VSMDH. 72.575.05	**SET-01** Cell: CZJT-182M-16D1, 16bb solar cell manufactured by JTPV Front Cover: Semi-tempered AR Coated glass, by Gujarat Borosil Limited -2mm Back Cover: Semi Tempered glass, by Gujarat Borosil Limited -2mm EVA: EP304 (Front Side), F406PS (Back Side) by Hangzhou First PV Material Co., Ltd Frame: Anodized Al frame, manufactured by Taihe new energy JB: Type: FT50xy, by Zhejiang Renhe Photovoltaic Technology Co., Ltd, Adhesive: ADSIL PV 555 by Adarsha Specialty Chemicals Pvt Ltd Potting : ADSIL JB597, manufactured by Adarsha Specialty Chemicals Pvt Ltd. Cell connector: Shanghai SunBy Solar Technology Co.,Ltd. - Ø=0.26/ Sn60Pb40 Flux: Arbital Solutions Private Limited - ARSOL- 313
A003527777-002	1024580012	B1	HYPERSOL VSMDH. 72.575.05	
A003527777-004	1024580020	B2	HYPERSOL VSMDH. 72.575.05	
A003527777-005	1024580032	C1	HYPERSOL VSMDH. 72.575.05	
A003527777-006	1024580035	C2	HYPERSOL VSMDH. 72.575.05	
A003527777-007	1024580039	D1	HYPERSOL VSMDH. 72.580.05	
A003527777-008	1024580040	D2	HYPERSOL VSMDH. 72.575.05	
A003527777-009	1024580044	E1	HYPERSOL VSMDH. 72.580.05	
A003527777-010	1024580048	E2	HYPERSOL VSMDH. 72.575.05	
A003527777-015	1024580058	K1	HYPERSOL VSMDH. 72.575.05	
A003527777-016	1024580059	K2	HYPERSOL VSMDH. 72.575.05	
A003527777-017	1024580060	K3	HYPERSOL VSMDH. 72.575.05	
A003527777-027	1024590015	K4	HYPERSOL VSMDH. 72.575.05	
A003527777-011	1024580049	M	HYPERSOL VSMDH. 72.575.05	
A003562285-001	1024590006	I	HYPERSOL VSMDH. 72.575.05	
A003562285-002	1024580037	H	HYPERSOL VSMDH. 72.575.05	
A003527777-028	1024590009	G1	HYPERSOL VSMDH. 72.575.05	
A003527777-029	1024590014	G-1	HYPERSOL VSMDH. 72.575.05	
A003527777-030	1024590012	G-2	HYPERSOL VSMDH. 72.575.05	
A003527777-031	1024590005	F	HYPERSOL VSMDH. 72.575.05	
A003527777-003	1024580019	B3	HYPERSOL VSMDH. 72.575.05	
A003527777-012	1024580051	J1	HYPERSOL VSMDH. 72.575.05	
A003527777-013	1024580053	J2	HYPERSOL VSMDH. 72.575.05	
A003527777-014	1024580054	J3	HYPERSOL VSMDH. 72.575.05	
A003527777-036	22840607	120 cell low	HYPERSOL VSMDH. 60.450.05	
A003527777-039	22840611	120 cell low	HYPERSOL VSMDH. 60.450.05	
A003527777-037	22840608	120 cell high	HYPERSOL VSMDH. 60.460.05	
A003527777-038	22840609	120 cell high	HYPERSOL VSMDH. 60.460.05	
A003527777-042	22771995	108 cell low	HYPERSOL VSMDH. 54.400.05	
A003527777-043	22771996	108 cell low	HYPERSOL VSMDH. 54.400.05	
A003527777-040	22771992	108 cell high	HYPERSOL VSMDH. 54.425.05	
A003527777-041	22771993	108 cell high	HYPERSOL VSMDH. 54.425.05	

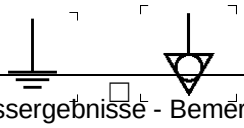
Absatz	**Photovoltaic (PV) modules**			Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*			*Measuring results - Remarks*	*Result*
A003527777-018	1024580062	A	HYPERSOL VSMDH. 72.575.05	Cell: 16bb, 182mm Monocrystalline Bifacial Perc solar cell manufactured by Solarspace Technology Co., Ltd. Front Cover: Semi-tempered AR Coated glass, by Gujarat Borosil Limited Back Cover: Semi Tempered glass, by Gujarat Borosil Limited EVA: EP304 (Front Side), F406PS (Back Side) by Hangzhou First PV Material Co., Ltd Frame: Anodized Al frame, manufactured by Taihe new energy JB: Type: FT50xy, by Zhejiang Renhe Photovoltaic Technology Co., Ltd, Frame Adhesive: ADSIL PV 555 by Adarsha Specialty Chemicals Pvt Ltd Potting : ADSIL JB597, manufactured by Adarsha Specialty Chemicals Pvt Ltd	
A003527777-019	1024580063	B2	HYPERSOL VSMDH. 72.575.05		
A003527777-020	1024580064	B2	HYPERSOL VSMDH. 72.575.05		
A003527777-025	1024580079	C1	HYPERSOL VSMDH. 72.565.05		
A003527777-026	1024590037	C2	HYPERSOL VSMDH. 72.575.05		
A003527777-021	1024580068	D1	HYPERSOL VSMDH. 72.575.05		
A003527777-022	1024580069	D2	HYPERSOL VSMDH. 72.575.05		
A003527777-023	1024580075	E1	HYPERSOL VSMDH. 72.575.05		
A003527777-024	1024580076	E2	HYPERSOL VSMDH. 72.565.05		
A003527777-033	1024580080	K1	HYPERSOL VSMDH. 72.575.05		
A003527777-034	1024590038	K2	HYPERSOL VSMDH. 72.575.05		
A003527777-035	1024590032	K3	HYPERSOL VSMDH. 72.575.05		
A003527777-032	1024590007	K4	HYPERSOL VSMDH. 72.575.05		
A003527778-015	51037271	A	PARADEA VSMDH. 78.590.05	**SET-03** Cell: 10BB-Bifacial-Topcon cell by Jupiter International JTPV Back sheet: Semi Tempered Glass, manufactured by Xinyi Solar EVA: F406PS (Front Side) EP308(Back Side) By Hangzhou First PV Material Co., Ltd Front cover: Semi Tempered Front AR Coated Glass, manufactured by Xinyi Solar Junction box: Type: PV-JB12x, by Suzhou UKT New Energy Technology CO., Ltd. Adhesive: 1527, by Tonsan (H.B. Fuller). Potting: Zhengzhou Zhongyuan Silande High Technology Co., Ltd with model no: MF962L Flux: Model no: RC PV FLUX 9BB, soldering flux manufactured by Reality chemical.	
A003527778-016	51037238	B1	PARADEA VSMDH. 78.590.05		
A003527778-017	51037275	B2	PARADEA VSMDH. 78.590.05		
A003527778-022	51037257	C1	PARADEA VSMDH. 78.590.05		
A003527778-023	51037254	C2	PARADEA VSMDH. 78.590.05		
A003527778-018	51037249	D1	PARADEA VSMDH. 78.590.05		
A003527778-019	51037251	D2	PARADEA VSMDH. 78.590.05		
A003527778-020	51037269	E1	PARADEA VSMDH. 78.590.05		
A003527778-021	51037270	E2	PARADEA VSMDH. 78.590.05		
A003527778-024	51037264	K1	PARADEA VSMDH. 78.590.05		
A003527778-025	51037262	K2	PARADEA VSMDH. 78.590.05		
A003527778-026	51037265	K3	PARADEA VSMDH. 78.590.05		
A003527778-027	51037266	K4	PARADEA VSMDH. 78.590.05		
A003527778-028	51037235	M	PARADEA VSMDH. 78.590.05		
A003527778-029	51037272	B3	PARADEA VSMDH. 78.590.05		
A003599023-001	51110599	156 cell high	PARADEA VSMDH. 78.605.05		
A003599023-002	51110600	156 cell high	PARADEA VSMDH. 78.605.05		
A003599023-005	51037276	156 cell low	PARADEA VSMDH. 78.585.05		
A003599023-006	51037268	156 cell low	PARADEA VSMDH. 78.585.05		

Supplementary information: See test chart in Appendix A for full test sequences.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
7	**Requirements for design and construction (Clause 5 of IEC/EN 61215-1 and CSA C22.2 NO. 61730-1)**		
7.1	**General (Clause 5.1 of CSA C22.2 NO. 61730-1)**		
	Incorporation of a PV module into the final assembly does not require any alteration of the PV module from its originally evaluated form. (It is not provided in subassemblies).	PV modules are completely assembled.	P
	Product shipped from the factory	☒ completely assembled ☐ as subassemblies	—
	Equipotential bonding continuity is not interrupted by installation.	Confirmed by test MST 13	P
	Any adjustable or movable structural part is provided with a locking device.	No such parts	-
	PV modules do not have accessible burrs, sharp edges or sharp points.	Compliance checked by tests MST 01 and MST 06.	P
	Parts are prevented from loosening or turning if this results in a risk of fire, electric shock, or injury to persons.	Compliance checked by tests MST 01	P
7.2	**Marking and documentation (Clause 5.2 of CSA C22.2 NO. 61730-1 and Clause 5 of IEC/EN 61215-1)**		
	Instructions related to safety are in an official language of the country where the equipment is to be installed.	Marking and documentation are written in English and french	-
7.2.1	**Marking (Clause 5.2.2 of CSA C22.2 NO. 61730-1 and Clause 5.1 of IEC/EN 61215-1)**		
7.2.1.1	**General (Clause 5.2.2.1 of CSA C22.2 NO. 61730-1 and Clause 5.1 of IEC/EN 61215-1)**		
	Each PV module includes the following clear and indelible markings:	Compliance checked by tests MST 01 and MST 05	—
	a) Name, registered trade name, or registered trade mark of manufacturer	Marked on type label	P
	b) Type or model number designation	Marked on type label	P
	c) Serial number (unless marked on other part of product)	Marked on type label	P
	d) Date and place of manufacture; alternatively serial number assuring traceability of date and place of manufacture	Available on Type label	P
	The manufacturer's identification is in a traceable code if the product is identified by the brand or trademark owned by a private labeler.	N/A	P
	The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code	Provided on Back label	P
	- does not repeat in less than 10 years	Complied	P
	- does not require reference to the production records of the manufacturer to determine when the product was manufactured.	Complied	P
	e) Polarity of terminals or leads	"+" and "-" indicated on terminal	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	f) Maximum system voltage or "V_{sys}"	Marked on type label	P
	g) Class of protection against electrical shock, in accordance with Clause 4 of CSA C22.2 NO. 61730-1	Marked on type label	P
	h) Voltage at open-circuit or "V_{oc}" including manufacturing tolerances	Marked on type label	P
	i) Current at short-circuit or "I_{sc}" including manufacturing tolerances	Marked on type label	P
	j) Maximum power or "P_{max}" including manufacturing tolerances	Marked on type label	P
	k) Maximum overcurrent protection rating	Maximum series fuse rating indicated	P
	l) Short-circuit current bifaciality coefficient φ_{Isc} Open-circuit voltage bifaciality coefficient φ_{Voc} Maximum power bifaciality coefficient φ_{Pmax}	Marked on type label	P
	m) Minimum radius of curvature	N/A	-
	All electrical data are shown at standard test conditions (STC) (1000 W/m², (25 ± 2) °C, AM 1.5 according to IEC 60904-3).	Marked on type label	P
	Description of measurement of BNPI (AM 1.5, T = 25 °C, Irradiance = 1000W/m² + φ•135W/m²)	Marked on type label	P
	PV connectors or wiring are marked with a symbol or/and hint „Do not disconnect under load". Symbol or/and warning notice is imprinted or labelled close to connector.	Symbol, e.g. / warning notice indicated on connectors	P
	For Class II and Class 0 PV modules, the (IEC 60417-6042: Caution, risk of electric shock) symbol is applied near the PV module electrical connection means.	Electrical hazard symbol indicated on type label	P
	PV modules are marked to indicate the class.	☒ class II: ☐ class III: ☐ class 0: no symbol	
	PV modules provided with terminals for field wiring rated only for use with copper wire are marked, at or adjacent to the terminals, with the statement "Use copper wire only", "Cu only", or the equivalent.	N/A	—
	PV modules provided with terminals for field wiring rated only for use with a different specific wiring material are marked with a similar statement referring to the rated material.	N/A	—
	A module employing a nonmetallic junction box having a threaded or unthreaded opening is marked "For use with nonmetallic conduit systems only" or the equivalent.	Compliance checked by MST 01	P

7.2.1.2	**Symbols (Clause 5.2.2.2 of CSA C22.2 NO. 61730-1**

Absatz	**Photovoltaic (PV) modules**	☒ Messergebnisse - Bemerkungen	- Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
7.2.1.2.1	**Equipotential bonding (Clause 5.2.2.2.1 of CSA C22.2 NO. 61730-1)**		
	A wiring terminal or bonding location for equipotential bonding is identified with:		
	No other terminal or location is identified in this manner.	Compliance checked by MST 01	P
7.2.1.2.2	**Functional earthing (Clause 5.2.2.2.2 of CSA C22.2 NO. 61730-1)**		
	Field installed functional earthing conductor is identified with the symbol:		N/A
7.2.1.2.1	**Equipment bonding (Clause 5.2.2.2.1 of CSA C22.2 NO. 61730-1)**		
	A wiring terminal or bonding location for equipotential bonding is identified with:		P
	No other terminal or location is identified in this manner.		
7.2.2	**Documentation (Clause 5.2.3 of CSA C22.2 NO. 61730-1 and Clause 5.2 of IEC/EN 61215-1)**		
	Documentation concerning electrical and mechanical installation is provided.	Available in installation manual	P
	The documentation states the class for protection against electrical shock under which the PV module was qualified and any specific limitations required for that class.	Available in installation manual	P
	Environmental conditions to which the module has been qualified are stated.	Available in installation manual	P
	- concerning temperature range, typically -40 °C to +40 °C.	Available in installation manual;	P
	- concerning wind/snow load including safety factor.	Available in installation manual	P
	The documentation states: “The module is considered to be in compliance with this standard only when the module is mounted in the manner specified by the mounting instructions. A module with exposed conductive parts is considered to be in compliance with this standard only when it is electrically grounded in accordance with the manufacturer's instructions and the requirements of the National Electrical Code, ANSI/NFPA 70 (2014-2017).”	Available in installation manual	P
	The electrical documentation includes a detailed description of the electrical installation wiring method to be used.	Available in installation manual	P
	The documentation contains the following information:		—
	- Name, registered trade name, or registered trade mark of manufacturer	Available in installation manual	P
	- Type or model number designation	Available in installation manual	P
	- Maximum system voltage or ”V_{sys}”	Available in installation manual	P
	- Class for protection against electrical shock, in accordance with Clause 4 of CSA C22.2 NO. 61730-1	Available in installation manual	P
	- Voltage at open-circuit or “V_{oc}” including manufacturing tolerances	Available in installation manual	P
	- Current at short-circuit or “I_{sc}” including manufacturing tolerances	Available in installation manual	P
	- Maximum power or “P_{max}” including manufacturing tolerances	Available in installation manual	P
	- Short-circuit current bifaciality coefficient φ_{Isc}	Available in installation manual	P

Absatz *Clause*	Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	Open-circuit voltage bifaciality coefficient φ_{Voc}		
	Maximum power bifaciality coefficient φ_{Pmax}		
	- Minimum radius of curvature	N/A	-
	- Maximum overcurrent protection rating (compliance verified by reverse current overload test (MST 26))	Available in installation manual	P
	- Recommended maximum series / parallel PV module configurations	Available in installation manual	P
	- Temperature coefficient for maximum output power	Available in installation manual	P
	- Temperature coefficient for voltage at open-circuit	Available in installation manual	P
	- Temperature coefficient for short-circuit current	Available in installation manual	P
	- All electrical data are shown at standard test conditions (1000 W/m², (25 ± 2) °C, AM 1.5 according to IEC 60904-3).	Available in installation manual	P
	- Description of measurement of BNPI (AM 1.5, T = 25 °C, Irradiance = 1000W/m² + φ•135W/m²)	Available in installation manual	P
	- Performance at low irradiance (MQT 07) is specified.	Available in installation manual	P
	Detailed wiring method for electrical installation is included in the documentation, containing	Certified junction box with preassembled certified cables	P
	- any limitations on wiring methods and wire management that apply to the PV module junction box	N/A	-
	- specific PV connector model / types and manufacturer to which the PV module connectors can be mated	Available in installation manual. Refer to CDF no: **31985240.016**	P
	- bonding to be used (if applicable) including all provided or specified hardware	Available in installation manual.	P
	- type and ratings of bypass diode to be used (if applicable)	Junction box is approved according to IEC 62790:2020 Refer to CDF no: **31985240.016**	P
	The documentation includes		—
	- limitations to the mounting situation (e.g. slope, mounting means, cooling).	No limitations indicated.	P
	- a statement indicating the fire rating(s)	☒ fire rating(s) and applied standards ☐ statement that resistance to external fire sources was not evaluated	P
	- a statement indicating the minimum mechanical means for securing the PV module	Evaluated with Static mechanical load test (MST 34) and Module breakage test (MST 32)	P
	- a statement indicating the maximum altitude the PV module is designed for	≤ 2000 m above sea level	P
	The documentation for roof mounting includes		—
	- a statement indicating the minimum mechanical means for securing the PV module	Evaluated with Static mechanical load test (MST 34) and Module breakage test (MST 32)	P
	- specific parameter(s) when the fire rating is dependent on a specific mounting structure, specific spacing, or specific means of attachment to the roof or structure	Fire test conducted acc. To ANSI/UL 790 : 2018	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	The documentation includes a statement advising that external or otherwise artificially concentrated sunlight shall not be directed onto the front or back face of the PV module (if not qualified for).	Available in installation manual.	P
	Assembly instructions are provided with a product shipped in subassemblies, and are detailed and adequate to the degree required to facilitate complete and safe assembly of the product.	No subassemblies.	-
	The following or equivalent statement is included: *"Under normal conditions, a photovoltaic module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on this PV module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, and size of controls (e.g. inverter) connected to the PV output."* Safety factor may vary acc. to local conditions.	Available in installation manual.	P
7.3	**Electrical components and insulation (Clause 5.3 of CSA C22.2 NO. 61730-1)**		
	Fuse holders built into the module comply with the relevant UL fuse holder standard.	N/A	-
7.3.1	**Internal wiring (Clause 5.3.2 of CSA C22.2 NO. 61730-1)**		
	Internal wiring has sufficient current carrying capacity for the relevant application.	Verified by MST 14 and MST 26	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
7.3.2	**External wiring (Clause 5.3.3 of CSA C22.2 NO. 61730-1)**		
	External wires and cables fulfil the requirements of IEC 62930.	☐ EN 50618 ☒ IEC 62930 Certification no: R 50452023	P
7.3.3	**Connectors (Clause 5.3.4 of CSA C22.2 NO. 61730-1)**		
	External DC connectors fulfil the requirements of IEC 62852	☒ IEC 62852 ☐ UL 6703 Certification no: R 50334688	P
	Non-locking connectors according to IEC 62852 are not used in readily accessible PV systems with voltages above 30V.	N/A	-
7.3.4	**Junction boxes for PV modules (Clause 5.3.5 of CSA C22.2 NO. 61730-1)**		
	Junction boxes for PV modules fulfil the requirements of IEC 62790 or UL 3730.	☒ IEC 62790:2020 ☐ UL 3730 Certification no: R 50415465	P
	Junction boxes according to IEC 62790 additionally fulfil the requirement that the Cord anchorage test was passed with a pull force of either the value given in Table 6 of IEC 62790 or 89 N, whichever is higher.	Cord anchorage test done and passed with min. 89 N	P
	The pull force used in the Retention on mounting surface test (either in IEC 62790 qualification or according to MST 14.1 of CSA C22.2. 61730) is minimum 156 N.	Retention on mounting surface test done and passed with min. 156 N	P
7.3.5	**Front sheets and back sheets (Clause 5.3.6 of CSA C22.2 NO. 61730-1)**		
	Front sheet:		—
	Material of front sheet:	☒ Glass ☐ Polymeric material ☐ Others	—
	Polymeric front sheets meet relevant requirements of Clause 5.5.2 of CSA C22.2 NO. 61730-1)	See 7.5.1	P
	Polymeric front sheets used as relied upon insulation fulfil requirements of		—
	- Clause 5.6.4.3 of CSA C22.2 NO. 61730-1) for insulation in thin layers	See 7.6.4.3	P
	- Clause 5.5.2.3 of CSA C22.2 NO. 61730-1) for electrical insulation	See 7.5.1.3	P
	Thermal index front sheet (see also Clause 5.5.2.3.3 of CSA C22.2 NO. 61730-1):	☐ TI: ☐ RTE: ☐ RTI:	—
	Adhesion to encapsulant or glass is appropriate.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	Backsheet:		—
	Material of back sheet:	☒ Glass ☒ Polymeric material ☐ Others	—
	Polymeric front sheets meet relevant requirements of Clause 5.5.2 of CSA C22.2 NO. 61730-1	See 7.5.1	P
	Polymeric back sheets used as relied upon insulation fulfil requirements of		
	- Clause 5.6.4.3 of CSA C22.2 NO. 61730-1 for insulation in thin layers	See 7.6.4.3	P
	- Clause 5.5.2.3 of CSA C22.2 NO. 61730-1 for electrical insulation	See 7.5.1.3	P
	Thermal index back sheet (see also Clause 5.5.2.3.3 of CSA C22.2 NO. 61730-1)	☐ TI: ☐ RTE: ☐ RTI: Glass	—
	Adhesion to encapsulant or glass is appropriate.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
7.3.6	**Insulation barriers (Clause 5.3.7 of CSA C22.2 NO. 61730-1)**		
	Polymeric insulation barrier meets the relevant requirements of Clause 5.5.2 of CSA C22.2 NO. 61730-1)	See 7.5.1 Part of IEC 62790 qualification	P
	Barrier is held in place while keeping its required electrical and mechanical properties.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
	Removal of barrier is only possible by using a tool.	Tools are necessary for removal of the insulation barrier.	P
7.3.7	**Electrical connections (Clause 5.3.8 of CSA C22.2 NO. 61730-1)**		
7.3.7.1	**General (Clause 5.3.8.1 of CSA C22.2 NO. 61730-1)**		
	Terminations are so designed, that the contact pressure is not transmitted through insulating material except ceramic, mica or other adequate material.	Compliance checked by MST 01.	P
	Prevention are taken that connections do not become loose, e.g. by using a washer.	Verified by MST 01	P
	End of a stranded conductor is not consolidated by soft soldering.	Part of IEC 62790 qualification.	P
	Precautions are taken to prevent contact stress which might impair electrical conductivity.	Part of IEC 62790 qualification.	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
7.3.7.2	**Terminals for external cables and PV connector ribbons(Clause 5.3.8.2 of CSA C22.2 NO. 61730-1)**		
	Terminals for electrical connections are suitable for the type and range of conductor cross-sectional areas according to specification of the manufacturer. They meet the requirements of IEC 62790	☒ IEC 62790:2020 Certification no : R 50415465	P
	Insulated terminals are designed in a manner where a possible displacement that may result in a reduction of clearances and creepage distances is prevented.	Insulated terminals are qualified according to the related component standards. Certification no : R 50415465	P
7.3.7.3	**Splices and connections inside a PV module (Clause 5.3.8.3 of CSA C22.2 NO. 61730-1)**		
	Splices and connections inside a PV module are mechanically secured.	All tests of CSA C22.2 NO. 61730-2 passed.	P
	Electrical connections are soldered, welded, conductively adhered, crimped, or otherwise securely connected.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
	A soldered or conductively adhered joint is additionally mechanically secured.	All tests of CSA C22.2 NO. 61730-2 passed. Part of IEC 62790 qualification.	P
7.3.8	**Encapsulant (Clause 5.3.9 of CSA C22.2 NO. 61730-1)**		
	Thermal properties are sufficient for intended application.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
	The insulation properties according to Clause 5.5.2.3 of CSA C22.2 NO. 61730-1 are met, if applicable.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
7.3.9	**Bypass diodes (Clause 5.3.10 of CSA C22.2 NO. 61730-1)**		
	Bypass diodes are rated to withstand the current and voltage for their intended use.	Compliance checked by MST 01, MST 07, MST 22 and MST 25 Datasheet values for bypass diode checked.	P

7.4	**Mechanical and electromechanical connections (Clause 5.4 of CSA C22.2 NO. 61730-1)**		
7.4.1	**General (Clause 5.4.1 of CSA C22.2 NO. 61730-1**		
	Type of connection:	☒ Connection within frame ☒ Mounting interfaces via adhesive ☐ Frame to clamp a mounting system ☒ Equipotential bonding ☒ Attachment of junction box ☐ Mechanical connections within the laminate	—
	Mechanical connections are durable to withstand the thermal, mechanical, and environmental stresses occurring in the application.	Compliance checked by inspection and by MST 13, MST 32, MST 34 and MST 37	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	Parts intended to be removed are only detachable with the aid of tools.	No parts are intended to be removed manually in a PV module. Tools are necessary for removal.	P
	Lids attached without screws have one or several detectable facilities for enabling tools.	JB lid may not easily be removable without a tool. Compliance checked by the corresponding component standards.	P
	A tool does not come into contact with the live parts when the lid is removed with it.	Compliance checked by CSA C22.2 NO. 61730-2 tests.	P
	No friction occurs between surfaces as the sole means to inhibit the turning or loosening of a part, unless provisions to prevent unintended movement or rotation of the component are given.	No such parts.	P
7.4.2	**Screw connections (Clause 5.4.2 of CSA C22.2 NO. 61730-1)**		
	Screws and mechanical connections withstand the mechanical stresses occurring in normal use.	No screws Compliance checked by inspection	P
	Screws are not made of a material which is soft or liable to creep.	No screws Compliance checked by inspection	P
	Screws used to provide mechanical stability and continuity for equipotential bonding withstand the mechanical stresses occurring in normal use.	No screws Compliance checked by inspection	P
	At least one screw per electrical-mechanical connection ensures the electrical connection between the metallic components.	No screws Compliance checked by inspection	P
	Screws used for mechanical and electrical connections with a nominal diameter of less than 3 mm are screwed into metal.	No screws Compliance checked by inspection	P
	For screws used for mechanical and electrical connections two full threads are engaged into the metal.	No screws Compliance checked by inspection	P
	Screwed and other fixed connections are in such a way that they do not come loose through torsion, bending stresses, vibration, etc.	No screws Compliance checked by inspection	P
7.4.3	**Rivets (Clause 5.4.3 of CSA C22.2 NO. 61730-1)**		
	Rivets which serve as electrical as well as mechanical connections are locked against loosening.	No rivet is used.	-

7.4.4	**Thread-cutting screws (Clause 5.4.4 of CSA C22.2 NO. 61730-1)**		
	Thread-cutting and self-tapping screws are not used for interconnection of current-carrying parts made of a material which is soft or liable to creep.	No thread-cutting screw is used.	—

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	No thread-forming or thread-cutting (self-tapping) screws (sheet metal screws) are used for the connection of current-carrying parts.	No thread-cutting screw is used.	—
	Thread-cutting (self-tapping) screws are not used if they are likely to be operated by the user or installer.	No thread-cutting screw is used.	—
	Thread-cutting and thread-forming screws, used to provide continuity for equipotential bonding, are such that it is not necessary to disturb the connection in normal use.	No thread-cutting screw is used.	—
	For equipotential bonding one screw is used if two full threads engage the metal.	No thread-cutting screw is used.	—
7.4.5	**Form / press / tight fit (Clause 5.4.5 of CSA C22.2 NO. 61730-1)**		
	Form/press/tight fits of metallic components which are not separately equipotential bonded are electrically connected.	Compliance checked by inspection and tested by MST 32, MST 34 and MST 13 pre and post the MST 32 and MST 34 tests.	P
7.4.6	**Connections by adhesives (Clause 5.4.6 of CSA C22.2 NO. 61730-1)**		
	Connections by adhesive for mounting means are sufficient.	Compliance checked by MST 34, MST 13, MST 32 for mounting adhesives.	P
	Fixing of junction box by adhesive is sufficient.	Compliance checked by MST 42, MST 17 for junction box adhesives.	P
	Adhesion of a polymer relied upon for insulation to another insulating layer is appropriate for the application.	Compliance checked by MST 34, MST 13, MST 32 for adhesives used for mounting means and MST 42, MST 17 for junction box adhesives.	P
	Requirements for adhesive materials are met.	See 7.5.2.2	P
	Connection by adhesive which is considered as cemented joint fulfills the requirements of Clause 5.6.4.2 of CSA C22.2 NO. 61730-1.	See 7.6.4.2	P
7.4.7	**Other connections (Clause 5.4.7 of CSA C22.2 NO. 61730-1)**		
	Other connections (such as welded or soldered) as well as materials and processes to create the connections are appropriate for the application and for the intended use.	Compliance checked by MST 01.	P
	Other connections which are relied upon for equipotential bonding fulfil the requirements of MST 13.	Compliance checked by MST 01	P

7.5	**Materials (Clause 5.5 of CSA C22.2 NO. 61730-1)**

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
7.5.1	**Polymeric materials (Clause 5.5.2 of CSA C22.2 NO. 61730-1)**		
7.5.1.1	**General (Clause 5.5.2.1 of CSA C22.2 NO. 61730-1)**		
	Polymeric materials are able to durably and safely withstand the electrical, mechanical, thermal, environmental, and corrosive stresses occurring in the application.	Compliance checked by UL 61730-2 tests listed in this report and other environmental chamber tests including pre- and post-measurements and including assessment of creepages.	P
	Polymeric materials are resistant to electrical and mechanical property degradation.	Compliance checked by MST 37. Compliance checked by all tests including pre- and post-measurements and including assessment of creepages.	P
	Polymeric parts which ensure either the electrical or mechanical safety of the PV module or both, are resistant to electrical and mechanical property degradation. They comply with the requirements of the Materials creep test (MST 37) depending on their constructive function in the PV module.	Compliance checked by MST 37.	P
	Polymeric material used as a part of a cemented joint fulfills additionally the requirements of Clause 5.6.4.2 of UL 61730-1/ CSA C22.2 NO. 61730-1)	See 7.6.4.2	P
7.5.1.2	**Endurance to weathering stress (Clause 5.5.2.2 of CSA C22.2 NO. 61730-1)**		
	Polymeric materials of the module and its components are durable to weathering stress.	Components are evaluated according to the relevant requirements in the applicable component standards.	P
7.5.1.3	**Polymeric materials used as electrical insulation (Clause 5.5.2.3 of CSA C22.2 No.61730-1)**		
7.5.1.3.1	**General (Clause 5.5.2.3.1 of CSA C22.2 NO. 61730-1)**		
	The temperature limits of materials used as insulation are not less than the maximum measured operating temperature of the specific material in application, as measured during the temperature test (MST 21).	See MST 21	P
7.5.1.3.2	**Endurance to electrical stress (Clause 5.5.2.3.2 of CSA C22.2 NO. 61730-1)**		
	Materials used as electrical insulation are in compliance with the insulation coordination requirements.	See 7.6.3	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
7.5.1.3.3	**Endurance to thermal stress (Clause 5.5.2.3.3 of CSA C22.2 NO. 61730-1)**		
	Materials used as relied upon insulation have a electrical relative thermal endurance, relative thermal index or temperature index (RTE / RTI / TI) appropriate for the application, at least 90°C.	☐ TI: ☐ RTE: ☐ RTI: Glass Compliance is checked with temperature test (MST 21). Assessed polymeric parts see CDF no. **31985240.016**	P
7.5.1.3.4	**Polymeric insulating materials used as external parts (Clause 5.5.2.3.4 of CSA C22.2 NO. 61730-1)**		
	External polymeric parts of the PV module whose deterioration could impair the safety meet the following additional requirements:		—
	- Flammability class minimum V-1 according to IEC 60695-11-10	Part of IEC 62790 qualification.	P
	- Ball pressure test according to IEC 60695-10-2 with a temperature of 75°C (not applicable to insulation in thin layers)	Part of IEC 62790 qualification.	P
	- Ignitability test (MST 24) in final application (laminated or the PV module)	See section 9.42	P
	- Peel test (MST 35) for proof of cemented joints	No cemented joints	-
	- Lap shear strength test (MST 36) for proof of cemented joints	No cemented joints	-
7.5.1.3.5	**Polymeric insulating parts supporting live parts (Clause 5.5.2.3.5 of CSA C22.2 NO. 61730-1)**		
	External parts of insulating material supporting live parts including connections, and parts of polymeric material providing supplementary insulation or reinforced insulation, are sufficiently resistant to heat.	Assessed polymeric parts see CDF no. **31985240.016** Part of IEC 62790 qualification.	P
	Other than elastomeric polymeric materials meet the following requirements:		—
	- Flammability class minimum HB	Assessed polymeric parts see CDF no. **31985240.016** Part of IEC 62790 qualification.	P
	- Ball pressure test with a temperature of 125°C	N/A Part of IEC 62790 qualification.	—
	- Material creep test (MST 37)	N/A	—
7.5.1.3.6	**Polymeric insulating used for mechanical functions (Clause 5.5.2.4 of CSA C22.2 NO. 61730-1)**		
	Materials used for mechanical functions have a mechanical relative thermal endurance, relative thermal index or temperature index (RTE / RTI / TI) appropriate for the application, at least 90°C.	☐ TI: ☐ RTE: ☐ RTI: Glass Compliance is checked with Temperature test (MST 21). Assessed polymeric parts see CDF no. **31985240.016**	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
7.5.2	**Metallic materials (Clause 5.5.3 of CSA C22.2 NO. 61730-1)**		
7.5.2.1	**General (Clause 5.5.3.1 of CSA C22.2 NO. 61730-1)**		
	Metal parts are not in contact to other metal parts having a difference of their electrochemical potentials of more than 600 mV.	Assessed parts see CDF no. **31985240.016**	P
	Iron or mild steel is plated, painted, or enamelled for protection against corrosion.	Compliance is checked by inspection.	P
	For iron or mild steel, corrosion protection is at least equivalent to a zinc coating of 0.015 mm thickness, and the manufacturer specified how they demonstrate this.	Assessed parts see CDF no. **31985240.016** Compliance is checked by inspection.	P
7.5.2.2	**Current carrying parts (Clause 5.5.3.2 of CSA C22.2 NO. 61730-1)**		
	Assessed parts:	See CDF no. **31985240.016**	—
	Current-carrying parts have sufficient mechanical strength and electrical conductivity.	Compliance checked by CSA C22.2 NO. 61730-2 tests listed in this report.	P
	Current-carrying materials are protected against corrosion.	N/A for encapsulated designs	—
	The coating for protective coated metal is capable of preventing corrosion according to either one of the listed standards.	☒ ISO 1456 ☐ ISO 1461 ☐ ISO 2081 ☐ ISO 2093	P
	Coated metal is not used if the current-carrying parts are stressed by abrasion.	N/A for encapsulated designs	—
7.5.2.3	**Adhesives (Clause 5.5.4 of CSA C22.2 NO. 61730-1)**		
	Adhesives are appropriate for the application.	Compliance is checked by relevant tests of UL 61730-1 including MST 42, MST 34, MST 01, MST 11 and MST 17.	P

7.6	**Protection against electric shock (Clause 5.6 of CSA C22.2 NO. 61730-1)**		
7.6.1	**General (Clause 5.6.1 of CSA C22.2 NO. 61730-1)**		
	Adequate protection against contact with hazardous live parts is provided and poses no risk of electric shock.	See section 7.6.2 - 7.6.4	P
7.6.2	**Protection against accessibility to hazardous live parts (Clause 5.6.2 of CSA C22.2 NO. 61730-1)**		
7.6.2.1	**General (Clause 5.6.2.1 of CSA C22.2 NO. 61730-1)**		
	Class of module	See safety ratings	—
	For Class 0 and Class II modules, adequate protection against accessibility to hazardous live parts (> 35 V DC) is provided.	Compliance is checked by MST 01 and MST 11.	P
	For Class 0 PV modules, accessible metal parts and accessible surfaces as well as live parts of different potential of the same circuit are separated by at least basic insulation.	Table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	For Class II PV modules, construction provides separation between accessible parts or accessible surfaces and hazardous live parts by double or reinforced insulation.	Table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1	P
	For Class II PV modules, live parts of different potential of the same circuit are separated by at least basic insulation.	Table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1	P
	For Class III PV modules, construction provides separation between accessible parts or accessible surfaces and hazardous live parts by at least functional insulation.	Table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1	P
	In Class III PV modules live parts of different polarity are separated by at least functional insulation.	Table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1	P
	Materials used for realizing protection against accessibility of hazardous live parts by means of enclosure, insulation barrier or relied upon insulation comply with the requirements of Clause 5.5.2 of CSA C22.2 NO. 61730-1 due to their application.	See 7.5.1	P
7.6.2.2	**Protection by means of enclosures and insulation barriers (Clause 5.6.2.2 of CSA C22.2 NO. 61730-1)**		
	Enclosures or insulation barriers are designed that, after mounting, the live parts are not accessible.	Encapsulant, glass, backsheet, junction box, cable and connectors acceptably insulate any live parts.	P
	The degree of protection of housing is not impaired by any possible deformation.	Encapsulant, glass, backsheet, junction box, cable and connectors acceptably insulate any live parts.	P
	Parts of enclosures and insulation barriers that provide protection are not removable without the use of a tool.	Tools are necessary for removal.	P
	Lids which are attached without screws have one or several detectable features, e.g. recesses.	Compliance verified by evaluation of components.	P
	Tools to open the lid do not come into contact with the live parts if lid is removed correctly.	Tools are necessary for removal.	P
	Insulation barriers are held in place and are not affected by influences expected during normal operation. Electrical and mechanical properties do not fall below the minimum acceptable values for the application.	Compliance checked byUL 61730-1 tests listed in this report.	P
	Parts are prevented from loosening or turning.	No such parts.	P
7.6.2.3	**Protection by means of insulation of live parts (Clause 5.6.2.3 of CSA C22.2 NO. 61730-1)**		
	An insulation material providing the sole insulation between a live part and an accessible metal part, or between uninsulated live parts not of the same potential, is of adequate thickness and of a material appropriate for the application. For requirements see table 2 in Clause 5.6.2.3 of CSA C22.2 NO. 61730-1 (7.6.2.1).	Compliance verified by evaluation of materials and components.	P
	Distances through cemented joints as listed in line 4 of table 3 are used if the requirements according to UL 61730-2 are fulfilled.	N/A	-

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	Class 0 modules with cemented joints meet the requirements for cemented joints for Class II modules as specified in line 4 of Table 3.	N/A	-
7.6.3	**Insulation coordination (Clause 5.6.3 of UL 61730-1)**		
	Components comply with the requirements for their relevant standards (Clause 5.6.3.1 of CSA C22.2 NO. 61730-1)	See CDF no. **31985240.016**	P
	Pollution degree (Clause 5.6.3.2 of CSA C22.2 NO. 61730-1)	See tables in 7.7	—
	Material group (Clause 5.6.3.3 of CSA C22.2 NO. 61730-1)	See tables in 7.7	—
	Clearance and creepage distance (Clause 5.6.3.4 of CSA C22.2 NO. 61730-1):	See tables in 7.7	—
	Derating factor for altitude above 2000 m is considered.	Verified by Impulse voltage test	P
7.6.4	**Distance through insulation (Clause 5.6.4 of CSA C22.2 NO. 61730-1)**		
7.6.4.1	**General (Clause 5.6.4.1 of CSA C22.2 NO. 61730-1)**		
	Polymeric materials for cemented insulation parts and insulation in thin layers withstand environmental, thermal, electrical and mechanical stresses as far as they occur.	See 7.5	
	The insulation fulfils the material classification as given in IEC 60216-1, IEC 60216-2 and IEC 60216-5 (RTE/TI/RTI).	Compliance checked by MST 024	P
7.6.4.2	**Cemented joints (Clause 5.6.4.2 of CSA C22.2 NO. 61730-1)**		
	Cemented joints were considered as	☐ Edge seal ☐ Interface between junction box and mounting surface ☐ Others ☒ No cemented joints	—
	Distances along cemented joints comply with the minimum distances as required in table 3:		—
	System voltage	See safety ratings	—
	Distance along cemented joints, req./meas. [mm]:	No cemented joints	N/A
	A distance can be considered as cemented joint if following requirements are met:	No cemented joints	N/A
	- Neither cracks nor voids in the insulating compounds have been occurred which either by themselves or in combination reduces the distances through the cemented joint below the required values.	No cemented joints	N/A
	- No breakdown at MST 16 (initial and final tests) with a 1.35 times higher test voltage occurred.	No cemented joints	N/A
	- No breakdown at MST 17 (initial and final tests) with a 1.35 times higher test voltage occurred.	No cemented joints	N/A
	- The electrically insulating adhesive / sealant has a volume resistivity of bigger than 50×10^6 Ω cm (dry) / bigger than 10×10^6 Ω cm (wet)	No cemented joints	N/A
	- Peel test (MST 35) was passed (rigid / flexible)	No cemented joints	N/A

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	- Lap shear strength test (MST 36) was passed (rigid / rigid)	No cemented joints	N/A
	Supplementary information: Above listed tests have to be performed for each cemented joint. The materials and their properties are listed in the CDF no…. **31985240.016**		
7.6.4.3	**Insulation in thin layers (Clause 5.6.4.3 of CSA C22.2 NO. 61730-1)**		
	Relied upon insulation in thin layers is applied at	☐ Back sheet ☐ Front sheet ☐ Insulation within laminate ☐ Others	—
	Initial construction of insulation in thin layers complies with requirements concerning thickness under consideration of figure 4 as described in table 3 or 4.	See CDF no…. **31985240.016**	P
	Construction of insulation in thin layers complies with requirements concerning RTE/TI/RTI.	See CDF no…. **31985240.016**	P
	Insulation in thin layers provides sufficient dielectric strength:		—
	Test voltage for single-layer sheet and for entire multi-layer sheet providing relied upon insulation (2000V + 4 times system voltage):	See CDF no…. **31985240.016**	P
	Single-layer sheet as well as entire multi-layer sheet in final application comply with following:		—
	Dielectric strength for basic insulation is provided after Cut susceptibility test (MST 12). Test voltage [V]: (1000V + 2 times system voltage)	Complied at 4000V	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

7.7	**Clearance and creepage distances (Clause 5.6.3.4 of IEC/EN 61730-1)**

Table 1: Design evaluation - HYPERSOL VSMDH. 72.575.05

Clearance (cl) and creepage distance (cr) at/of/between:	Line of table 3or 4	Type of insulation	Pollution degree	CTI Material group	Working voltage [V]	Clearance cl [mm]		Creepage cr [mm]	
						Required	Design[a]	Required	Design
Position 1: Cell edge and module edge	1a	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 2: String interconnect and module edge	1a	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 3: Cell to cell	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.0	0.2	1.0
Position 4: String to String	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.5	0.2	1.5

Supplementary information:

[a] List relevant position and test voltage for each clearence which is verified by Impulse voltage test according to IEC 60664-1.

[b] If a measured clearance is smaller than the minimum required clearance an impulse voltage test as specified in IEC 60664-1 shall show that the distance is adequate. To assess clearances between internal live parts and outer accessible surfaces IEC 61730-2, MST 14 may be applied

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

7.7	**Clearance and creepage distances (Clause 5.6.3.4 of IEC/EN 61730-1)**								
Table 2: PV module evaluation MST 01 initial									
Sample no.			A003527777-031						
Clearance (cl) and creepage distance (cr) at/of/between:	Line of table 3or 4	Type of insulation	Pollution degree	CTI Material group	Working voltage [V]	Clearance cl [mm]		Creepage cr [mm]	
						Required	Measured[a]	Required	Measured
Position 1: Cell edge and module edge	1a	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 2: String interconnect and module edge	1a	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 3: Cell to cell	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.0	0.2	1.0
Position 4: String to String	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.5	0.2	1.5
Supplementary information:									

[a] List relevant position and test voltage for each clearence which is verified by Impulse voltage test according to IEC 60664-1.

[b] If a measured clearance is smaller than the minimum required clearance an impulse voltage test as specified in IEC 60664-1 shall show that the distance is adequate. To assess clearances between internal live parts and outer accessible surfaces IEC 61730-2, MST 14 may be applied

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

7.7 **Clearance and creepage distances (Clause 5.6.3.4 of CSA C22.2 NO. 61730-1)**

Table 3: PV module evaluation MST 01 final

Sample no.			A003527777-031						
Clearance (cl) and creepage distance (cr) at/of/between:	Line of table 3or 4	Type of insulation	Pollution degree	CTI Material group	Working voltage [V]	Clearance cl [mm]		Creepage cr [mm]	
						Required	Measured[a]	Required	Measured
Position 1: Cell edge and module edge	1a)	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 2: String interconnect and module edge	1a)	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	1500	19.4[b]	12.5	10.4	12.5
Position 3: Cell to cell	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.0	0.2	1.0
Position 4: String to String	2	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	☒ 1 ☐ 2 ☐ 3	☒ I ☐ II ☐ IIIa	≤35	0.1	1.5	0.2	1.5

Supplementary information:

[a] List relevant position and test voltage for each clearence which is verified by Impulse voltage test according to IEC 60664-1.

[b] If a measured clearance is smaller than the minimum required clearance an impulse voltage test as specified in IEC 60664-1 shall show that the distance is adequate. To assess clearances between internal live parts and outer accessible surfaces IEC 61730-2, MST 14 may be applied

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

11.7	**Clearance and creepage distances (5.6.3.4)**

Table 4: Clearance evaluated by Impulse voltage test

Sample no.	A003562285-002
Test date (DD/MM/YYYY)	08/11/2023

Results

☒ No evidence of dielectric breakdown or surface tracking observed

Supplementary information:

Clearance (cl) at/of/between:	Line of table 3 or 4	Type of insulation	Working voltage [V]	Impulse voltage [V]	Measured			Verdict
					Voltage Peak [kV]	T_1 [µs]	T_2 [µs]	—
Position 1: Cell edge and module edge	1a)	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	1500	18560	18560	1.50	47.70	P
Position 2: String interconnect and module edge	1a)	☐ Functional ☐ Basic ☐ Suppl. ☒ Reinforced	1500	18560	18560	1.50	47.70	P

Supplementary information: None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
8	**Pass criteria (Clause 7 of IEC/EN 61215-1)**		
8.1	**Output power and electric circuitry (Clause 7.2 of IEC/EN 61215-1)**		
8.1.1	**Verification of rated label values (Gate #1) (STC) (Clause 7.2.1 of IEC/EN 61215-1)**		
	After stabilization, each individual module shall meet: $P_{\max}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_1 \rvert}{100}\right) \geq P_{\max}(\mathrm{NP}) \cdot \left(1 - \frac{\lvert t_1 \rvert}{100}\right)$ $\bar{P}_{\max}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_1 \rvert}{100}\right) \geq P_{\max}(\mathrm{NP})$	See table “Gate #1 evaluation”	P
	After stabilization, each individual module shall meet: $V_{\mathrm{OC}}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_2 \rvert}{100}\right) \leq V_{\mathrm{OC}}(\mathrm{NP}) \cdot \left(1 + \frac{\lvert t_2 \rvert}{100}\right)$	See table “Gate #1 evaluation”	P
	After stabilization, each individual module shall meet: $I_{\mathrm{SC}}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_3 \rvert}{100}\right) \leq I_{\mathrm{SC}}(\mathrm{NP}) \cdot \left(1 + \frac{\lvert t_3 \rvert}{100}\right)$	See table “Gate #1 evaluation”	P
	After stabilization, each individual module that is used for the qualification of low end power classes shall meet: $P_{\max}(\mathrm{Lab}) \cdot \left(1 - \frac{\frac{1.65}{2}\lvert m_1 \rvert}{100}\right) \leq P_{\max 4}(\mathrm{NP}) \cdot \left(1 + \frac{\lvert t_4 \rvert}{100}\right)$	See table “Gate #1 evaluation”	P
	m_1 [%] = measurement uncertainty of laboratory for $P_{\max}$ m_2 [%] = measurement uncertainty of laboratory for V_{OC} m_3 [%] = measurement uncertainty of laboratory for I_{SC} t_1 [%] = manufacturer’s rated lower production tolerance for $P_{\max}$ t_2 [%] = manufacturer’s rated upper production tolerance for V_{OC} t_3 [%] = manufacturer’s rated upper production tolerance for I_{SC} t_4 [%] = manufacturer’s rated upper production tolerance for $P_{\max 4}$ $P_{\max 4}$ = maximum rated nameplate power of lowest power class module NP = name plate		—
—	**Verification of rated label values (Gate #1) (BNPI) (Clause 7.2.1 of IEC/EN 61215-1)**		
	After stabilization, each individual module shall meet: $P_{\max\,(\mathrm{BNPI})}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_{1(\mathrm{BNPI})} \rvert}{100}\right) \geq P_{\max\,(\mathrm{BNPI})}(\mathrm{NP}) \cdot \left(1 - \frac{\lvert t_{1(\mathrm{BNPI})} \rvert}{100}\right)$ $\bar{P}_{\max\,(\mathrm{BNPI})}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_{1(\mathrm{BNPI})} \rvert}{100}\right) \geq P_{\max\,(\mathrm{BNPI})}(\mathrm{NP})$	See table “Gate #1 evaluation”	P
	After stabilization, each individual module shall meet: $V_{\mathrm{OC(BNPI)}}(\mathrm{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_{2(\mathrm{BNPI})} \rvert}{100}\right) \leq V_{\mathrm{OC(BNPI)}}(\mathrm{NP}) \cdot \left(1 + \frac{\lvert t_{2(\mathrm{BNPI})} \rvert}{100}\right)$	See table “Gate #1 evaluation”	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
	After stabilization, each individual module shall meet: $I_{SC(BNPI)}(\text{Lab}) \cdot \left(1 + \frac{\frac{1.65}{2}\lvert m_{3(BNPI)}\rvert}{100}\right) \leq I_{SC\,(BNPI)}(\text{NP}) \cdot \left(1 + \frac{\lvert t_{3(BNPI)}\rvert}{100}\right)$	See table “Gate #1 evaluation”	P
	After stabilization, each individual module that is used for the qualification of low end power classes shall meet: $P_{max\,(BNPI)}(\text{Lab}) \cdot \left(1 - \frac{\frac{1.65}{2}\lvert m_{1(BNPI)}\rvert}{100}\right) \leq P_{max4(BNPI)}(\text{NP}) \cdot \left(1 + \frac{\lvert t_{4(BNPI)}\rvert}{100}\right)$	See table “Gate #1 evaluation”	P
	$m_{1(BNPI)}$ [%] = measurement uncertainty of laboratory for $P_{max(BNPI)}$ $m_{2(BNPI)}$ [%] = measurement uncertainty of laboratory for $V_{OC(BNPI)}$ $m_{3(BNPI)}$ [%] = the measurement uncertainty of laboratory for $I_{SC(BNPI)}$ $t_{1(BNPI)}$ [%] = manufacturer’s rated lower production tolerance for $P_{max(BNPI)}$ $t_{2(BNPI)}$ [%] = manufacturer’s rated upper production tolerance for $V_{OC(BNPI)}$ $t_{3(BNPI)}$ [%] = manufacturer’s rated upper production tolerance for $I_{SC(BNPI)}$ $t_{4(BNPI)}$ [%] = manufacturer’s rated upper production tolerance for $P_{max4(BNPI)}$ $P_{max4(BNPI)}$ = maximum rated nameplate power of lowest power class module (under BNPI) NP = name plate		—
8.1.2	**Maximum power degradation during type approval testing (Gate #2) (STC) (Clause 7.2.2 of IEC/EN 61215-1)**		
	At the end of each test sequence, each test sample shall meet: $P_{max}(\text{Lab_Gate \#2}) \geq 0.95 \times P_{max}(\text{Lab_Gate \#1}) \cdot \left(1 - \frac{r}{100}\right)$	r = 0.09/0.05 See table “Gate #2 evaluation”	
	r = reproducibility		—
—	**Maximum power degradation during type approval testing (Gate #2) (BNPI) (Clause 7.2.2 of IEC/EN 61215-1)**		
	At the end of each test sequence, each test sample shall meet: $P_{max\,(BNPI)}(\text{Lab_Gate \#2}) \geq 0.95 \times P_{max\,(BNPI)}(\text{Lab_Gate \#1}) \cdot \left(1 - \frac{r_{(BNPI)}}{100}\right)$	$r_{(BNPI)}$ = 0.27/0.12/0.14 See table “Gate #2 evaluation”	
	$r_{(BNPI)}$ = reproducibility		—

8.1.3	**Electrical circuitry (Clause 7.2.3 of IEC/EN 61215-1)**		
	Samples are not permitted to exhibit an open-circuit during the tests.	No open-circuit during tests	P
8.2	**Visual defects (Clause 7.3 of IEC/EN 61215-1)**		
	There is no visual evidence of a major defect.	No major visual defect	P
8.3	**Electrical safety (Clause 7.4 of IEC/EN 61215-1)**		
	The insulation test (MQT 03) requirements are met at the beginning and the end of each sequence.	See tables below	P
	The wet leakage current test (MQT 15) requirements are met at the beginning and the end of each sequence.	See tables below	P
	Specific requirements of the individual tests are met.	See tables below	P
Supplementary information: - None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
III	**IEC/EN 61215-2 and CSA C22.2 NO. 61730-2 – Test procedures**		
9	**Overview of tests and test results**		
Initial examination	—		—
Visual inspection (MQT 01 / MST 01)	See table 9.1		P
Insulation test (MQT 03 / MST 16)	See table 9.2		P
Wet leakage current test (MQT 15 / MST 17)	See table 9.3		P
Accessibility test (MST 11)	See table 9.4		P
Continuity test of equipotential bonding (MST 13)	See table 9.5		P
Maximum power determination (MQT 02 / MST 03)	See table 9.6		P
Initial stabilization (MQT 19.1)	See table 9.7		P
Performance at STC and BNPI (MQT 06.1 / MST 03)	See table 9.8		P
Gate #1 evaluation	See table 9.9		P
Sequence A	—		—
Measurement of temperature coefficients (MQT 04)	See table 9.10		P
Performance at low irradiance (MQT 07)	See table 9.11		P
Sequence B1	—		—
Outdoor exposure test (MQT 08)	See table 9.12		P
Sequence B2	—		—
Temperature test (MST 21)	See table 9.13		P
Hot-spot endurance test (MQT 09 / MST 22)	See table 9.14		P
Reverse current overload test (MST 26)	See table 9.15		P
Sequence B3	—		—
Bypass diode thermal test (MQT 18.1 / MST 25)	See table 9.16		P
Sequence C	—		—
UV preconditioning test (MQT 10 / MST 54)	See table 9.17		P
Cyclic (dynamic) mechanical load test (MQT 20)	See table 9.18		P
Thermal cycling test (50 cycles) (MQT 11 / MST 51)	See table 9.19		P
Humidity-freeze test (MQT 12 / MST 52)	See table 9.20		P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
Sequence C1		—	—
Retention of junction box on mounting surface (MQT 14.1 / MST 42)		See table 9.21	P
Test of cord anchorage (MQT 14.2)		See table 9.22 Junction box is approved according to IEC 62790:2020	N/A
Sequence D		—	—
Thermal cycling test (200 cycles) (MQT 11 / MST 51)		See table 9.23	P
Sequence E		—	—
Damp heat test (MQT 13 / MST 53)		See table 9.24	P
Sequence E1		—	—
Static mechanical load test (MQT 16 / MST 34)		See table 9.25	P
Sequence E2		—	—
Hail test (MQT 17)		See table 9.26	P
Sequence E3		—	—
Bending test (MQT 22)		No flexible construction	N/A
Sequence F		—	—
Materials creep test (MST 37)		See table 9.28	P
Sequence G		—	—
Damp heat test (200h) (MST 53)		See table 9.29	P
UV test (front side) (MST 54)		See table 9.30	P
Humidity-freeze test 1 (MST 52)		See table 9.31	P
UV test (back side) (MST 54)		See table 9.32	P
Humidity-freeze test 2 (MST 52)		See table 9.33	P
Insulation thickness test (MST 04)		See table 9.34	P
Sequence G1		—	—
Cold conditioning 1 (MST 55)		See table 9.35	P
Dry heat conditioning (MST 56)		See table 9.36	P
Humidity-freeze test 1 (MST 52)		See table 9.37	P
Cold conditioning 2 (MST 55)		See table 9.38	P
Humidity-freeze test 2 (MST 52)		See table 9.39	P

Absatz *Clause*	**Photovoltaic (PV) modules** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Ergebnis *Result*
Sequence H		—	—
Impulse voltage test (MST 14)		See table 9.40	P
Sequence M		—	—
Module breakage test (MST 32)		See table 9.41	P
Sequence I		—	—
Ignitability test (MST 24)		See table 9.42	P
Sequence K		—	—
Potential induced degradation test (MQT 21)		See table 9.43	P
Sequence J		—	—
Fire test (MST 23)		See table 9.44	P
Final measurements		—	—
Final stabilization (MQT 19.2 / MQT 19.3)		See table 9.45	N/A
Maximum power determination (MQT 02 / MST 03)		See table 9.46	P
Performance at STC and BNPI (MQT 06.1 / MST 03)		See table 9.47	P
Gate #2 evaluation		See table 9.48	P
Bypass diode functionality test (MQT 18.2 / MST 07)		See table 9.49	P
Cut susceptibility test (MST 12)		See table 9.50	P
Accessibility test (MST 11)		See table 9.51	P
Continuity test of equipotential bonding (MST 13)		See table 9.52	P
Screw connections test (MST 33)		No screw connections	N/A
Durability of markings (MST 05)		See table 9.54	P
Sharp edge test (MST 06)		See table 9.55	P
Component tests		—	—
Peel test (MST 35)		No cemented joints	N/A
Lap shear strength test (MST 36)		No cemented joints	N/A
Supplementary information: See Appendix A: Test charts for more details.			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.1 **Visual inspection (initial) – MQT 01**

Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of initial findings	
28/07/2023	A003527777-001	No major visual defects	No major visual defects	P
28/07/2023	A003527777-002		No major visual defects	P
28/07/2023	A003527777-004		No major visual defects	P
28/07/2023	A003527777-005		No major visual defects	P
28/07/2023	A003527777-006		No major visual defects	P
28/07/2023	A003527777-007		No major visual defects	P
28/07/2023	A003527777-008		No major visual defects	P
28/07/2023	A003527777-009		No major visual defects	P
28/07/2023	A003527777-010		No major visual defects	P
28/07/2023	A003527777-015		No major visual defects	P
28/07/2023	A003527777-016		No major visual defects	P
28/07/2023	A003527777-017		No major visual defects	P
28/07/2023	A003527777-027		No major visual defects	P
28/07/2023	A003527777-011		No major visual defects	P
15/09/2023	A003562285-001		No major visual defects	P
15/09/2023	A003562285-002		No major visual defects	P
28/07/2023	A003527777-028		No major visual defects	P
28/07/2023	A003527777-029		No major visual defects	P
28/07/2023	A003527777-030		No major visual defects	P
28/07/2023	A003527777-031		No major visual defects	P
28/07/2023	A003527777-003		No major visual defects	P
28/07/2023	A003527777-012		No major visual defects	P
28/07/2023	A003527777-013		No major visual defects	P
28/07/2023	A003527777-014		No major visual defects	P
23/08/2023	A003527777-036		No major visual defects	P
23/08/2023	A003527777-039		No major visual defects	P
23/08/2023	A003527777-037		No major visual defects	P
23/08/2023	A003527777-038		No major visual defects	P
23/08/2023	A003527777-042		No major visual defects	P
23/08/2023	A003527777-043		No major visual defects	P
23/08/2023	A003527777-040		No major visual defects	P
23/08/2023	A003527777-041		No major visual defects	P

Supplementary information: - None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.1	**Visual inspection (initial) – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of initial findings	
28/07/2023	A003527777-018	No major visual defects	No major visual defects	P
28/07/2023	A003527777-019		No major visual defects	P
28/07/2023	A003527777-020		No major visual defects	P
28/07/2023	A003527777-025		No major visual defects	P
28/07/2023	A003527777-026		No major visual defects	P
28/07/2023	A003527777-021		No major visual defects	P
28/07/2023	A003527777-022		No major visual defects	P
28/07/2023	A003527777-023		No major visual defects	P
28/07/2023	A003527777-024		No major visual defects	P
28/07/2023	A003527777-033		No major visual defects	P
28/07/2023	A003527777-034		No major visual defects	P
28/07/2023	A003527777-035		No major visual defects	P
28/07/2023	A003527777-032		No major visual defects	P
Supplementary information: - None				

9.1	**Visual inspection (initial) – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of initial findings	
28/07/2023	A003527778-015	No major visual defects	No major visual defects	P
28/07/2023	A003527778-016		No major visual defects	P
28/07/2023	A003527778-017		No major visual defects	P
28/07/2023	A003527778-022		No major visual defects	P
28/07/2023	A003527778-023		No major visual defects	P
28/07/2023	A003527778-018		No major visual defects	P
28/07/2023	A003527778-019		No major visual defects	P
28/07/2023	A003527778-020		No major visual defects	P
28/07/2023	A003527778-021		No major visual defects	P
28/07/2023	A003527778-024		No major visual defects	P
28/07/2023	A003527778-025		No major visual defects	P
28/07/2023	A003527778-026		No major visual defects	P
28/07/2023	A003527778-027		No major visual defects	P
28/07/2023	A003527778-028		No major visual defects	P
28/07/2023	A003527778-029		No major visual defects	P
13/11/2023	A003599023-001		No major visual defects	P
13/11/2023	A003599023-002		No major visual defects	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
13/11/2023	A003599023-005	No major visual defects	P
13/11/2023	A003599023-006	No major visual defects	P

Supplementary information: - None

9.2	**Insulation test (initial) – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
04/08/2023	A003527777-001	45.5	2.58	117.39	--	No	P
04/08/2023	A003527777-002	41.4	2.58	106.81	--	No	P
04/08/2023	A003527777-004	44.5	2.58	114.81	--	No	P
04/08/2023	A003527777-005	41.5	2.58	107.07	--	No	P
04/08/2023	A003527777-006	42.8	2.58	110.42	--	No	P
04/08/2023	A003527777-007	45.4	2.58	117.13	--	No	P
04/08/2023	A003527777-008	45.6	2.58	117.65	--	No	P
04/08/2023	A003527777-009	47.5	2.58	122.55	--	No	P
04/08/2023	A003527777-010	43.8	2.58	113.00	--	No	P
04/08/2023	A003527777-015	41.5	2.58	107.07	--	No	P
04/08/2023	A003527777-016	43.9	2.58	113.26	--	No	P
04/08/2023	A003527777-017	42.9	2.58	110.68	--	No	P
04/08/2023	A003527777-027	43.9	2.58	113.26	--	No	P
15/09/2023	A003562285-002	41.6	2.58	107.33	--	No	P
31/07/2023	A003527777-028	42.1	2.58	108.62	--	No	P
31/07/2023	A003527777-029	44.5	2.58	114.81	--	No	P
31/07/2023	A003527777-030	41.6	2.58	107.33	--	No	P
31/07/2023	A003527777-031	42.1	2.58	108.62	--	No	P
31/07/2023	A003527777-003	41.5	2.58	107.07	--	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.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.2	**Insulation test (initial) – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
04/08/2023	A003527777-018	43.50	2.58	112.23	--	No	P
04/08/2023	A003527777-019	41.50	2.58	107.07	--	No	P
04/08/2023	A003527777-020	44.20	2.58	114.04	--	No	P
04/08/2023	A003527777-025	40.00	2.58	103.20	--	No	P
04/08/2023	A003527777-026	41.50	2.58	107.07	--	No	P
04/08/2023	A003527777-021	44.10	2.58	113.78	--	No	P
04/08/2023	A003527777-022	41.60	2.58	107.33	--	No	P
04/08/2023	A003527777-023	41.80	2.58	107.84	--	No	P
04/08/2023	A003527777-024	44.20	2.58	114.04	--	No	P
04/08/2023	A003527777-033	44.50	2.58	114.81	--	No	P
04/08/2023	A003527777-034	42.30	2.58	109.13	--	No	P
04/08/2023	A003527777-035	44.50	2.58	114.81	--	No	P
04/08/2023	A003527777-032	42.10	2.58	108.62	--	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.							

9.2	**Insulation test (initial) – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
03-08-2023	A003527778-015	36.50	2.78	101.47	--	No	P
03-08-2023	A003527778-016	38.60	2.78	107.31	--	No	P
03-08-2023	A003527778-017	43.20	2.78	120.10	--	No	P
03-08-2023	A003527778-018	46.80	2.78	130.10	--	No	P
03-08-2023	A003527778-019	40.30	2.78	112.03	--	No	P
03-08-2023	A003527778-020	31.70	2.78	88.13	--	No	P
03-08-2023	A003527778-021	25.30	2.78	70.33	--	No	P

Absatz	**Photovoltaic (PV) modules**				Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*				*Measuring results - Remarks*		*Result*
03-08-2023	A003527778-022	42.80	2.78	118.98	--	No	P
03-08-2023	A003527778-023	11.20	2.78	31.14	--	No	P
03-08-2023	A003527778-024	26.30	2.78	73.11	--	No	P
03-08-2023	A003527778-025	31.50	2.78	87.57	--	No	P
03-08-2023	A003527778-026	37.90	2.78	105.36	--	No	P
03-08-2023	A003527778-027	37.30	2.78	103.69	--	No	P
03-08-2023	A003527778-029	39.87	2.78	110.84	--	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.

9.3	**Wet leakage current test (initial) – MQT 15 / MST 17**				
Maximum system voltage [V_{DC}]			1500V		
Cemented joints?			☒ No ☐ Yes		
Insulation resistance measured at [V_{DC}]			1500V		
Solution resistivity [Ω·cm]			≤ 3500		
Solution temperature [°C]			22 ± 2		
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
04/08/2023	A003527777-001	6200.00	2.58	15996.00	P
04/08/2023	A003527777-002	5500.00	2.58	14190.00	P
04/08/2023	A003527777-004	5100.00	2.58	13158.00	P
04/08/2023	A003527777-005	6700.00	2.58	17286.00	P
04/08/2023	A003527777-006	5700.00	2.58	14706.00	P
04/08/2023	A003527777-007	5500.00	2.58	14190.00	P
04/08/2023	A003527777-008	7200.00	2.58	18576.00	P
04/08/2023	A003527777-009	5700.00	2.58	14706.00	P
04/08/2023	A003527777-010	6100.00	2.58	15738.00	P
04/08/2023	A003527777-015	6300.00	2.58	16254.00	P
04/08/2023	A003527777-016	6200.00	2.58	15996.00	P
04/08/2023	A003527777-017	6000.00	2.58	15480.00	P
04/08/2023	A003527777-027	5800.00	2.58	14964.00	P
31/07/2023	A003527777-028	5700.00	2.58	14706.00	P
31/07/2023	A003527777-029	6600.00	2.58	17028.00	P
31/07/2023	A003527777-030	5600.00	2.58	14448.00	P
31/07/2023	A003527777-031	5500.00	2.58	14190.00	P
31/07/2023	A003527777-003	4800.00	2.58	12384.00	P

Supplementary information:
Minimum requirement is 40 MΩ·m².

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.3	**Wet leakage current test (initial) – MQT 15 / MST 17**				
Maximum system voltage [V_{DC}]			1500V		
Cemented joints?			☒ No ☐ Yes		
Insulation resistance measured at [V_{DC}]			1500V		
Solution resistivity [Ω·cm]			≤ 3500		
Solution temperature [°C]			22 ± 2		
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
04/08/2023	A003527777-018	5600.00	2.58	14448.00	P
04/08/2023	A003527777-019	5900.00	2.58	15222.00	P
04/08/2023	A003527777-020	5400.00	2.58	13932.00	P
04/08/2023	A003527777-025	5800.00	2.58	14964.00	P
04/08/2023	A003527777-026	5400.00	2.58	13932.00	P
04/08/2023	A003527777-021	5800.00	2.58	14964.00	P
04/08/2023	A003527777-022	5900.00	2.58	15222.00	P
04/08/2023	A003527777-023	5500.00	2.58	14190.00	P
04/08/2023	A003527777-024	5800.00	2.58	14964.00	P
04/08/2023	A003527777-033	5100.00	2.58	13158.00	P
04/08/2023	A003527777-034	5300.00	2.58	13674.00	P
04/08/2023	A003527777-035	5200.00	2.58	13416.00	P
04/08/2023	A003527777-032	7100.00	2.58	18318.00	P
Supplementary information: Minimum requirement is 40 MΩ·m².					

9.3	**Wet leakage current test (initial) – MQT 15 / MST 17**				
Maximum system voltage [V_{DC}]			1500V		
Cemented joints?			☒ No ☐ Yes		
Insulation resistance measured at [V_{DC}]			1500V		
Solution resistivity [Ω·cm]			≤ 3500		
Solution temperature [°C]			22 ± 2		
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
03/08/2023	A003527778-015	1400.00	2.78	3892.00	P
03/08/2023	A003527778-016	150.00	2.78	417.00	P
03/08/2023	A003527778-017	1220.00	2.78	3391.60	P
03/08/2023	A003527778-018	1930.00	2.78	5365.40	P
03/08/2023	A003527778-019	1870.00	2.78	5198.60	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*		*Result*
03/08/2023	A003527778-020	1300.00	2.78	3614.00	P
03/08/2023	A003527778-021	1120.00	2.78	3113.60	P
03/08/2023	A003527778-022	990.00	2.78	2752.20	P
03/08/2023	A003527778-023	1990.00	2.78	5532.20	P
03/08/2023	A003527778-024	680.00	2.78	1890.40	P
03/08/2023	A003527778-025	760.00	2.78	2112.80	P
03/08/2023	A003527778-026	950.00	2.78	2641.00	P
03/08/2023	A003527778-027	2120.00	2.78	5893.60	P
03/08/2023	A003527778-029	1850.00	2.78	5143.00	P

Supplementary information:
Minimum requirement is 40 MΩ·m².

9.4	**Accessibility test (initial) – MST 11**			
Applied force [N]		10		
Test date (dd/mm/yyyy)	Sample no.	Contact with live electrical part?	R_{iso} [MΩ]	
04/08/2023	A003527777-005	☐ Yes ☒ No	>1	P
04/08/2023	A003527777-007	☐ Yes ☒ No	>1	P
04/08/2023	A003527777-009	☐ Yes ☒ No	>1	P
31/07/2023	A003527777-028	☐ Yes ☒ No	>1	P
31/07/2023	A003527777-029	☐ Yes ☒ No	>1	P
31/07/2023	A003527777-030	☐ Yes ☒ No	>1	P
31/07/2023	A003527777-031	☐ Yes ☒ No	>1	P

Supplementary information: None

9.5	**Continuity test of equipotential bonding (initial) – MST 13**			
Maximum overcurrent protection rating [A]			25	
Current applied [A]			62.50	
Duration of applied current [min]			2	
Location of designated point for equipotential bonding			Long side of the frame	
No. of other conductive parts tested			2	
Test date (dd/mm/yyyy)	Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
04/08/2023	A003527777-005	258.1	4.13	P
04/08/2023	A003527777-007	261.5	4.18	P
04/08/2023	A003527777-009	261.5	4.18	P
04/08/2023	A003527777-011	225.4	3.61	P
04/08/2023	A003527777-015	294.2	4.71	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

04/08/2023	A003527777-016	258.1	4.13	P
04/08/2023	A003527777-017	224.6	3.59	P
04/08/2023	A003527777-027	218.4	3.49	P
31/07/2023	A003527777-028	231.6	3.71	P
31/07/2023	A003527777-029	276.2	4.42	P
31/07/2023	A003527777-030	253.4	4.05	P
31/07/2023	A003527777-031	256.4	4.10	P

Supplementary information: None

9.6	**Initial stabilization – MQT 19.1**

☐ Simulator ☒ Natural sunlight ☐ Other stabilization procedures

Test date (dd/mm/yyyy)			31/07/2023 – 04/08/2023		—
Irradiance [W/m²]			800 – 1000		
Module temperature [°C]			Stabilization done in natural sunlight		
Sample no.	Test	Integrated irradiation [kWh/m²]	P_{max} [W]	Stabilization [%] *	
A003527777-001	Initial	—	571.5	0.30	P
	Light-soaking 1	5	571.2		
	Light-soaking 2	5	569.8		
A003527777-002	Initial	—	572.8	0.23	P
	Light-soaking 1	5	572.9		
	Light-soaking 2	5	571.6		
A003527777-005	Initial	—	572.9	0.27	P
	Light-soaking 1	5	572.7		
	Light-soaking 2	5	571.3		
A003527777-006	Initial	—	572.8	0.30	P
	Light-soaking 1	5	572.8		
	Light-soaking 2	5	571.1		
A003527777-007	Initial	—	579.6	0.57	P
	Light-soaking 1	5	578.0		
	Light-soaking 2	5	576.2		
A003527777-008	Initial	—	572.6	0.31	P
	Light-soaking 1	5	572.3		
	Light-soaking 2	5	570.8		
A003527777-009	Initial	—	581.3	0.54	P
	Light-soaking 1	5	579.8		
	Light-soaking 2	5	578.2		

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*		*Result*
A003527777-010	Initial	—	571.8	0.32	P
	Light-soaking 1	5	571.4		
	Light-soaking 2	5	570.0		
A003527777-015	Initial	—	571.4	0.32	P
	Light-soaking 1	5	571.2		
	Light-soaking 2	5	569.5		
A003527777-016	Initial	—	573.3	0.25	P
	Light-soaking 1	5	572.6		
	Light-soaking 2	5	571.8		
A003527777-017	Initial	—	571.8	0.32	P
	Light-soaking 1	5	571.3		
	Light-soaking 2	5	569.9		
A003527777-027	Initial	—	571.4	0.25	P
	Light-soaking 1	5	570.7		
	Light-soaking 2	5	569.9		

Supplementary information:
* Stabilization criterion: $(P_{max}-P_{min})/P_{avg} \leq 1$ % for three consecutive measurements.
Initial measurement corresponds to MQT 02 of IEC/EN 61215.
The non-illuminated side was covered with non-reflective background and aperture.

9.6	**Initial stabilization – MQT 19.1**				
☐ Simulator ☒ Natural sunlight ☐ Other stabilization procedures					
Test date (dd/mm/yyyy)			31/07/2023- 04/08/2023		—
Irradiance [W/m²]			800 – 1000		
Module temperature [°C]			Stabilization done in natural sunlight		
Sample no.	Test	Integrated irradiation [kWh/m²]	P_{max} [W]	Stabilization [%] *	
A003527777-018	Initial	—	572.9	0.46	P
	Light-soaking 1	5	571.7		
	Light-soaking 2	5	570.3		
A003527777-019	Initial	—	572.9	0.31	P
	Light-soaking 1	5	572.6		
	Light-soaking 2	5	571.2		
A003527777-021	Initial	—	572.0	0.33	P
	Light-soaking 1	5	571.2		
	Light-soaking 2	5	570.1		

Absatz	**Photovoltaic (PV) modules**			Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*			*Measuring results - Remarks*	*Result*
A003527777-022	Initial	—	572.8	0.24	P
	Light-soaking 1	5	572.2		
	Light-soaking 2	5	571.4		
A003527777-023	Initial	—	571.2	0.31	P
	Light-soaking 1	5	571.1		
	Light-soaking 2	5	569.5		
A003527777-024	Initial	—	570.8	0.27	P
	Light-soaking 1	5	570.9		
	Light-soaking 2	5	569.4		
A003527777-025	Initial	—	571.9	0.36	P
	Light-soaking 1	5	571.3		
	Light-soaking 2	5	569.9		
A003527777-026	Initial	—	571.9	0.30	P
	Light-soaking 1	5	571.1		
	Light-soaking 2	5	570.3		
A003527777-032	Initial	—	573.1	0.23	P
	Light-soaking 1	5	572.6		
	Light-soaking 2	5	571.8		
A003527777-033	Initial	—	571.7	0.21	P
	Light-soaking 1	5	570.7		
	Light-soaking 2	5	570.5		
A003527777-034	Initial	—	572.8	0.26	P
	Light-soaking 1	5	571.9		
	Light-soaking 2	5	571.3		
A003527777-035	Initial	—	572.6	0.29	P
	Light-soaking 1	5	572.5		
	Light-soaking 2	5	570.9		

Supplementary information:
* Stabilization criterion: $(P_{max}-P_{min})/P_{avg} \leq 1$ % for three consecutive measurements.
Initial measurement corresponds to MQT 02 of IEC/EN 61215.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.6	**Initial stabilization – MQT 19.1**

☐ Simulator ☒ Natural sunlight ☐ Other stabilization procedures

Test date (dd/mm/yyyy)			28/07/2023 to 02/08/2023		—
Irradiance [W/m²]			800 – 1000		
Module temperature [°C]			Stabilization done in natural sunlight		
Sample no.	Test	Integrated irradiation [kWh/m²]	P_{max} [W]	Stabilization [%] *	
A003527778-015	Initial	—	584.3	0.31	P
	Light-soaking 1	5	583.4		
	Light-soaking 2	5	582.6		
A003527778-016	Initial	—	584.4	0.29	P
	Light-soaking 1	5	583.4		
	Light-soaking 2	5	582.7		
A003527778-022	Initial	—	587.4	0.24	P
	Light-soaking 1	5	586.5		
	Light-soaking 2	5	586.0		
A003527778-023	Initial	—	586.2	0.32	P
	Light-soaking 1	5	585.1		
	Light-soaking 2	5	584.3		
A003527778-018	Initial	—	585.2	0.26	P
	Light-soaking 1	5	584.6		
	Light-soaking 2	5	583.7		
A003527778-019	Initial	—	585.6	0.23	P
	Light-soaking 1	5	585.4		
	Light-soaking 2	5	584.2		
A003527778-020	Initial	—	587.1	0.25	P
	Light-soaking 1	5	586.4		
	Light-soaking 2	5	585.7		
A003527778-021	Initial	—	585.7	0.25	P
	Light-soaking 1	5	584.9		
	Light-soaking 2	5	584.2		
A003527778-024	Initial	—	586.2	0.28	P
	Light-soaking 1	5	585.2		
	Light-soaking 2	5	584.5		
A003527778-025	Initial	—	585.9	0.29	P
	Light-soaking 1	5	584.9		
	Light-soaking 2	5	584.2		

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*		*Result*
A003527778-026	Initial	—	586.6	0.47	P
	Light-soaking 1	5	584.7		
	Light-soaking 2	5	583.8		
A003527778-027	Initial	—	586.4	0.27	P
	Light-soaking 1	5	585.4		
	Light-soaking 2	5	584.8		

Supplementary information:
* Stabilization criterion: $(P_{max}-P_{min})/P_{avg} \leq 1$ % for three consecutive measurements.
Initial measurement corresponds to MQT 02 of IEC/EN 61215.

9.6	**Initial stabilization – MQT 19.1**					
☐ Simulator ☒ Natural sunlight ☐ Other stabilization procedures						
Irradiance [W/m²]		800 – 1000				
Module temperature [°		Stabilization done in natural sunlight				
Test date (dd/mm/yyyy)	Sample no.	Test	Integrated irradiation [kWh/m²]	P_{max} [W]	Stabilization [%] *	
23/08/2023 to 29/08/2023	A003527777-036	Initial	—	455.8	0.47	P
		Light-soaking 1	5	457.9		
		Light-soaking 2	5	456.1		
	A003527777-037	Initial	—	457.3	0.31	P
		Light-soaking 1	5	458.7		
		Light-soaking 2	5	457.3		
	A003527777-038	Initial	—	451.3	0.30	P
		Light-soaking 1	5	452.7		
		Light-soaking 2	5	451.4		
	A003527777-039	Initial	—	449.3	0.29	P
		Light-soaking 1	5	450.6		
		Light-soaking 2	5	450.5		
	A003527777-042	Initial	—	407.4	0.42	P
		Light-soaking 1	5	406.2		
		Light-soaking 2	5	405.7		
	A003527777-043	Initial	—	407.1	0.48	P
		Light-soaking 1	5	406.7		
		Light-soaking 2	5	405.1		
	A003527777-040	Initial	—	424.9	0.61	P
		Light-soaking 1	5	423.8		
		Light-soaking 2	5	422.3		

Absatz	**Photovoltaic (PV) modules**			Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*			*Measuring results - Remarks*		*Result*
	A003527777-041	Initial	—	424.6	0.63	P
		Light-soaking 1	5	423.5		
		Light-soaking 2	5	421.9		
20/01/2024 to 24/01/2024	A003599023-001	Initial	—	609.4	0.71	P
		Light-soaking 1	5	607.3		
		Light-soaking 2	5	605.1		
	A003599023-002	Initial	—	609.3	0.62	P
		Light-soaking 1	5	607.5		
		Light-soaking 2	5	605.5		
16/11/2023 to 20/11/2023	A003599023-005	Initial	—	583.1	0.17	P
		Light-soaking 1	5	582.7		
		Light-soaking 2	5	582.1		
	A003599023-006	Initial	—	582.9	0.47	P
		Light-soaking 1	5	581.0		
		Light-soaking 2	5	580.2		

Supplementary information:
* Stabilization criterion: $(P_{max}-P_{min})/P_{avg} \leq 1$ % for three consecutive measurements.
Initial measurement corresponds to MQT 02 of IEC/EN 61215.

9.7	**Maximum power determination (initial) – MST 03**		
Irradiance [W/m²]		1000 ± 10	
Module temperature [°C]		Corrected to 25	
Test method		☒ Simulator ☐ Natural sunlight	
Test date (dd/mm/yyyy)	Sample no.	Appearance of initial IV-curve	
31/07/2023	A003527777-004	No kinks or other unusual characteristics	P
31/07/2023	A003527777-003	No kinks or other unusual characteristics	P
31/07/2023	A003527777-005	No kinks or other unusual characteristics	P
31/07/2023	A003527777-007	No kinks or other unusual characteristics	P
31/07/2023	A003527777-009	No kinks or other unusual characteristics	P
31/07/2023	A003527777-028	No kinks or other unusual characteristics	P
31/07/2023	A003527777-029	No kinks or other unusual characteristics	P
31/07/2023	A003527777-030	No kinks or other unusual characteristics	P
31/07/2023	A003562285-002	No kinks or other unusual characteristics	P
31/07/2023	A003527777-031	No kinks or other unusual characteristics	P

Supplementary information: -
The non-illuminated side was covered with non-reflective background and aperture.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.7	**Maximum power determination (initial) – MST 03**		
Irradiance [W/m²]		1000 ± 10	
Module temperature [°C]		Corrected to 25	
Test method		☒ Simulator ☐ Natural sunlight	
Test date (dd/mm/yyyy)	Sample no.	Appearance of initial IV-curve	
31/07/2023	A003527777-020	No kinks or other unusual characteristics	P
31/07/2023	A003527777-025	No kinks or other unusual characteristics	P
31/07/2023	A003527777-021	No kinks or other unusual characteristics	P
31/07/2023	A003527777-023	No kinks or other unusual characteristics	P
Supplementary information: - The non-illuminated side was covered with non-reflective background and aperture.			

9.7	**Maximum power determination (initial) – MST 03**		
Irradiance [W/m²]		1000 ± 10	
Module temperature [°C]		Corrected to 25	
Test method		☒ Simulator ☐ Natural sunlight	
Test date (dd/mm/yyyy)	Sample no.	Appearance of initial IV-curve	
02/08/2023	A003527778-017	No kinks or other unusual characteristics	P
28/07/2023	A003527778-022	No kinks or other unusual characteristics	P
28/07/2023	A003527778-018	No kinks or other unusual characteristics	P
28/07/2023	A003527778-020	No kinks or other unusual characteristics	P
28/07/2023	A003527778-029	No kinks or other unusual characteristics	P
Supplementary information: - None			

9.8	**Performance at STC (initial) (front side)– MQT 06.1**							
Test method			☒ Simulator ☐ Natural sunlight					
Illuminated side			☒ Front side ☐ Rear side					
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
04/08/2023	A003527777-001	569.8	42.69	13.35	51.77	13.97	78.8	P
04/08/2023	A003527777-002	571.6	42.76	13.37	51.81	13.96	79.1	P
04/08/2023	A003527777-005	571.3	42.75	13.36	51.79	13.96	79.0	P

Absatz	**Photovoltaic (PV) modules**				Messergebnisse - Bemerkungen			Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*				*Measuring results - Remarks*			*Result*
04/08/2023	A003527777-006	571.1	42.75	13.36	51.80	13.95	79.0	P
04/08/2023	A003527777-007	576.2	42.94	13.42	51.82	14.04	79.2	P
04/08/2023	A003527777-008	570.8	42.73	13.36	51.80	13.94	79.0	P
04/08/2023	A003527777-009	578.2	43.46	13.30	51.80	13.89	80.4	P
04/08/2023	A003527777-010	570.0	42.78	13.32	51.80	13.94	78.9	P
04/08/2023	A003527777-015	569.5	42.64	13.36	51.75	13.97	78.8	P
04/08/2023	A003527777-016	571.8	42.76	13.37	51.75	13.96	79.2	P
04/08/2023	A003527777-017	569.9	42.71	13.34	51.76	13.98	78.7	P
04/08/2023	A003527777-027	569.9	42.70	13.35	51.74	13.94	79.0	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture.

9.8	**Performance at STC (initial) (front side) – MQT 06.1**							
Test method			☒ Simulator		☐ Natural sunlight			
Illuminated side			☒ Front side		☐ Rear side			
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
04/08/2023	A003527777-018	570.3	42.78	13.33	51.77	13.96	78.9	P
04/08/2023	A003527777-019	571.2	42.78	13.35	51.76	13.95	79.1	P
04/08/2023	A003527777-021	570.1	42.72	13.35	51.77	13.96	78.9	P
04/08/2023	A003527777-022	571.4	42.75	13.37	51.77	13.97	79.0	P
04/08/2023	A003527777-023	569.5	42.72	13.33	51.72	13.9	79.2	P
04/08/2023	A003527777-024	569.4	42.68	13.34	51.78	13.95	78.8	P
04/08/2023	A003527777-025	569.9	42.76	13.33	51.79	13.96	78.8	P
04/08/2023	A003527777-026	570.3	42.72	13.35	51.74	13.94	79.0	P
04/08/2023	A003527777-032	571.8	42.77	13.37	51.77	13.95	79.1	P
04/08/2023	A003527777-033	570.5	42.74	13.35	51.75	13.96	78.9	P
04/08/2023	A003527777-034	571.3	42.79	13.35	51.77	13.96	79.1	P
04/08/2023	A003527777-035	570.9	42.72	13.36	51.81	13.97	78.9	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.8 **Performance at STC (initial) (front side) – MQT 06.1**

Test method			☒ Simulator		☐ Natural sunlight			
Illuminated side			☒ Front side		☐ Rear side			
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
02/08/2023	A003527778-015	582.6	45.44	12.82	54.23	13.41	80.1	P
02/08/2023	A003527778-016	582.7	45.44	12.82	54.23	13.41	80.1	P
02/08/2023	A003527778-018	583.7	45.4	12.86	54.32	13.45	79.9	P
02/08/2023	A003527778-019	584.2	45.47	12.85	54.42	13.45	79.8	P
02/08/2023	A003527778-020	585.7	45.5	12.87	54.35	13.46	80.1	P
02/08/2023	A003527778-021	584.2	45.45	12.85	54.27	13.44	80.1	P
02/08/2023	A003527778-022	586.0	45.46	12.89	54.42	13.48	79.9	P
02/08/2023	A003527778-023	584.3	45.43	12.86	54.40	13.44	79.9	P
02/08/2023	A003527778-024	584.5	45.50	12.85	54.39	13.43	80.0	P
02/08/2023	A003527778-025	584.2	45.46	12.85	54.22	13.43	80.2	P
02/08/2023	A003527778-026	583.8	45.49	12.84	54.30	13.42	80.1	P
02/08/2023	A003527778-027	584.8	45.49	12.86	54.36	13.44	80.1	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.8 Performance at STC (initial) (front side) – MQT 06.1

Test method			☒ Simulator ☐ Natural sunlight					
Illuminated side			☒ Front side ☐ Rear side					
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
29/08/2023	A003527777-036	456.1	35.86	12.72	43.17	13.28	79.5	P
29/08/2023	A003527777-037	457.3	35.90	12.74	43.18	13.29	79.7	P
29/08/2023	A003527777-038	451.4	35.60	12.68	42.81	13.24	79.6	P
29/08/2023	A003527777-039	450.5	35.56	12.67	42.87	13.23	79.4	P
29/08/2023	A003527777-042	405.7	31.82	12.75	38.62	13.39	79.1	P
29/08/2023	A003527777-043	405.1	31.85	12.72	38.62	13.39	78.9	P
29/08/2023	A003527777-040	422.3	32.67	12.93	38.57	13.50	81.1	P
29/08/2023	A003527777-041	421.9	32.64	12.93	38.61	13.50	80.9	P
24/01/2024	A003599023-001	605.1	46.44	13.03	56.28	13.60	79.0	P
24/01/2024	A003599023-002	605.5	47.20	12.83	56.31	13.57	79.2	P
20/11/2023	A003599023-005	582.1	45.39	12.82	54.35	13.42	79.8	P
20/11/2023	A003599023-006	580.2	45.26	12.82	54.42	13.43	79.4	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture

9.8 Performance at STC (initial) (rear side)– MQT 06.1

Test method			☒ Simulator ☐ Natural sunlight					
Illuminated side			☐ Front side ☒ Rear side					
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
04/08/2023	A003527777-001	430.5	44.48	9.68	51.16	10.76	78.17	P
04/08/2023	A003527777-002	434.4	43.99	9.88	51.18	10.72	79.2	P
04/08/2023	A003527777-005	431.9	44.65	9.67	51.16	10.62	79.5	P
04/08/2023	A003527777-006	434.4	44.86	9.68	51.20	10.74	79.0	P

Absatz	**Photovoltaic (PV) modules**				Messergebnisse - Bemerkungen			Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*				*Measuring results - Remarks*			*Result*
04/08/2023	A003527777-007	430.5	45.01	9.57	51.18	10.64	79.1	P
04/08/2023	A003527777-008	430.0	44.56	9.65	51.18	10.68	78.7	P
04/08/2023	A003527777-009	430.0	44.56	9.65	51.18	10.68	78.7	P
04/08/2023	A003527777-010	431.9	44.66	9.67	51.18	10.70	78.9	P
04/08/2023	A003527777-015	430.3	44.39	9.69	51.13	10.67	78.9	P
04/08/2023	A003527777-016	431.5	44.45	9.71	51.13	10.64	79.3	P
04/08/2023	A003527777-017	431.4	44.47	9.70	51.14	10.62	79.4	P
04/08/2023	A003527777-027	433.3	44.23	9.80	51.13	10.72	79.0	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture.

9.8	**Performance at STC (initial) (rear side)– MQT 06.1**							
Test method			☒ Simulator		☐ Natural sunlight			
Illuminated side			☐ Front side		☒ Rear side			
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
04/08/2023	A003527777-018	430.9	44.21	9.75	51.15	10.6	79.47	P
04/08/2023	A003527777-019	431.7	44.09	9.79	51.14	10.67	79.1	P
04/08/2023	A003527777-021	433.7	43.95	9.87	51.15	10.75	78.9	P
04/08/2023	A003527777-022	431.2	44.62	9.66	51.13	10.75	78.4	P
04/08/2023	A003527777-023	431.2	44.14	9.77	51.12	10.63	79.4	P
04/08/2023	A003527777-024	433.9	44.24	9.81	51.18	10.77	78.7	P
04/08/2023	A003527777-025	432.1	44.28	9.76	51.17	10.61	79.6	P
04/08/2023	A003527777-026	432.7	44.19	9.79	51.13	10.74	78.8	P
04/08/2023	A003527777-032	429.4	44.43	9.67	51.14	10.58	79.4	P
04/08/2023	A003527777-033	433.3	44.58	9.72	51.14	10.68	79.3	P
04/08/2023	A003527777-034	433.7	44.08	9.84	51.14	10.68	79.4	P
04/08/2023	A003527777-035	430.8	44.73	9.63	51.2	10.63	79.1	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.8.2 Performance at STC (initial) (rear side) – MQT 06.1

Test method			☒ Simulator		☐ Natural sunlight			
Illuminated side			☐ Front side		☒ Rear side			
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
02/08/2023	A003527778-015	418.7	46.87	8.93	53.73	10.26	75.9	P
02/08/2023	A003527778-016	414.5	47.1	8.8	53.71	10.13	76.2	P
02/08/2023	A003527778-018	419.1	46.76	8.96	53.79	10.14	76.8	P
02/08/2023	A003527778-019	423.2	46.82	9.04	53.89	10.34	75.9	P
02/08/2023	A003527778-020	420.1	46.90	8.96	53.82	10.24	76.3	P
02/08/2023	A003527778-021	420.1	46.90	8.96	53.82	10.24	76.3	P
02/08/2023	A003527778-022	417.3	47.18	8.84	53.91	10.1	76.7	P
02/08/2023	A003527778-023	419.2	46.96	8.93	53.88	10.08	77.2	P
02/08/2023	A003527778-024	418.5	47.00	8.90	53.86	10.12	76.7	P
02/08/2023	A003527778-025	424.4	46.72	9.08	53.71	10.2	77.5	P
02/08/2023	A003527778-026	420.2	46.74	8.99	53.76	10.12	77.3	P
02/08/2023	A003527778-027	418.1	47.05	8.89	53.84	10.15	76.5	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture.

9.8.2 Performance at STC (initial) (rear side) – MQT 06.1

Test method			☒ Simulator		☐ Natural sunlight			
Illuminated side			☐ Front side		☒ Rear side			
Ambient temperature [°C]			25 ± 2					
Irradiance [W/m²]			1000 ± 10					
Module temperature [°C]			25 ± 2					
Spectral mismatch			N/A					
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
29/08/2023	A003527777-036	388.2	37.33	10.4	42.82	11.42	79.4	P
29/08/2023	A003527777-037	388.3	36.91	10.52	42.86	11.45	79.1	P
29/08/2023	A003527777-038	382.6	36.93	10.36	42.49	11.45	78.6	P
29/08/2023	A003527777-039	384.7	36.81	10.45	42.55	11.35	79.7	P

Absatz	**Photovoltaic (PV) modules**				Messergebnisse - Bemerkungen			Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*				*Measuring results - Remarks*			*Result*
29/08/2023	A003527777-042	405.7	31.82	12.75	38.62	13.39	79.1	P
29/08/2023	A003527777-043	405.1	31.85	12.72	38.62	13.39	78.9	P
29/08/2023	A003527777-040	422.3	32.67	12.93	38.57	13.50	81.1	P
29/08/2023	A003527777-041	421.9	32.64	12.93	38.61	13.50	80.9	P
24/01/2024	A003599023-001	479.7	48.84	9.82	55.71	10.95	78.6	P
24/01/2024	A003599023-002	479.1	48.84	9.81	55.80	10.94	78.7	P
20/11/2023	A003599023-005	418.3	46.83	8.93	53.85	10.32	75.3	P
20/11/2023	A003599023-006	421.1	46.87	8.98	53.93	10.22	76.4	P

Supplementary information:
The non-illuminated side was covered with non-reflective background and aperture.

9.8.3	**Bifaciality Coefficients (initial)**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	-
A003527777-001	77.02	98.82	75.54	-
A003527777-002	76.79	98.78	75.99	-
A003527777-005	76.07	98.78	75.60	-
A003527777-006	76.99	98.84	76.06	-
A003527777-007	75.78	98.76	74.72	-
A003527777-008	76.61	98.80	75.34	-
A003527777-009	76.89	98.80	74.38	-
A003527777-010	76.76	98.80	75.76	-
A003527777-015	76.38	98.80	75.56	-
A003527777-016	76.22	98.80	75.46	-
A003527777-017	75.97	98.80	75.70	-
A003527777-027	76.90	9882	76.03	-

Supplementary information: - None

9.8.3	**Bifaciality Coefficients (initial)**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	-
A003527777-018	75.93	98.80	75.55	-
A003527777-019	76.49	98.80	75.58	-
A003527777-021	77.01	98.80	76.08	-
A003527777-022	76.95	98.76	75.47	-
A003527777-023	76.47	98.84	75.72	-
A003527777-024	77.20	98.84	76.21	-
A003527777-025	76.00	98.80	75.83	-
A003527777-026	77.04	98.82	75.87	-
A003527777-032	75.84	98.78	75.10	-

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

A003527777-033	76.50	98.82	75.95	-
A003527777-034	76.50	98.78	75.92	-
A003527777-035	76.09	98.82	75.44	-
Supplementary information: - None				

9.8.3	**Bifaciality Coefficients (initial)**			
Sample no.	φ_{Isc}	$\varphi_{Voc.}$	φ_{Pmax}	-
A003527778-015	76.51	99.08	71.87	-
A003527778-016	75.54	99.04	71.13	-
A003527778-018	75.39	99.02	71.81	-
A003527778-019	76.88	99.03	72.44	-
A003527778-020	76.08	99.02	71.73	-
A003527778-021	76.19	99.17	71.91	-
A003527778-022	74.93	99.06	71.20	-
A003527778-023	75.00	99.04	71.74	-
A003527778-024	75.35	99.03	71.59	-
A003527778-025	75.95	99.06	72.64	-
A003527778-026	75.41	99.01	71.97	-
A003527778-027	75.52	99.04	71.50	-
Supplementary information: - None				

9.8.3	**Bifaciality Coefficients (initial)**			
Sample no.	φ_{Isc}	$\varphi_{Voc.}$	φ_{Pmax}	-
A003527777-036	85.99	99.19	85.11	-
A003527777-039	85.86	99.26	85.44	-
A003527777-037	86.16	99.26	84.91	-
A003527777-038	86.55	99.26	84.83	-
A003527777-042	79.69	99.02	81.45	-
A003527777-043	79.69	98.99	81.18	-
A003527777-040	78.00	98.94	79.24	-
A003527777-041	78.96	98.94	78.01	-
A003599023-001	80.51	98.99	79.29	-
A003599023-002	80.62	99.09	79.12	-
A003599023-005	76.90	99.08	71.86	-
A003599023-006	76.10	99.10	72.57	-
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.8.4	**Performance at BNPI (initial) – MQT 06.1**						
Test date (dd/mm/yyyy)			04/08/2023				—
Test method			☒ Simulator ☐ Natural sunlight				
Illuminated side			☒ Front side ☐ Rear side				
Ambient temperature [°C]			25 ± 2				
Irradiance [W/m²]			1000 + φ•135*				
Module temperature [°C]			25 ± 2				
Spectral mismatch			N/A				
Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
A003527777-001	629.4	42.78	14.71	51.97	15.40	78.6	P
A003527777-002	628.0	42.70	14.71	51.98	15.39	78.5	P
A003527777-005	627.9	42.64	14.72	51.96	15.39	78.5	P
A003527777-006	628.0	42.71	14.70	52.00	15.39	78.5	P
A003527777-007	633.1	42.81	14.79	52.01	15.46	78.3	P
A003527777-008	627.7	42.70	14.70	52.00	15.37	78.5	P
A003527777-009	633.4	43.34	14.62	52.00	15.29	79.7	P
A003527777-010	629.1	42.72	14.73	51.97	15.40	78.6	P
A003527777-015	628.6	42.74	14.71	51.97	15.40	78.6	P
A003527777-016	629.0	42.71	14.73	51.94	15.40	78.6	P
A003527777-017	628.1	42.83	14.66	51.96	15.37	78.7	P
A003527777-027	628.9	42.90	14.66	51.95	15.37	78.8	P

Supplementary information: The non-illuminated side was covered with non-reflective background and aperture.
* The bifaciality coefficient φ employed is the minimum value of φ_{Isc} and φ_{Pmax} as documented in table 9.8.3 for each test sample.

9.8.4	**Performance at BNPI (initial) – MQT 06.1**						
Test date (dd/mm/yyyy)			04/08/2023				—
Test method			☒ Simulator ☐ Natural sunlight				
Illuminated side			☒ Front side ☐ Rear side				
Ambient temperature [°C]			25 ± 2				
Irradiance [W/m²]			1000 + φ•135*				
Module temperature [°C]			25 ± 2				
Spectral mismatch			N/A				
Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
A003527777-018	628.9	42.75	14.71	51.94	15.38	78.8	P
A003527777-019	628.4	42.73	14.70	51.95	15.40	78.5	P
A003527777-021	628.4	42.72	14.71	51.96	15.40	78.6	P

Absatz	**Photovoltaic (PV) modules**				Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*				*Measuring results - Remarks*		*Result*
A003527777-022	628.1	42.67	14.72	51.98	15.40	78.5	P
A003527777-023	629.2	42.80	14.70	51.95	15.38	78.8	P
A003527777-024	628.9	42.76	14.71	51.95	15.40	78.6	P
A003527777-025	629.2	42.78	14.71	51.96	15.40	78.6	P
A003527777-026	628.7	42.73	14.71	51.97	15.40	78.6	P
A003527777-032	628.7	42.73	14.71	51.97	15.38	78.6	P
A003527777-033	628.1	42.68	14.72	51.96	15.40	78.5	P
A003527777-034	628.1	42.75	14.69	51.97	15.38	78.5	P
A003527777-035	627.8	42.66	14.71	52.02	15.40	78.3	P

Supplementary information: The non-illuminated side was covered with non-reflective background and aperture.

* The bifaciality coefficient φ employed is the minimum value of φ_{Isc} and φ_{Pmax} as documented in table 9.8.3 for each test sample.

9.8.4	**Performance at BNPI (initial) – MQT 06.1**						
Test date (dd/mm/yyyy)			02/08/2023				—
Test method			☒ Simulator ☐ Natural sunlight				
Illuminated side			☒ Front side ☐ Rear side				
Ambient temperature [°C]			25 ± 2				
Irradiance [W/m²]			1000 + φ•135*				
Module temperature [°C]			25 ± 2				
Spectral mismatch			N/A				
Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
A003527778-015	636.4	45.43	14.01	54.43	14.66	79.7	P
A003527778-016	637.3	45.42	14.03	54.42	14.68	79.7	P
A003527778-018	638.9	45.35	14.09	54.51	14.75	79.5	P
A003527778-019	639.4	45.43	14.07	54.61	14.74	79.4	P
A003527778-020	640.2	45.47	14.08	54.53	14.74	79.6	P
A003527778-021	639.6	45.42	14.08	54.45	14.74	79.7	P
A003527778-022	640.4	45.41	14.10	54.60	14.76	79.4	P
A003527778-023	639.0	45.39	14.08	54.58	14.73	79.5	P
A003527778-024	638.9	45.46	14.05	54.57	14.70	79.6	P
A003527778-025	638.8	45.43	14.06	54.41	14.71	79.8	P
A003527778-026	638.3	45.47	14.04	54.48	14.70	79.7	P
A003527778-027	639.2	45.45	14.06	54.53	14.71	79.7	P

Supplementary information: The non-illuminated side was covered with non-reflective background and aperture.

* The bifaciality coefficient φ employed is the minimum value of φ_{Isc} and φ_{Pmax} as documented in table 9.8.3 for each test sample.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.8.2	**Performance at BNPI (initial) (Front side) – MQT 06.1**								
Test method			☒ Simulator		☐ Natural sunlight				
Illuminated side			☒ Front side		☐ Rear side				
Ambient temperature [°C]			25 ± 2						
Irradiance [W/m²]			1000 + φ•135*						
Module temperature [°C]			25 ± 2						
Spectral mismatch			N/A						
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]		
29/08/2023	A003527777-036	507.1	35.80	14.17	43.13	14.8	79.4		P
29/08/2023	A003527777-037	509.2	35.90	14.19	43.18	14.82	79.6		P
29/08/2023	A003527777-038	503.2	35.61	14.13	42.82	14.78	79.5		P
29/08/2023	A003527777-039	501.6	35.55	14.11	42.87	14.77	79.3		P
29/08/2023	A003527777-042	452.5	31.93	14.17	38.78	14.82	78.7		P
29/08/2023	A003527777-043	450.9	31.92	14.12	38.78	14.82	78.5		P
29/08/2023	A003527777-040	470.3	32.75	14.36	38.72	14.92	80.5		P
29/08/2023	A003527777-041	470.1	32.76	14.35	38.75	14.91	80.4		P
24/01/2024	A003599023-001	670.1	46.44	14.43	56.54	15.10	78.5		P
24/01/2024	A003599023-002	668.1	46.62	14.33	56.63	15.14	77.9		P
20/11/2023	A003599023-005	638.5	45.40	14.07	54.59	14.73	79.4		P
20/11/2023	A003599023-006	638.5	45.38	14.07	54.66	14.75	79.2		P
Supplementary information: The non-illuminated side was covered with non-reflective background and aperture.									

9.9	**Gate #1 evaluation (STC)**			
Manufacturer tolerances given on name plate	for P_{max}	t_1 [%]	0	—
	for V_{OC}	t_2 [%]	±5	
	for I_{SC}	t_3 [%]	±5	
	for P_{max4}	t_4 [%]	3	
Measurement uncertainty of test laboratory	for P_{max}	m_1 [%]	± 1.85 (for c-Si)	
	for V_{OC}	m_2 [%]	± 0.48 (for c-Si)	
	for I_{SC}	m_3 [%]	± 1.83 (for c-Si)	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.1	**Evaluation of output power for each module (STC)**				
Sample no.	$P_{max,meas}$ [W]	$P_{max,meas,m1}$ [W]	$P_{max,NP}$ [W]	$P_{max,NP,t1}$ [W]	—
A003527777-001	569.8	578.5	575.0	575.0	P
A003527777-002	571.6	580.3	575.0	575.0	P
A003527777-005	571.3	580.0	575.0	575.0	P
A003527777-006	571.1	579.8	575.0	575.0	P
A003527777-007	576.2	585.0	580.0	580.0	P
A003527777-008	570.8	579.5	575.0	575.0	P
A003527777-009	578.2	586.9	580.0	580.0	P
A003527777-010	570.0	578.7	575.0	575.0	P
A003527777-015	569.5	578.2	575.0	575.0	P
A003527777-016	571.8	580.6	575.0	575.0	P
A003527777-017	569.9	578.6	575.0	575.0	P
A003527777-027	569.9	578.6	575.0	575.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,m1}$ = Measured maximum STC power taking positive measurement uncertainty into account
$P_{max,NP,t1}$ = Nominal maximum STC power taking negative rated production tolerance into account

9.9.1	**Evaluation of output power for each module (STC)**				
Sample no.	$P_{max,meas}$ [W]	$P_{max,meas,m1}$ [W]	$P_{max,NP}$ [W]	$P_{max,NP,t1}$ [W]	—
A003527777-018	570.3	578.9	575.0	575.0	P
A003527777-019	571.2	579.9	575.0	575.0	P
A003527777-021	570.1	578.8	575.0	575.0	P
A003527777-022	571.4	580.1	575.0	575.0	P
A003527777-023	569.5	578.2	575.0	575.0	P
A003527777-024	569.4	578.1	565.0	565.0	P
A003527777-025	569.9	578.6	565.0	565.0	P
A003527777-026	570.3	578.9	575.0	575.0	P
A003527777-032	571.8	580.5	575.0	575.0	P
A003527777-033	570.5	579.2	575.0	575.0	P
A003527777-034	571.3	580.0	575.0	575.0	P
A003527777-035	570.9	579.7	575.0	575.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,m1}$ = Measured maximum STC power taking positive measurement uncertainty into account
$P_{max,NP,t1}$ = Nominal maximum STC power taking negative rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.1	**Evaluation of output power for each module (STC)**				
Sample no.	$P_{max,meas}$ [W]	$P_{max,meas,m1}$ [W]	$P_{max,NP}$ [W]	$P_{max,NP,t1}$ [W]	—
A003527778-015	582.6	591.4	590.0	590.0	P
A003527778-016	582.7	591.6	590.0	590.0	P
A003527778-018	583.7	592.6	590.0	590.0	P
A003527778-019	584.2	593.2	590.0	590.0	P
A003527778-020	585.7	594.6	590.0	590.0	P
A003527778-021	584.2	593.2	590.0	590.0	P
A003527778-022	586.0	594.9	590.0	590.0	P
A003527778-023	584.3	593.2	590.0	590.0	P
A003527778-024	584.5	593.4	590.0	590.0	P
A003527778-025	584.2	593.1	590.0	590.0	P
A003527778-026	583.8	592.8	590.0	590.0	P
A003527778-027	584.8	593.7	590.0	590.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,m1}$ = Measured maximum STC power taking positive measurement uncertainty into account
$P_{max,NP,t1}$ = Nominal maximum STC power taking negative rated production tolerance into account

9.9.1	**Evaluation of output power for each module (STC)**				
Sample no.	$P_{max,meas}$ [W]	$P_{max,meas,m1}$ [W]	$P_{max,NP}$ [W]	$P_{max,NP,t1}$ [W]	—
A003527777-036	456.1	463.1	460.0	460.0	P
A003527777-037	457.3	464.3	460.0	460.0	P
A003527777-040	422.3	428.8	425.0	425.0	P
A003527777-041	421.9	428.4	425.0	425.0	P
A003599023-001	605.1	614.3	605.0	605.0	P
A003599023-002	605.5	614.8	605.0	605.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,m1}$ = Measured maximum STC power taking positive measurement uncertainty into account
$P_{max,NP,t1}$ = Nominal maximum STC power taking negative rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.2 **Evaluation of output power for average of all modules (STC)**

Module type	$P_{max,meas,avg}$ [W]	$P_{max,meas,avg,m1}$ [W]	$P_{max,NP}$ [W]	—
HYPERSOL VSMDH.72.575.05	571.7	580.4	575.0	P
HYPERSOL VSMDH.72.580.05	577.2	586.0	580.0	P
PARADEA VSMDH.78.590.05	584.2	593.1	590.0	P
PARADEA VSMDH.78.605.05	605.3	614.6	605.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,avg,m1}$ = Arithmetic average of meas. max. STC power taking positive measurement uncertainty into account

9.9.3 **Evaluation of open-circuit voltage for each module (STC)**

Sample no.	$V_{oc,meas}$ [V]	$V_{oc,meas,m2}$ [V]	$V_{oc,NP}$ [V]	$V_{oc,NP,t2}$ [V]	—
A003527777-001	51.77	51.98	50.70	53.24	P
A003527777-002	51.81	52.02	50.70	53.24	P
A003527777-005	51.79	52.00	50.70	53.24	P
A003527777-006	51.80	52.01	50.70	53.24	P
A003527777-007	51.82	52.03	50.90	53.45	P
A003527777-008	51.80	52.01	50.70	53.24	P
A003527777-009	51.80	52.01	50.90	53.45	P
A003527777-010	51.80	52.01	50.70	53.24	P
A003527777-015	51.75	51.95	50.70	53.24	P
A003527777-016	51.75	51.95	50.70	53.24	P
A003527777-017	51.76	51.96	50.70	53.24	P
A003527777-027	51.74	51.94	50.70	53.24	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc,meas,m2}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc,NP,t2}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.3 **Evaluation of open-circuit voltage for each module (STC)**

Sample no.	$V_{oc,meas}$ [V]	$V_{oc,meas,m2}$ [V]	$V_{oc,NP}$ [V]	$V_{oc,NP,t2}$ [V]	—
A003527777-018	51.77	51.98	50.70	53.24	P
A003527777-019	51.76	51.96	50.70	53.24	P
A003527777-021	51.77	51.98	50.70	53.24	P
A003527777-022	51.77	51.98	50.70	53.24	P
A003527777-023	51.72	51.92	50.70	53.24	P
A003527777-024	51.78	51.99	50.00	52.50	P
A003527777-025	51.79	52.00	50.00	52.50	P
A003527777-026	51.74	51.94	50.70	53.24	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*

A003527777-032	51.77	51.98	50.70	53.24	P
A003527777-033	51.75	51.95	50.70	53.24	P
A003527777-034	51.77	51.98	50.70	53.24	P
A003527777-035	51.81	52.02	50.70	53.24	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc,meas,m2}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc,NP,t2}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.3	**Evaluation of open-circuit voltage for each module (STC)**				
Sample no.	$V_{oc,meas}$ [V]	$V_{oc,meas,m2}$ [V]	$V_{oc,NP}$ [V]	$V_{oc,NP,t2}$ [V]	—
A003527778-015	54.23	54.44	53.73	56.42	P
A003527778-016	54.23	54.44	53.73	56.42	P
A003527778-018	54.32	54.54	53.73	56.42	P
A003527778-019	54.42	54.64	53.73	56.42	P
A003527778-020	54.35	54.57	53.73	56.42	P
A003527778-021	54.27	54.48	53.73	56.42	P
A003527778-022	54.42	54.64	53.73	56.42	P
A003527778-023	54.40	54.62	53.73	56.42	P
A003527778-024	54.39	54.61	53.73	56.42	P
A003527778-025	54.22	54.43	53.73	56.42	P
A003527778-026	54.30	54.52	53.73	56.42	P
A003527778-027	54.36	54.58	53.73	56.42	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc,meas,m2}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc,NP,t2}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.3	**Evaluation of open-circuit voltage for each module (STC)**				
Sample no.	$V_{oc,meas}$ [V]	$V_{oc,meas,m2}$ [V]	$V_{oc,NP}$ [V]	$V_{oc,NP,t2}$ [V]	—
A003527777-036	43.17	43.34	41.45	43.52	P
A003527777-037	43.18	43.35	41.45	43.52	P
A003527777-038	42.81	42.98	41.05	43.10	P
A003527777-039	42.87	43.04	41.05	43.10	P
A003527777-042	38.62	38.77	37.50	41.25	P
A003527777-043	38.62	38.77	37.50	41.25	P
A003527777-040	38.57	38.72	38.00	41.80	P
A003527777-041	38.61	38.76	38.00	41.80	P
A003599023-001	56.28	56.50	54.16	56.87	P
A003599023-002	56.31	56.53	54.16	56.87	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*		*Result*
A003599023-005	54.35	54.57	53.95	56.65	P
A003599023-006	54.42	54.64	53.95	56.65	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc,meas,m2}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc,NP,t2}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.4	**Evaluation of short-circuit current for each module (STC)**				
Sample no.	$I_{sc,meas}$ [A]	$I_{sc,meas,m3}$ [A]	$I_{sc,NP}$ [A]	$I_{sc,NP,t3}$ [A]	—
A003527777-001	13.97	14.18	14.14	14.85	P
A003527777-002	13.96	14.17	14.14	14.85	P
A003527777-005	13.96	14.17	14.14	14.85	P
A003527777-006	13.95	14.16	14.14	14.85	P
A003527777-007	14.04	14.25	14.20	14.91	P
A003527777-008	13.94	14.15	14.14	14.85	P
A003527777-009	13.89	14.10	14.20	14.91	P
A003527777-010	13.94	14.15	14.14	14.85	P
A003527777-015	13.97	14.18	14.14	14.85	P
A003527777-016	13.96	14.17	14.14	14.85	P
A003527777-017	13.98	14.19	14.14	14.85	P
A003527777-027	13.94	14.15	14.14	14.85	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc,meas,m3}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc,NP,t3}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.4	**Evaluation of short-circuit current for each module (STC)**				
Sample no.	$I_{sc,meas}$ [A]	$I_{sc,meas,m3}$ [A]	$I_{sc,NP}$ [A]	$I_{sc,NP,t3}$ [A]	—
A003527777-018	13.96	14.17	14.14	14.85	P
A003527777-019	13.95	14.16	14.14	14.85	P
A003527777-021	13.96	14.17	14.14	14.85	P
A003527777-022	13.97	14.18	14.14	14.85	P
A003527777-023	13.90	14.11	14.14	14.85	P
A003527777-024	13.95	14.16	14.03	14.73	P
A003527777-025	13.96	14.17	14.03	14.73	P
A003527777-026	13.94	14.15	14.14	14.85	P
A003527777-032	13.95	14.16	14.14	14.85	P
A003527777-033	13.96	14.17	14.14	14.85	P
A003527777-034	13.96	14.17	14.14	14.85	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*

A003527777-035	13.97	14.18	14.14	14.85	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc,meas,m3}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc,NP,t3}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.4	**Evaluation of short-circuit current for each module (STC)**				
Sample no.	$I_{sc,meas}$ [A]	$I_{sc,meas,m3}$ [A]	$I_{sc,NP}$ [A]	$I_{sc,NP,t3}$ [A]	—
A003527778-015	13.41	13.61	13.73	14.42	P
A003527778-016	13.41	13.61	13.73	14.42	P
A003527778-018	13.45	13.65	13.73	14.42	P
A003527778-019	13.45	13.65	13.73	14.42	P
A003527778-020	13.46	13.66	13.73	14.42	P
A003527778-021	13.44	13.64	13.73	14.42	P
A003527778-022	13.48	13.68	13.73	14.42	P
A003527778-023	13.44	13.64	13.73	14.42	P
A003527778-024	13.43	13.63	13.73	14.42	P
A003527778-025	13.43	13.63	13.73	14.42	P
A003527778-026	13.42	13.62	13.73	14.42	P
A003527778-027	13.44	13.64	13.73	14.42	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc,meas,m3}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc,NP,t3}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.4	**Evaluation of short-circuit current for each module (STC)**				
Sample no.	$I_{sc,meas}$ [A]	$I_{sc,meas,m3}$ [A]	$I_{sc,NP}$ [A]	$I_{sc,NP,t3}$ [A]	—
A003527777-036	13.28	13.48	13.90	14.60	P
A003527777-037	13.29	13.49	13.90	14.60	P
A003527777-038	13.24	13.44	13.78	14.47	P
A003527777-039	13.23	13.43	13.78	14.47	P
A003527777-042	13.39	13.59	13.00	13.65	P
A003527777-043	13.39	13.59	13.00	13.65	P
A003527777-040	13.50	13.70	13.80	14.49	P
A003527777-041	13.50	13.70	13.80	14.49	P
A003599023-001	13.60	13.81	13.99	14.69	P
A003599023-002	13.57	13.77	13.99	14.69	P
A003599023-005	13.42	13.62	13.64	14.32	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*
A003599023-006	13.43	13.63	13.64	14.32	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc,meas,m3}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc,NP,t3}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.5	**Evaluation of output power for lower end power class module (STC)**				
Sample no.	$P_{max,meas}$ [W]	$P_{max,meas,m1}$ [W]	$P_{max4,NP}$ [W]	$P_{max,NP,t4}$ [W]	—
A003527777-038	451.4	444.5	450.0	463.5	P
A003527777-039	450.5	443.6	450.0	463.5	P
A003527777-042	405.7	399.5	400.0	412.0	P
A003527777-043	405.1	398.9	400.0	412.0	P
A003599023-005	582.1	573.3	585.0	602.5	P
A003599023-006	580.2	571.4	585.0	602.5	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,m1}$ = Measured maximum STC power taking negative measurement uncertainty into account
$P_{max4,NP,t4}$ = Nominal maximum STC power taking positive rated production tolerance into account

9.9	**Gate #1 evaluation (BNPI)**			
Manufacturer tolerances given on name plate	for $P_{max(BNPI)}$	$t_{1(BNPI)}$ [%]	0	—
	for $V_{OC(BNPI)}$	$t_{2(BNPI)}$ [%]	±5	
	for $I_{SC(BNPI)}$	$t_{3(BNPI)}$ [%]	±5	
	for $P_{max4(BNPI)}$	$t_{4(BNPI)}$ [%]	+3	
Measurement uncertainty of test laboratory	for $P_{max(BNPI)}$	$m_{1(BNPI)}$ [%]	± 1.85 (for c-Si)	
	for $V_{OC(BNPI)}$	$m_{2(BNPI)}$ [%]	± 0.48 (for c-Si)	
	for $I_{SC(BNPI)}$	$m_{3(BNPI)}$ [%]	± 1.83 (for c-Si)	

9.9.6	**Evaluation of output power for each module (BNPI)**				
Sample no.	$P_{max(BNPI),meas}$ [W]	$P_{max(BNPI),meas,m1(BNPI)}$ [W]	$P_{max(BNPI),.0NP}$ [W]	$P_{max(BNPI),NP,t1(BNPI)}$ [W]	—
A003527777-001	629.4	639.0	637.0	637.0	P
A003527777-002	628.0	637.6	637.0	637.0	P
A003527777-005	627.9	637.5	637.0	637.0	P
A003527777-006	628.0	637.6	637.0	637.0	P
A003527777-007	633.1	642.8	640.0	640.0	P
A003527777-008	627.7	637.2	637.0	637.0	P
A003527777-009	633.4	643.0	640.0	640.0	P
A003527777-010	629.1	638.7	637.0	637.0	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen		Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*		*Result*
A003527777-015	628.7	638.3	637.0	637.0	P
A003527777-016	629.0	638.6	637.0	637.0	P
A003527777-017	628.1	637.7	637.0	637.0	P
A003527777-027	628.9	638.5	637.0	637.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max(BNPI),meas,m1(BNPI)}$ = Measured maximum BNPI power taking positive measurement uncertainty into account
$P_{max(BNPI),NP,t1(BNPI)}$ = Nominal maximum BNPI power taking negative rated production tolerance into account

9.9.6	**Evaluation of output power for each module (BNPI)**				
Sample no.	$P_{max(BNPI),meas}$ [W]	$P_{max(BNPI),meas,m1(BNPI)}$ [W]	$P_{max(BNPI),NP}$ [W]	$P_{max(BNPI),NP,t1(BNPI)}$ [W]	—
A003527777-018	628.9	638.5	637.0	637.0	P
A003527777-019	628.4	637.9	637.0	637.0	P
A003527777-021	628.4	637.9	637.0	637.0	P
A003527777-022	628.1	637.7	637.0	637.0	P
A003527777-023	629.2	638.8	637.0	637.0	P
A003527777-024	628.9	638.6	626.0	626.0	P
A003527777-025	629.2	638.8	626.0	626.0	P
A003527777-026	628.7	638.3	637.0	637.0	P
A003527777-032	628.7	638.3	637.0	637.0	P
A003527777-033	628.1	637.7	637.0	637.0	P
A003527777-034	628.1	637.7	637.0	637.0	P
A003527777-035	627.8	637.3	637.0	637.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max(BNPI),meas,m1(BNPI)}$ = Measured maximum BNPI power taking positive measurement uncertainty into account
$P_{max(BNPI),NP,t1(BNPI)}$ = Nominal maximum BNPI power taking negative rated production tolerance into account

9.9.6	**Evaluation of output power for each module (BNPI)**				
Sample no.	$P_{max(BNPI),meas}$ [W]	$P_{max(BNPI),meas,m1(BNPI)}$ [W]	$P_{max(BNPI),NP}$ [W]	$P_{max(BNPI),NP,t1(BNPI)}$ [W]	—
A003527778-015	636.4	646.1	646.0	646.0	P
A003527778-016	637.3	647.0	646.0	646.0	P
A003527778-018	638.9	648.6	646.0	646.0	P
A003527778-019	639.4	649.1	646.0	646.0	P
A003527778-020	640.2	649.9	646.0	646.0	P
A003527778-021	639.6	649.3	646.0	646.0	P
A003527778-022	640.4	650.2	646.0	646.0	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*
A003527778-023	639.0	648.8	646.0	646.0	P
A003527778-024	638.9	648.7	646.0	646.0	P
A003527778-025	638.8	648.6	646.0	646.0	P
A003527778-026	638.3	648.1	646.0	646.0	P
A003527778-027	639.2	648.9	646.0	646.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max(BNPI),meas,m1(BNPI)}$ = Measured maximum BNPI power taking positive measurement uncertainty into account
$P_{max(BNPI),NP,t1(BNPI)}$ = Nominal maximum BNPI power taking negative rated production tolerance into account

9.9.6	**Evaluation of output power for each module (BNPI)**				
Sample no.	$P_{max(BNPI),meas}$ [W]	$P_{max(BNPI),meas,m1(BNPI)}$ [W]	$P_{max(BNPI),NP}$ [W]	$P_{max(BNPI),NP,t1(BNPI)}$ [W]	—
A003527777-036	507.1	514.9	510.0	510.0	P
A003527777-037	509.2	517.0	510.0	510.0	P
A003527777-040	470.3	477.5	474.0	474.0	P
A003527777-041	470.1	477.3	474.0	474.0	P
A003599023-001	670.1	680.4	662.0	662.0	P
A003599023-002	668.1	678.3	662.0	662.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max(BNPI),meas,m1(BNPI)}$ = Measured maximum BNPI power taking positive measurement uncertainty into account
$P_{max(BNPI),NP,t1(BNPI)}$ = Nominal maximum BNPI power taking negative rated production tolerance into account

9.9.7	**Evaluation of output power for average of all modules (BNPI)**			
Module type	$P_{max(BNPI),meas,avg}$ [W]	$P_{max(BNPI),meas,avg,m1(BNPI)}$ [W]	$P_{max(BNPI),NP}$ [W]	—
HYPERSOL VSMDH. 72.575.05	629.0	638.6	637.0	P
HYPERSOL VSMDH. 72.575.05	628.5	638.1	637.0	P
PARADEA VSMDH .78.590.05	638.9	648.6	646.0	P
PARADEA VSMDH .78.605.05	669.5	679.7	662.0	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,avg,m1}$ = Arithmetic average of meas. max. BNPI power taking positive measurement uncertainty into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.8	**Evaluation of open-circuit voltage for each module (BNPI)**				
Sample no.	$V_{oc(BNPI),meas}$ [V]	$V_{oc(BNPI),meas,m2(BNPI)}$ [V]	$V_{oc(BNPI),NP}$ [V]	$V_{oc(BNPI),NP,t2(BNPI)}$ [V]	—
A003527777-001	51.97	52.18	50.70	53.24	P
A003527777-002	51.98	52.19	50.70	53.24	P
A003527777-005	51.96	52.17	50.70	53.24	P
A003527777-006	52.00	52.21	50.70	53.24	P
A003527777-007	52.01	52.22	50.90	53.45	P
A003527777-008	52.00	52.21	50.70	53.24	P
A003527777-009	52.00	52.21	50.90	53.45	P
A003527777-010	51.97	52.18	50.70	53.24	P
A003527777-015	51.97	52.18	50.70	53.24	P
A003527777-016	51.94	52.15	50.70	53.24	P
A003527777-017	51.96	52.17	50.70	53.24	P
A003527777-027	51.95	52.16	50.70	53.24	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc(BNPI),meas,m2(BNPI)}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc(BNPI),NP,t2(BNPI)}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.8	**Evaluation of open-circuit voltage for each module (BNPI)**				
Sample no.	$V_{oc(BNPI),meas}$ [V]	$V_{oc(BNPI),meas,m2(BNPI)}$ [V]	$V_{oc(BNPI),NP}$ [V]	$V_{oc(BNPI),NP,t2(BNPI)}$ [V]	—
A003527777-018	51.94	52.15	50.70	53.24	P
A003527777-019	51.95	52.16	50.70	53.24	P
A003527777-021	51.96	52.17	50.70	53.24	P
A003527777-022	51.98	52.19	50.70	53.24	P
A003527777-023	51.95	52.16	50.70	53.24	P
A003527777-024	51.95	52.16	50.00	52.50	P
A003527777-025	51.96	52.17	50.00	52.50	P
A003527777-026	51.97	52.18	50.70	53.24	P
A003527777-032	51.97	52.18	50.70	53.24	P
A003527777-033	51.96	52.17	50.70	53.24	P
A003527777-034	51.97	52.18	50.70	53.24	P
A003527777-035	52.02	52.23	50.70	53.24	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc(BNPI),meas,m2(BNPI)}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc(BNPI),NP,t2(BNPI)}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.8 **Evaluation of open-circuit voltage for each module (BNPI)**

Sample no.	$V_{oc(BNPI),meas}$ [V]	$V_{oc(BNPI),meas,m2(BNPI)}$ [V]	$V_{oc(BNPI),NP}$ [V]	$V_{oc(BNPI),NP,t2(BNPI)}$ [V]	—
A003527778-015	54.43	54.65	53.73	56.42	P
A003527778-016	54.42	54.64	53.73	56.42	P
A003527778-018	54.51	54.73	53.73	56.42	P
A003527778-019	54.61	54.83	53.73	56.42	P
A003527778-020	54.53	54.75	53.73	56.42	P
A003527778-021	54.45	54.67	53.73	56.42	P
A003527778-022	54.60	54.82	53.73	56.42	P
A003527778-023	54.58	54.80	53.73	56.42	P
A003527778-024	54.57	54.79	53.73	56.42	P
A003527778-025	54.41	54.63	53.73	56.42	P
A003527778-026	54.48	54.70	53.73	56.42	P
A003527778-027	54.53	54.75	53.73	56.42	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc(BNPI),meas,m2(BNPI)}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc(BNPI),NP,t2(BNPI)}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

9.9.8 **Evaluation of open-circuit voltage for each module (BNPI)**

Sample no.	$V_{oc(BNPI),meas}$ [V]	$V_{oc(BNPI),meas,m2(BNPI)}$ [V]	$V_{oc(BNPI),NP}$ [V]	$V_{oc(BNPI),NP,t2(BNPI)}$ [V]	—
A003527777-036	43.13	43.30	41.45	43.52	P
A003527777-037	43.18	43.35	41.45	43.52	P
A003527777-038	42.82	42.99	41.05	43.10	P
A003527777-039	42.87	43.04	41.05	43.10	P
A003527777-042	38.78	38.93	37.50	41.25	P
A003527777-043	38.78	38.93	37.50	41.25	P
A003527777-040	38.72	38.87	38.00	41.80	P
A003527777-041	38.75	38.90	38.00	41.80	P
A003599023-001	56.54	56.76	54.16	56.87	P
A003599023-002	56.63	56.85	54.16	56.87	P
A003599023-005	54.59	54.81	53.63	56.31	P
A003599023-006	54.66	54.88	53.63	56.31	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$V_{oc(BNPI),meas,m2(BNPI)}$ = Measured open-circuit voltage taking positive measurement uncertainty into account
$V_{oc(BNPI),NP,t2(BNPI)}$ = Nominal open-circuit voltage taking positive rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.9	**Evaluation of short-circuit current for each module (BNPI)**				
Sample no.	$I_{sc(BNPI),meas}$ [A]	$I_{sc(BNPI),meas,m3(BNPI)}$ [A]	$I_{sc(BNPI),NP}$ [A]	$I_{sc(BNPI),NP,t3(BNPI)}$ [A]	—
A003527777-001	15.40	15.63	16.00	16.80	P
A003527777-002	15.39	15.62	16.00	16.80	P
A003527777-005	15.39	15.62	16.00	16.80	P
A003527777-006	15.39	15.62	16.00	16.80	P
A003527777-007	15.46	15.69	16.00	16.80	P
A003527777-008	15.37	15.60	16.00	16.80	P
A003527777-009	15.29	15.52	16.00	16.80	P
A003527777-010	15.40	15.63	16.00	16.80	P
A003527777-015	15.40	15.63	16.00	16.80	P
A003527777-016	15.40	15.63	16.00	16.80	P
A003527777-017	15.37	15.60	16.00	16.80	P
A003527777-027	15.37	15.60	16.00	16.80	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc(BNPI),meas,m3(BNPI)}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc(BNPI),NP,t3(BNPI)}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.9	**Evaluation of short-circuit current for each module (BNPI)**				
Sample no.	$I_{sc(BNPI),meas}$ [A]	$I_{sc(BNPI),meas,m3(BNPI)}$ [A]	$I_{sc(BNPI),NP}$ [A]	$I_{sc(BNPI),NP,t3(BNPI)}$ [A]	—
A003527777-018	15.38	15.61	16.00	16.80	P
A003527777-019	15.40	15.63	16.00	16.80	P
A003527777-021	15.40	15.63	16.00	16.80	P
A003527777-022	15.40	15.63	16.00	16.80	P
A003527777-023	15.38	15.61	16.00	16.80	P
A003527777-024	15.40	15.63	16.00	16.80	P
A003527777-025	15.40	15.63	16.00	16.80	P
A003527777-026	15.40	15.63	16.00	16.80	P
A003527777-032	15.38	15.61	16.00	16.80	P
A003527777-033	15.40	15.63	16.00	16.80	P
A003527777-034	15.38	15.61	16.00	16.80	P
A003527777-035	15.40	15.63	16.00	16.80	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc(BNPI),meas,m3(BNPI)}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc(BNPI),NP,t3(BNPI)}$ = Nominal short-circuit current taking positive rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.9 **Evaluation of short-circuit current for each module (BNPI)**

Sample no.	$I_{sc(BNPI),meas}$ [A]	$I_{sc(BNPI),meas,m3(BNPI)}$ [A]	$I_{sc(BNPI),NP}$ [A]	$I_{sc(BNPI),NP,t3(BNPI)}$ [A]	—
A003527778-015	14.66	14.88	15.00	15.75	P
A003527778-016	14.68	14.90	15.00	15.75	P
A003527778-018	14.75	14.97	15.00	15.75	P
A003527778-019	14.74	14.96	15.00	15.75	P
A003527778-020	14.74	14.96	15.00	15.75	P
A003527778-021	14.74	14.96	15.00	15.75	P
A003527778-022	14.76	14.98	15.00	15.75	P
A003527778-023	14.73	14.95	15.00	15.75	P
A003527778-024	14.70	14.92	15.00	15.75	P
A003527778-025	14.71	14.93	15.00	15.75	P
A003527778-026	14.70	14.92	15.00	15.75	P
A003527778-027	14.71	14.93	15.00	15.75	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc(BNPI),meas,m3(BNPI)}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc(BNPI),NP,t3(BNPI)}$ = Nominal short-circuit current taking positive rated production tolerance into account

9.9.9 **Evaluation of short-circuit current for each module (BNPI)**

Sample no.	$I_{sc(BNPI),meas}$ [A]	$I_{sc(BNPI),meas,m3(BNPI)}$ [A]	$I_{sc(BNPI),NP}$ [A]	$I_{sc(BNPI),NP,t3(BNPI)}$ [A]	—
A003527777-036	14.80	15.02	15.40	16.17	P
A003527777-037	14.82	15.04	15.40	16.17	P
A003527777-038	14.78	15.00	15.27	16.03	P
A003527777-039	14.77	14.99	15.27	16.03	P
A003527777-042	14.82	15.04	14.49	15.21	P
A003527777-043	14.82	15.04	14.49	15.21	P
A003527777-040	14.92	15.15	15.00	15.75	P
A003527777-041	14.91	15.14	15.00	15.75	P
A003599023-001	15.10	15.33	15.00	15.75	P
A003599023-002	15.14	15.37	15.00	15.75	P
A003599023-005	14.73	14.95	15.00	15.75	P
A003599023-006	14.75	14.97	15.00	15.75	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$I_{sc(BNPI),meas,m3(BNPI)}$ = Measured short-circuit current taking positive measurement uncertainty into account
$I_{sc(BNPI),NP,t3(BNPI)}$ = Nominal short-circuit current taking positive rated production tolerance into account

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.9.10	**Evaluation of output power for lower end power class module (BNPI)**				
Sample no.	$P_{max(BNPI),meas}$ [W]	$P_{max(BNPI),meas,m1(BNPI)}$ [W]	$P_{max4(BNPI),NP}$ [W]	$P_{max(BNPI),NP,t4(BNPI)}$ [W]	—
A003527777-038	503.2	495.5	499.0	513.9	P
A003527777-039	501.6	493.9	499.0	513.9	P
A003527777-042	452.5	445.6	446.0	459.4	P
A003527777-043	450.9	443.9	446.0	459.4	P
A003599023-005	638.5	628.8	640.0	659.2	P
A003599023-006	638.5	628.8	640.0	659.2	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max(BNPI),meas,m1(BNPI)}$ = Measured maximum BNPI power taking negative measurement uncertainty into account
$P_{max4(BNPI),NP,t4(BNPI)}$ = Nominal maximum BNPI power taking positive rated production tolerance into account

9.10	**Measurement of temperature coefficients – MQT 04**		
Test date (dd/mm/yyyy)		24/08/2023	—
Irradiance [W/m²]		1000 ± 10	
Module temperature [°C] low / high		25/65	
Sample no.	Coefficient	Calculated value	
A003527777-001	α [%/K]	0.0603	
	β [%/K]	-0.3020	
	γ [%/K]	-0.4220	

Supplementary information:
Temperature coefficients were measured with a solar simulator of class AAA acc. to IEC 60904-9.

9.11	**Performance at low irradiance – MQT 07**

9.11.1	**Performance at low irradiance (front side)**							
Test method		☒indoor …… ☐outdoor						
Illuminated side		☒Front side ……☐ Rear side						
Ambient temperature [°C]		25 ± 2						
Irradiance [W/m²]		200 ± 20 corrected to 200						
Module temperature [°C]		25 ± 2 corrected to 25						
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
24/08/2023	A003527777-001	113.83	42.15	2.70	47.69	2.77	86.20	

Supplementary information: None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.11.2	**Performance at low irradiance (rear side)**							
Test method		☒indoor …… ☐outdoor						
Illuminated side		☐Front side ……☒ Rear side						
Ambient temperature [°C]		25 ± 2						
Irradiance [W/m²]		200 ± 20 corrected to 200						
Module temperature [°C]		25 ± 2 corrected to 25						
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
24/08/2023	A003527777-001	85.34	43.17	1.98	47.01	2.14	84.95	
Supplementary information: The non-illuminated side was covered with non-reflective background and aperture								

9.11.3	**Bifaciality Coefficients at low irradiance**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	—
A003527777-001	77.26	98.57	74.97	—
Supplementary information: - None				

9.12	**Outdoor exposure test – MQT 08**	
Test date (dd/mm/yyyy)	30/08/2023 to 10/09/2023	—
Sample no.	A003527777-002	
Total irradiation dosage [kWh/m²]	60.55	
Supplementary information: - None		

9.12.1	**Visual inspection after Outdoor exposure test – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Nature and position of findings	Nature and position of findings	
11/09/2023	A003527777-002	No major visual defects	No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.12.2 Insulation test after Outdoor exposure test – MQT 03

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
11/09/2023	A003527777-002	40.20	2.58	103.71	--	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.

9.12.3 Wet leakage current test after Outdoor exposure test – MQT 15

Maximum system voltage [V_{DC}]		1500V			
Cemented joints?		☒ No.....☐ Yes			
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
11/09/2023	A003527777-002	5300.00	2.58	13674.00	P

Supplementary information: Minimum requirement is 40 MΩ·m².

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.13	**Temperature test – MST 21**			
Test date (dd/mm/yyyy)	28/08/2023			—
Sample no.	A003527777-004			
Test method	☒ Simulator ☐ Natural sunlight			
Irradiance [W/m²]	1227			
Environmental temperature T_{ENV} [°C]	39.4			
Wind speed [m/s]	< 0.25			
Measuring location	Component temperature T_{OBS} [°C]	Normalised temperature T_{CON} [°C]	Component temperature limit [°C]	
Module frontsheet above the centre cell	84.3	84.9	Not provided- (glass)	P
Module backsheet below the centre cell	81.3	81.9	Not provided- (glass)	P
Terminal enclosure interior surface	Potted JB		*	N/A
Field wiring terminals	Potted JB		*	N/A
Insulation of the field wiring leads	60.6	61.2	120.0	P
External connector bodies	55.5	56.1	100.0	P
Bypass diode bodies	Potted JB		*	N/A

Supplementary information:
* The field wiring terminals and bypass diode bodies are not accessible because the junction box is potted.
** The exposure was performed under G_{BSI} which equals to 1000W/m² + φ•300W/m²
$T_{CON} = T_{OBS} + (40\ °C – T_{ENV})$. Thermal material requirements are given in section 5.5 of CSA C22.2 NO. 61730.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.13	**Temperature test – MST 21**

Test date (dd/mm/yyyy)	28/08/2023			—
Sample no.	A003527777-020			
Test method	☒ Simulator ☐ Natural sunlight			
Irradiance [W/m²]	1227			
Environmental temperature T_{ENV} [°C]	39.5			
Wind speed [m/s]	< 0.25			
Measuring location	Component temperature T_{OBS} [°C]	Normalised temperature T_{CON} [°C]	Component temperature limit [°C]	
Module frontsheet above the centre cell	84.5	85.0	Not provided- (glass)	P
Module backsheet below the centre cell	81.4	81.9	Not provided- (glass)	P
Terminal enclosure interior surface	Potted JB		*	N/A
Field wiring terminals	Potted JB		*	N/A
Insulation of the field wiring leads	60.4	60.9	120.0	P
External connector bodies	55.5	56.0	100.0	P
Bypass diode bodies	Potted JB		*	N/A

Supplementary information:
* The field wiring terminals and bypass diode bodies are not accessible because the junction box is potted.
** The exposure was performed under G_{BSI} which equals to 1000W/m² + φ•300W/m²
$T_{CON} = T_{OBS} + (40\ °C – T_{ENV})$. Thermal material requirements are given in section 5.5 of CSA C22.2 NO. 61730.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.13	**Temperature test – MST 21**			
Test date (dd/mm/yyyy)	17/10/2023			—
Sample no.	A003527778-017			
Test method	☒ Simulator ☐ Natural sunlight			
Irradiance [W/m²]	1225			
Environmental temperature T_{ENV} [°C]	39.8			
Wind speed [m/s]	< 0.25			
Measuring location	Component temperature T_{OBS} [°C]	Normalised temperature T_{CON} [°C]	Component temperature limit [°C]	
Module frontsheet above the centre cell	76.5	76.7	Not provided- (glass)	P
Module backsheet below the centre cell	76.0	76.2	Not provided- (glass)	P
Terminal enclosure interior surface	Potted JB		*	N/A
Field wiring terminals	Potted JB		*	N/A
Insulation of the field wiring leads	46.2	46.8	120.0	P
External connector bodies	59.5	59.7	100.00	P
Bypass diode bodies	Potted JB		*	N/A
Supplementary information: * The field wiring terminals and bypass diode bodies are not accessible because the junction box is potted. $T_{CON} = T_{OBS} + (40\ °C – T_{ENV})$. Thermal material requirements are given in section 5.5 of CSA C22.2 NO. 61730.				

9.13.1	**Visual inspection after Temperature test – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Nature and position of findings	Nature and position of findings	
28/08/2023	A003527777-004	No major visual defects	No major visual defects	P
28/08/2023	A003527777-020		No major visual defects	P
17/10/2023	A003527778-017		No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.13.2 **Insulation test after Temperature test – MST 16**

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
28/08/2023	A003527777-004	42.1	2.58	108.62	--	No	P
28/08/2023	A003527777-020	41.2	2.58	106.29	--	No	P
17/10/2023	A003527778-017	21.4	2.78	59.49	--	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.

9.13.3 **Wet leakage current test after Temperature test – MST 17**

Maximum system voltage [V_{DC}]		1500V			
Cemented joints?		☒ No.....☐ Yes			
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
28/08/2023	A003527777-004	4800.00	2.58	12384.00	P
28/08/2023	A003527777-020	5100.00	2.58	13158.00	P
17/10/2023	A003527778-017	1090.00	2.78	3030.20	P

Supplementary information:
Minimum requirement is 40 MΩ·m².

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.14	**Hot-spot endurance test (WBT) – MQT 09 / MST 22**			
Test date (dd/mm/yyyy)	13/09/2023			—
Sample no.	A003527777-002			
Cell interconnection circuit	☐ S	☒ SP	☐ PS	
Module temperature at thermal equilibrium [°C]	53-56			
Cell of complete module with highest shunt resistance shaded				
Maximum measured cell temperature [°C]	105.4			
Shading rate[%]	4.97			
1st worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	125.6			
Shading rate[%]	18.33			
2nd worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	130.4			
Shading rate[%]	16.73			
Cell adjacent to module edge with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	134.3			
Shading rate[%]	22.52			
Supplementary information: The exposure was performed under G_{BSI} which is equal to 1000W/m² + φ•300W/m².				

9.14	**Hot-spot endurance test (WBT) – MQT 09 / MST 22**			
Test date (dd/mm/yyyy)	13/09/2023			—
Sample no.	A003527777-019			
Cell interconnection circuit	☐ S	☒ SP	☐ PS	
Module temperature at thermal equilibrium [°C]	55±2 (maintained)			
Cell of complete module with highest shunt resistance shaded				
Maximum measured cell temperature [°C]	108.6			
Shading rate[%]	4.13			
1st worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	121.0			
Shading rate[%]	10.79			
2nd worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	130.4			
Shading rate[%]	10.23			
Cell adjacent to module edge with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	91.1			
Shading rate[%]	11.74			
Supplementary information: The exposure was performed under G_{BSI} which is equal to 1000W/m² + φ•300W/m².				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.14	**Hot-spot endurance test (WBT) – MQT 09 / MST 22**			
Test date (dd/mm/yyyy)	05/10/2023			—
Sample no.	A003527778-016			
Cell interconnection circuit	☐ S	☒ SP	☐ PS	
Module temperature at thermal equilibrium [°C]	55±2 (maintained)			
Cell of complete module with highest shunt resistance shaded				
Maximum measured cell temperature [°C]	138.4			
Shading rate[%]	12.72			
1st worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	137.6			
Shading rate[%]	20.85			
2nd worst case cell of complete module with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	151.7			
Shading rate[%]	20.31			
Cell adjacent to module edge with lowest shunt resistance shaded				
Maximum measured cell temperature [°C]	134.0			
Shading rate[%]	21.63			
Supplementary information: The exposure was performed under G_{BSI} which is equal to 1000W/m² + φ•300W/m².				

9.14.1	**Visual inspection after Hot-spot endurance test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
14/09/2023	A003527777-002	No major visual defects	No major visual defects	P
14/09/2023	A003527777-019		No major visual defects	P
06/10/2023	A003527778-016		No major visual defects	P
Supplementary information: - None				

9.14.2	**Insulation test after Hot-spot endurance test – MQT 03 / MST 16**							
Maximum system voltage [V_{DC}]			1500V					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
14/09/2023	A003527777-002	39.2	2.58	101.13	--	No		P
14/09/2023	A003527777-019	40.2	2.58	103.71	--	No		P
06/10/2023	A003527778-016	36.8	2.78	102.30	--	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.								

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.14.3	**Wet leakage current test after Hot-spot endurance test – MQT 15 / MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
14/09/2023	A003527777-002	5100.00	2.58	13158.00	P
14/09/2023	A003527777-019	5100.00	2.58	13158.00	P
06/10/2023	A003527778-016	900.00	2.78	2502.00	P
Supplementary information: Minimum requirement is 40 MΩ·m².					

9.14.4	**Maximum power determination after Hot-spot endurance test – MQT 02 / MST 03**							
Test method		☒ Simulator ☐ Natural sunlight						
Ambient temperature [°C]		25 ± 2						
Irradiance [W/m²]		1000 ± 10						
Module temperature [°C]		25 ± 2						
Spectral mismatch		N/A						-
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
14/09/2023	A003527777-002	570.5	42.76	13.34	51.70	13.90	79.4	
14/09/2023	A003527777-019	570.7	42.79	13.34	51.75	13.95	79.1	
06/10/2023	A003527778-016	581.5	45.36	12.82	54.35	13.42	79.7	
Supplementary information: None								

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.15	**Reverse current overload test – MST 26**		
Test date (dd/mm/yyyy)		21/11/2023	—
Ambient temperature [°C]		20±5	
Irradiance at test area [W/m²]		<50	
Module over-current protection rating [A]		25	
Test current [A]		33.75	
Range of applied voltage [V]		58.25 – 52.55	
Test duration [h]	Detection of hot spot	1 Hour	
	To determine max temperature	2 Hour	
Sample no.	Test results		—
A003527777-004	☒ Maximum measured temperature [°C]	70.6	P
	☒ No Flaming of the module or its components		
Supplementary information: None			

9.15	**Reverse current overload test – MST 26**		
Test date (dd/mm/yyyy)		21/11/2023	—
Ambient temperature [°C]		20±5	
Irradiance at test area [W/m²]		<50	
Module over-current protection rating [A]		25	
Test current [A]		33.75	
Range of applied voltage [V]		58.24 – 51.28	
Test duration [h]	Detection of hot spot	1 Hour	
	To determine max temperature	2 Hour	
Sample no.	Test results		—
A003527777-020	☒ Maximum measured temperature [°C]	70.9	P
	☒ No Flaming of the module or its components		
Supplementary information: None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.15	**Reverse current overload test – MST 26**		
Test date (dd/mm/yyyy)		18/10/2023	—
Ambient temperature [°C]		20±5	
Irradiance at test area [W/m²]		<50	
Module over-current protection rating [A]		25	
Test current [A]		40.5	
Range of applied voltage [V]		59.28 – 52.72	
Test duration [h]	Detection of hot spot	1 Hour	
	To determine max temperature	2 Hour	
Sample no.	Test results		—
A003527778-017	☒ Maximum measured temperature [°C]	67.0	P
	☒ No Flaming of the module or its components		
Supplementary information: None			

9.15.1	**Visual inspection after Reverse current overload test – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Nature and position of findings	Nature and position of findings	
21/11/2023	A003527777-004	No major visual defects	No major visual defects	P
21/11/2023	A003527777-020		No major visual defects	P
18/10/2023	A003527778-017		No major visual defects	P
Supplementary information: - None				

9.15.2	**Insulation test after Reverse current overload test – MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
21/11/2023	A003527777-004	42.6	2.58	109.91	--	No	P
21/11/2023	A003527777-020	40.1	2.58	103.46	--	No	P
18/10/2023	A003527778-017	40.2	2.78	111.76	--	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.							

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.15.3 **Wet leakage current test after Reverse current overload test – MST 17**

Maximum system voltage [V_{DC}]		1500V			
Cemented joints?		☒ No.....☐ Yes			
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
21/11/2023	A003527777-004	4900.00	2.58	12642.00	P
21/11/2023	A003527777-020	4800.00	2.58	12384.00	P
18/10/2023	A003527778-017	1490.00	2.78	4142.20	P

Supplementary information:
Minimum requirement is 40 MΩ·m².

9.16 **Bypass diode thermal test – MQT 18.1 / MST 25**

Test date (dd/mm/yyyy)	16/08/2023				
Sample no.	A003527777-003				
Number of diodes in junction box	3				
Max. permissible junction temperature $T_{j\,max}$ [°C] (according to diode datasheet)	200				
Step 1: Determination of V_D versus T_J characteristic					
Temperature of junction box (average) [°C]	30 ± 2	50 ± 2	70 ± 2	90 ± 2	
Diode voltage [V_D]	0.420	0.392	0.370	0.342	
Determined V_D versus T_J characteristics					
y = -0.0012x + 0.4495					—
y = -0.0013x + 0.4578					
y = -0.0012x + 0.4549					
Step 2: Bypass diode thermal test					
	Diode 1	Diode 2	Diode 3		
Module temperature [°C]	75 ± 5	75 ± 5	75 ± 5		
Diode current flow applied (I_{SC}) [A]	13.96	13.96	13.96		
Voltage drop across diode after 1 hour [V]	0.277	0.269	0.286		
Calculated junction temperature $T_{j\,calc}$ [°C]	143.50	145.08	140.25		
$T_{j\,calc} < T_{j\,max}$ (required for passing the test)?	Yes	yes	yes		P
Diode current flow applied (1.25 · Isc) [A]	17.45	17.45	17.45		—
Diode functional?	Yes	yes	yes		P

Supplementary information: See CDF no. **31985240.016** for diode information

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.16	**Bypass diode thermal test – MQT 18.1 / MST 25**				
Test date (dd/mm/yyyy)	17/10/2023				—
Sample no.	A003527778-029				
Number of diodes in junction box	3				
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet)	200				
Step 1: Determination of V_D versus T_J characteristic					
Temperature of junction box (average) [°C]	30 ± 2	50 ± 2	70 ± 2	90 ± 2	
Diode voltage [V_D]	0.456	0.430	0.408	0.388	
Determined V_D versus T_J characteristics					
y = -0.0010x + 0.4295					
y = -0.0010x + 0.4218					
y = -0.0013x + 0.4411					
Step 2: Bypass diode thermal test					
	Diode 1	Diode 2	Diode 3		
Module temperature [°C]	75 ± 5	75 ± 5	75 ± 5		
Diode current flow applied (I_{SC}) [A]	16.28	16.28	16.28		
Voltage drop across diode after 1 hour [V]	0.312	0.310	0.318		
Calculated junction temperature Tj_{calc} [°C]	116.00	119.33	105.77		
$Tj_{calc} < Tj_{max}$ (required for passing the test)?	Yes	yes	yes		P
Diode current flow applied (1.25 · Isc) [A]	20.35	20.35	20.35		—
Diode functional?	Yes	yes	yes		P
Supplementary information: See CDF no. **31985240.014** for diode information					

9.16.1	**Visual inspection after Bypass diode thermal test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
16/08/2023	A003527777-003	No major visual defects	No major visual defects	P
17/10/2023	A003527778-029		No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.16.2	**Insulation test after Bypass diode thermal test – MQT 03 / MST 16**							
Maximum system voltage [V_{DC}]			1500V					
Cemented joints?			☒ No……☐ Yes					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
16/08/2023	A003527777-003	40.3	2.58	103.97	--	No	P	
17/10/2023	A003527778-029	43.5	2.78	120.93	--	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.								

9.16.3	**Wet leakage current test after Bypass diode thermal test – MQT 15 / MST 17**				
Maximum system voltage [V_{DC}]		1500V			
Cemented joints?		☒ No……☐ Yes			
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
16/08/2023	A003527777-003	4200.00	2.58	12384.00	P
17/10/2023	A003527778-029	1250.00	2.78	3475.00	P
Supplementary information: Minimum requirement is 40 MΩ·m².					

9.17	**UV preconditioning test – MQT 10 / MST 54**		
Test date (dd/mm/yyyy)	28/09/2023 - 03/10/2023		—
Module temperature [°C]	60 ± 5		
Ratio of UV-B irradiation (280 – 320 nm) [%]	4.57		
UV irradiation dose (280 – 400 nm) [kWh/m²]	15.38		
UV irradiation direction	☒ Front side	☐ Rear side	
Operation mode	☒ Short-circuit	☐ Open-circuit	
Sample no.	—		
A003527777-005	—		P
A003527777-006	—		P
Supplementary information: None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.17	**UV preconditioning test – MQT 10 / MST 54**		
Test date (dd/mm/yyyy)	03/10/2023 - 08/10/2023		—
Module temperature [°C]	60 ± 5		
Ratio of UV-B irradiation (280 – 320 nm) [%]	4.01		
UV irradiation dose (280 – 400 nm) [kWh/m²]	15.21		
UV irradiation direction	☐ Front side	☒ Rear side	
Operation mode	☒ Short-circuit	☐ Open-circuit	
Sample no.	—		
A003527777-005	—		P
A003527777-006	—		P

Supplementary information:
For bifacial modules, UV preconditioning performed on both front side and rear side.

9.17.1	**Visual inspection after UV preconditioning test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
03/10/2023	A003527777-005	No major visual defects	No major visual defects	P
03/10/2023	A003527777-006		No major visual defects	P
08/10/2023	A003527777-005		No major visual defects	P
08/10/2023	A003527777-006		No major visual defects	P

Supplementary information: - None

9.17.2	**Insulation test after UV preconditioning test – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
03/10/2023	A003527777-005	40.1	2.58	103.46	--	No	P
03/10/2023	A003527777-006	41.3	2.58	106.55	--	No	P
08/10/2023	A003527777-005	41.2	2.58	106.29	--	No	P
08/10/2023	A003527777-006	40.4	2.58	104.23	--	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.

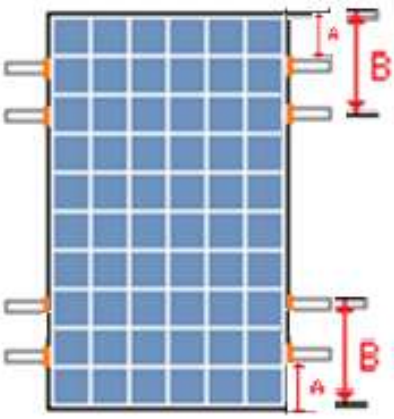
Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.17.3 **Wet leakage current test after UV preconditioning test – MQT 15 / MST 17**

Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
03/10/2023	A003527777-005	6100.00	2.58	15738.00	P
03/10/2023	A003527777-006	5400.00	2.58	13932.00	P
08/10/2023	A003527777-005	5700.00	2.58	14706.00	P
08/10/2023	A003527777-006	5100.00	2.58	13158.00	P

Supplementary information: None
Minimum requirement is 40 MΩ·m².

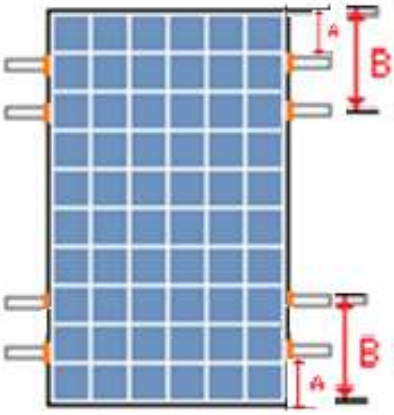
9.18 **Cyclic (dynamic) mechanical load test – MQT 20**

Test date (dd/mm/yyyy)	09/10/2023	—
Mechanical pressure load applied [Pa]	1000	
Mechanical tensile load applied [Pa]	1000	
Total number of cycles	1000	
Frequency of cycles [cycles/minute]	5	
Mounting method	Variant 2 (8 holes mounting method)	
Distance A [mm]	440	
Distance B [mm]	590	
Tst configuration		

Sample no.	Open circuits (yes/no)	
A003527777-005	No open circuits	P
A003527777-006	No open circuits	P

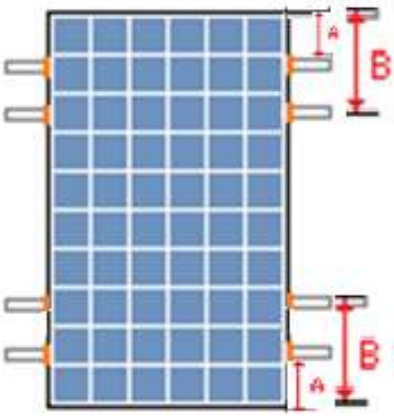
Supplementary information: -
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is >10%.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.18	**Cyclic (dynamic) mechanical load test – MQT 20**	
Test date (dd/mm/yyyy)	14/08/2023	—
Mechanical pressure load applied [Pa]	1000	
Mechanical tensile load applied [Pa]	1000	
Total number of cycles	1000	
Frequency of cycles [cycles/minute]	5	
Mounting method	Variant 2 (8 holes mounting method)	
Distance A [mm]	440	
Distance B [mm]	590	
Tst configuration		
Sample no.	Open circuits (yes/no)	
A003527777-025	No open circuits	P
A003527777-026	No open circuits	P

Supplementary information: -
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is >10%.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.18	**Cyclic (dynamic) mechanical load test – MQT 20**	
Test date (dd/mm/yyyy)	07/08/2023 – 08/08/2023	—
Mechanical pressure load applied [Pa]	1000	
Mechanical tensile load applied [Pa]	1000	
Total number of cycles	1000	
Frequency of cycles [cycles/minute]	7	
Mounting method	Variant 2 (8 holes mounting method)	
Distance A [mm]	435	
Distance B [mm]	640	
Tst configuration		

Sample no.	Open circuits (yes/no)	
A003527778-022	No open circuits	P
A003527778-023	No open circuits	P

Supplementary information: -
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is >10%.

9.18.1	**Visual inspection after Cyclic (dynamic) mechanical load test – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
10/10/2023	A003527777-005	No major visual defects	No major visual defects	P
10/10/2023	A003527777-006		No major visual defects	P
14/08/2023	A003527777-025		No major visual defects	P
14/08/2023	A003527777-026		No major visual defects	P
08/08/2023	A003527778-022		No major visual defects	P
08/08/2023	A003527778-023		No major visual defects	P

Supplementary information: - None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.18.2 Insulation test after Cyclic (dynamic) mechanical load test – MQT 03

Maximum system voltage [V_{DC}]	1500V
Cemented joints?	☒ No……☐ Yes
High voltage applied [V_{DC}]	8000V
Insulation resistance measured at [V_{DC}]	1500V

Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
10/10/2023	A003527777-005	38.4	2.58	99.07	--	No	P
10/10/2023	A003527777-006	35.1	2.58	90.55	--	No	P
14/08/2023	A003527777-025	38.6	2.58	99.58	--	No	P
14/08/2023	A003527777-026	40.2	2.58	103.71	--	No	P
08/08/2023	A003527778-022	20.4	2.78	56.71	-	No	P
08/08/2023	A003527778-023	28.4	2.78	78.95	-	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.

9.18.3 Wet leakage current test after Cyclic (dynamic) mechanical load test – MQT 15

Insulation resistance measured at [V_{DC}]	1500V
Solution resistivity [Ω·cm]	≤ 3500
Solution temperature [°C]	22 ± 2

Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
10/10/2023	A003527777-005	5500.00	2.58	14190.00	P
10/10/2023	A003527777-006	4800.00	2.58	12384.00	P
14/08/2023	A003527777-025	5300.00	2.58	13674.00	P
14/08/2023	A003527777-026	5100.00	2.58	13158.00	P
08/08/2023	A003527778-022	1400.00	2.78	3892.00	P
08/08/2023	A003527778-023	1050.00	2.78	2919.00	P

Supplementary information: None
Minimum requirement is 40 MΩ·m².

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.19	**Thermal cycling test (50 cycles) – MQT 11 / MST 51**		
Test date (dd/mm/yyyy)		13/10/2023 - 20/10/2023	—
Total number of cycles		50	
Actual dwell duration at high and low temperatures		30min/30min	
Sample no.	Open circuits (yes/no)		
A003527777-005	No open circuits		P
A003527777-006	No open circuits		P
Supplementary information: A single 5N weight was attached to the junction box. The maximum current, I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m^2 + φ•300W/m^2) of 16.38 is applied applied.			

9.19	**Thermal cycling test (50 cycles) – MQT 11 / MST 51**		
Test date (dd/mm/yyyy)		24/08/2023 to 01/09/2023	—
Total number of cycles		50	
Actual dwell duration at high and low temperatures		30min/30min	
Sample no.	Open circuits (yes/no)		
A003527777-025	No open circuits		P
A003527777-026	No open circuits		P
Supplementary information: A single 5N weight was attached to the junction box. The maximum current, I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m^2 + φ•300W/m^2) of 16.38 is applied applied.			

9.19	**Thermal cycling test (50 cycles) – MQT 11 / MST 51**		
Test date (dd/mm/yyyy)		24/08/2023 - 31/08/2023	—
Total number of cycles		50	
Actual dwell duration at high and low temperatures		30min/30min	
Sample no.	Open circuits (yes/no)		
A003527778-022	No open circuits		P
A003527778-023	No open circuits		P
Supplementary information: A single 5N weight was attached to the junction box. The maximum current, I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m^2 + φ•300W/m^2) of 15.60 is applied applied.			

9.19.1	**Visual inspection after Thermal cycling test (50 cycles) – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
20/10/2023	A003527777-005	No major visual defects	No major visual defects	P
20/10/2023	A003527777-006		No major visual defects	P
01/09/2023	A003527777-025		No major visual defects	P
01/09/2023	A003527777-026		No major visual defects	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
01/09/2023	A003527778-022	No major visual defects	P
01/09/2023	A003527778-023	No major visual defects	P
Supplementary information: - None			

9.19.2	**Insulation test after Thermal cycling test (50 cycles) – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No…….☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
20/10/2023	A003527777-005	39.8	2.58	102.68	--	No	P
20/10/2023	A003527777-006	40.6	2.58	104.75	--	No	P
01/09/2023	A003527777-025	38.1	2.58	98.29	--	No	P
01/09/2023	A003527777-026	39.3	2.58	101.39	--	No	P
01/09/2023	A003527778-022	46.7	2.78	129.83	--	No	P
01/09/2023	A003527778-023	38.6	2.78	107.45	--	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.							

9.19.3	**Wet leakage current test after Thermal cycling test (50 cycles) – MQT 15 / MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
20/10/2023	A003527777-005	5200.00	2.58	13416.00	P
20/10/2023	A003527777-006	4700.00	2.58	12126.00	P
01/09/2023	A003527777-025	5100.00	2.58	13158.00	P
01/09/2023	A003527777-026	4800.00	2.58	12384.00	P
01/09/2023	A003527778-022	990.00	2.78	2752.20	P
01/09/2023	A003527778-023	1150.00	2.78	3197.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.20	**Humidity-freeze test – MQT 12 / MST 52**	
Test date (dd/mm/yyyy)	20/10/2023 - 30/10/2023	—
Total number of cycles	10	
Sample no.	Open circuits (yes/no)	
A003527777-005	No open circuits	P
A003527777-006	No open circuits	P
Supplementary information: - None		

9.20	**Humidity-freeze test – MQT 12 / MST 52**	
Test date (dd/mm/yyyy)	04/09/2023 - 14/09/2023	—
Total number of cycles	10	
Sample no.	Open circuits (yes/no)	
A003527777-025	No open circuits	P
A003527777-026	No open circuits	P
Supplementary information: - None		

9.20	**Humidity-freeze test – MQT 12 / MST 52**	
Test date (dd/mm/yyyy)	04/09/2023 - 14/09/2023	—
Total number of cycles	10	
Sample no.	Open circuits (yes/no)	
A003527778-022	No open circuits	P
A003527778-023	No open circuits	P
Supplementary information: - None		

9.20.1	**Visual inspection after Humidity-freeze test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
30/10/2023	A003527777-005	No major visual defects	No major visual defects	P
30/10/2023	A003527777-006		No major visual defects	P
14/09/2023	A003527777-025		No major visual defects	P
14/09/2023	A003527777-026		No major visual defects	P
14/09/2023	A003527778-022		No major visual defects	P
14/09/2023	A003527778-023		No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.20.2 **Insulation test after Humidity-freeze test – MQT 03 / MST 16**

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
30/10/2023	A003527777-005	39.1	2.58	100.88	--	No	P
30/10/2023	A003527777-006	40.0	2.58	103.20	--	No	P
14/09/2023	A003527777-025	38.7	2.58	99.85	--	No	P
14/09/2023	A003527777-026	40.2	2.58	103.72	--	No	P
14/09/2023	A003527778-022	44.4	2.78	123.4	--	No	P
14/09/2023	A003527778-023	43.4	2.78	120.7	--	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.

9.20.3 **Wet leakage current test after Humidity-freeze test – MQT 15 / MST 17**

Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
30/10/2023	A003527777-005	5800.00	2.58	14964.00	P
30/10/2023	A003527777-006	5300.00	2.58	13674.00	P
14/09/2023	A003527777-025	4300.00	2.58	11094.00	P
14/09/2023	A003527777-026	4100.00	2.58	10578.00	P
14/09/2023	A003527778-022	990.00	2.78	2752.2	P
14/09/2023	A003527778-023	1120.00	2.78	3113.6	P

Supplementary information: None
Minimum requirement is 40 MΩ·m².

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.21	**Retention of junction box on mounting surface – MQT 14.1 / MST 42**	
Test date (dd/mm/yyyy)	11/12/2023	—
Sample no.	A003527777-005	
Applied force in all directions parallel to the mounting surface and parallel to the module edges [N]	40	
Applied force perpendicular to the mounting surface [N]	40	
Supplementary information: - None		

9.21.1	**Visual inspection after Retention of junction box on mounting surface – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
11/12/2023	A003527777-005	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.21.2	**Insulation test after Retention of junction box on mounting surface – MQT 03 / MST 16**							
Maximum system voltage [V_{DC}]			1500V					
Cemented joints?			☒ No……☐ Yes					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
11/12/2023	A003527777-005	38.6	2.58	99.59	--	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.								

9.21.3	**Wet leakage current test after Retention of junction box on mounting surface – MQT 15 / MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
11/12/2023	A003527777-005	5500.00	2.58	14190.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.22	**Test of cord anchorage – MQT 14.2 / MST 42**	
a) Pull test		
Test date (DD/MM/YYYY)		
Sample no.	A003527777-005	
Applied force [N]		
Supplementary information: Test not required, since junction box is qualified in accordance with IEC 62790. Zhejiang Renhe - FT50xy - Refer to CDF no. 50172934/ Certificate no. R 50415465 Tested in TUV Rheinland		
b) Torque test		
Test not required, since junction box is qualified in accordance with IEC 62790. Zhejiang Renhe - FT50xy - Refer to CDF no. 50172934/ Certificate no. R 50415465 Tested in TUV Rheinland		—

9.23	**Thermal cycling test (200 cycles) – MQT 11 / MST 51**	
Test date (dd/mm/yyyy)	13/09/2023 - 13/10/2023	—
Total number of cycles	200	
Actual dwell duration at high and low temperatures	30min/30min	
STC peak current applied	16.35 & 16.34	
Sample no.	Open circuits (yes/no)	
A003527777-007	No Open circuits	P
A003527777-008	No Open circuits	P
Supplementary information: A single 5N weight was attached to the junction box The maximum current I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m^2 + φ•300W/m^2) of 16.38A is applied		

9.23	**Thermal cycling test (200 cycles) – MQT 11 / MST 51**	
Test date (dd/mm/yyyy)	13/09/2023 - 13/10/2023	—
Total number of cycles	200	
Actual dwell duration at high and low temperatures	30min/30min	
STC peak current applied	16.35 & 16.34	
Sample no.	Open circuits (yes/no)	
A003527777-021	No Open circuits	P
A003527777-022	No Open circuits	P
Supplementary information: A single 5N weight was attached to the junction box The maximum current I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m^2 + φ•300W/m^2) of 16.38A is applied		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.23	**Thermal cycling test (200 cycles) – MQT 11 / MST 51**	
Test date (dd/mm/yyyy)	13/09/2023 - 13/10/2023	—
Total number of cycles	200	
Actual dwell duration at high and low temperatures	30min/30min	
STC peak current applied	16.34 & 16.32	
Sample no.	Open circuits (yes/no)	
A003527778-018	No Open circuits	P
A003527778-019	No Open circuits	P

Supplementary information: A single 5N weight was attached to the junction box
The maximum current I_{mpp} (G_{BSI}) (G_{BSI} equals to 1000W/m2 + φ•300W/m2) of 15.6A is applied

9.23.1	**Visual inspection after Thermal cycling test (200 cycles) – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
13/10/2023	A003527777-007	No major visual defects	No major visual defects	P
13/10/2023	A003527777-008		No major visual defects	P
13/10/2023	A003527777-021		No major visual defects	P
13/10/2023	A003527777-022		No major visual defects	P
13/10/2023	A003527778-018		No major visual defects	P
13/10/2023	A003527778-019		No major visual defects	P

Supplementary information: - None

9.23.2	**Insulation test after Thermal cycling test (200 cycles) – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No…….☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
13/10/2023	A003527777-007	41.2	2.58	106.30	--	No	P
13/10/2023	A003527777-008	42.3	2.58	109.13	--	No	P
13/10/2023	A003527777-021	42.6	2.58	109.91	--	No	P
13/10/2023	A003527777-022	40.7	2.58	105.01	--	No	P
13/10/2023	A003527778-018	41.9	2.78	116.48	--	No	P
13/10/2023	A003527778-019	37.9	2.78	105.36	--	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.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.23.3	**Wet leakage current test after Thermal cycling test (200 cycles) – MQT 15 / MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
13/10/2023	A003527777-007	5100.00	2.58	13158.00	P
13/10/2023	A003527777-008	6600.00	2.58	17028.00	P
13/10/2023	A003527777-021	5200.00	2.58	13416.00	P
13/10/2023	A003527777-022	5400.00	2.58	13932.00	P
13/10/2023	A003527778-018	1200.00	2.78	3336.00	P
13/10/2023	A003527778-019	1150.00	2.78	3197.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

9.24	**Damp heat test – MQT 13 / MST 53**	
Test date (dd/mm/yyyy)	09/08/2023 - 20/09/2023	—
Total duration [h]	1000	
Sample no.	—	
A003527777-009	—	P
A003527777-010	—	P
Supplementary information: -None		

9.24	**Damp heat test – MQT 13 / MST 53**	
Test date (dd/mm/yyyy)	09/08/2023 - 20/09/2023	—
Total duration [h]	1000	
Sample no.	—	
A003527777-023	—	P
A003527777-024	—	P
Supplementary information: -None		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

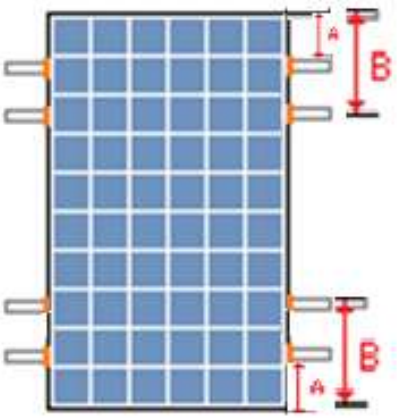
9.24	**Damp heat test – MQT 13 / MST 53**	
Test date (dd/mm/yyyy)	03/08/2023 - 13/09/2023	—
Total duration [h]	1000	
Sample no.	—	
A003527778-020	—	P
A003527778-021	—	P
Supplementary information: -None		

9.24.1	**Visual inspection after Damp heat test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
20/09/2023	A003527777-009	No major visual defects	No major visual defects	P
20/09/2023	A003527777-010		No major visual defects	P
20/09/2023	A003527777-023		No major visual defects	P
20/09/2023	A003527777-024		No major visual defects	P
15/09/2023	A003527778-020		No major visual defects	P
15/09/2023	A003527778-021		No major visual defects	P
Supplementary information: - None				

9.24.2	**Insulation test after Damp heat test – MQT 03 / MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
20/09/2023	A003527777-009	44.60	2.58	115.07	--	No	P
20/09/2023	A003527777-010	42.30	2.58	109.13	--	No	P
20/09/2023	A003527777-023	40.2	2.58	103.72	--	No	P
20/09/2023	A003527777-024	42.4	2.58	109.39	--	No	P
15/09/2023	A003527778-020	39.50	2.78	109.81	--	No	P
15/09/2023	A003527778-021	32.70	2.78	90.91	--	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.							

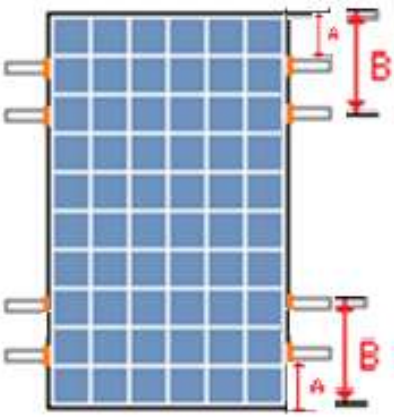
Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.24.3	**Wet leakage current test after Damp heat test – MQT 15 / MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
20/09/2023	A003527777-009	5200.00	2.58	13416.00	P
20/09/2023	A003527777-010	5800.00	2.58	14964.00	P
20/09/2023	A003527777-023	4800.00	2.58	12384.00	P
20/09/2023	A003527777-024	5100.00	2.58	13158.00	P
15/09/2023	A003527778-020	1300.00	2.78	3614.00	P
15/09/2023	A003527778-021	1740.00	2.78	4837.20	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

9.25	**Static mechanical load test – MQT 16 / MST 34**		
Test date (dd/mm/yyyy)	27/09/2023		—
Load direction applied	Positive (downward)	Negative (upward)	
Design load [Pa]	3600	1600	
Safety factor γ_m	1.5	1.5	
Test load [Pa]	5400	2400	
Mounting method	Variant 2 (8 holes mounting method)		
Distance A [mm]	440		
Distance B [mm]	590		
Test configuration	Variant 2 		
Sample no.	Open circuits (yes/no)		—
A003527777-009	No Open circuits		P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

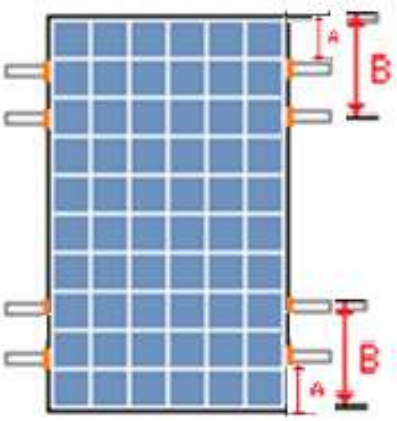
Supplementary information:
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is 10%.

9.25	**Static mechanical load test – MQT 16 / MST 34**		
Test date (dd/mm/yyyy)	27/09/2023		—
Load direction applied	Positive (downward)	Negative (upward)	
Design load [Pa]	3600	1600	
Safety factor γ_m	1.5	1.5	
Test load [Pa]	5400	2400	
Mounting method	Variant 2 (8 holes mounting method)		
Distance A [mm]	440		
Distance B [mm]	590		
Test configuration	Variant 2 		

Sample no.	Open circuits (yes/no)	—
A003527777-023	No Open circuits	P

Supplementary information:
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is 10%.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.25	**Static mechanical load test – MQT 16 / MST 34**		
Test date (dd/mm/yyyy)	10/10/2023		—
Load direction applied	Positive (downward)	Negative (upward)	
Design load [Pa]	3600	1600	
Safety factor γ_m	1.5	1.5	
Test load [Pa]	5400	2400	
Mounting method	Variant 2 (8 holes mounting method)		
Distance A [mm]	435		
Distance B [mm]	640		
Test configuration	Variant 2 		

Sample no.	Open circuits (yes/no)	—
A003527778-020	No Open circuits	P

Supplementary information:
Load was applied pneumatically. The coverage ratio of automated system (discrete-point application) is 10%.

9.25.1	**Visual inspection after Static mechanical load test – MQT 01 / MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
28/09/2023	A003527777-009	No major visual defects	No major visual defects	P
28/09/2023	A003527777-023		No major visual defects	P
10/10/2023	A003527778-020		No major visual defects	P

Supplementary information: - None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.25.2 Insulation test after Static mechanical load test – MQT 03 / MST 16

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
28/09/2023	A003527777-009	42.10	2.58	108.61	--	No	P
28/09/2023	A003527777-023	38.6	2.58	99.58	--	No	P
10/10/2023	A003527778-020	38.5	2.78	107.03	--	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.

9.25.3 Wet leakage current test after Static mechanical load test – MQT 15 / MST 17

Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
28/09/2023	A003527777-009	4300.00	2.58	11094.00	P
28/09/2023	A003527777-023	4100.00	2.58	10578.00	P
10/10/2023	A003527778-020	2400.00	2.78	6672.00	P

Supplementary information: None
Minimum requirement is 40 MΩ·m².

9.26 Hail test – MQT 17

Test date (dd/mm/yyyy)		21/09/2023	—
Ice ball diameter [mm]		25	
Ice ball mass [g]		7.53 ± 2 %	
Ice ball velocity [m/s]		23 ± 5 %	
Number of impact locations		11	
Sample no.	—		
A003527777-010	—		

Supplementary information: - None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.26.1	**Visual inspection after Hail test – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
21/09/2023	A003527777-010	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.26.2	**Insulation test after Hail test – MQT 03**							
Maximum system voltage [V_{DC}]			1500V					
Cemented joints?			☒ No……☐ Yes					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
21/09/2023	A003527777-010	41.7	2.58	107.59	--	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.								

9.26.3	**Wet leakage current test after Hail test – MQT 15**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
21/09/2023	A003527777-010	5100.00	2.58	13158.00	P
Supplementary information: Minimum requirement is 40 MΩ·m².					

9.28	**Materials creep test – MST 37**	
Test date (dd/mm/yyyy)	14/08/2023 - 23/08/2023	—
Temperature [°C]	105 ± 5	
Duration [h]	200	
Worst case mounting angle [°]	90	
Sample no.	—	
A003527777-031	—	P
Supplementary information: -None		

9.28.1	**Visual inspection after Materials creep test – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
23/08/2023	A003527777-031	Creepage and clearance distances acc. to CSA C22.2 NO. 61730-1, Table 3 are met.	No major visual defects observed - Complies	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.28.2	**Insulation test after Materials creep test – MST 16**							
Maximum system voltage [V_{DC}]			1500V					
Cemented joints?			☒ No……☐ Yes					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
23/08/2023	A003527777-031	38.3	2.58	98.81	--	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.								

9.28.3	**Wet leakage current test after Materials creep test – MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
23/08/2023	A003527777-031	5100.00	2.58	13158.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

9.29	**Damp heat test (200h) – MST 53**	
Test date (dd/mm/yyyy)	07/08/2023 - 16/08/2023	—
Total duration [h]	200	
Sample no.	—	
A003527777-029	—	P
A003527777-030		
Supplementary information: - None		

9.29.1	**Visual inspection after Damp heat test (200h) – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
16/08/2023	A003527777-029	No major visual defects	No major visual defects	P
16/08/2023	A003527777-030		No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.29.2	**Insulation test after Damp heat test (200h) – MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
16/08/2023	A003527777-029	41.1	2.58	106.03	--	No	P
16/08/2023	A003527777-030	40.3	2.58	103.97	--	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.							

9.30	**UV test (front side) – MST 54**		
Test date (dd/mm/yyyy)	10/11/2023 - 24/11/2023		—
Module temperature [°C]	60 ± 5		
Ratio of UV-B irradiation (280 – 320 nm) [%]	4.82		
UV irradiation dose (280 – 400 nm) [kWh/m²]	60.37		
Operation mode	☒ Short-circuit	☐ Open-circuit	
Sample no.	—		
A003527777-029	—		P
Supplementary information: The sample front side was exposed.			

9.32	**UV test (back side) – MST 54**		
Test date (dd/mm/yyyy)	10/11/2023 - 24/11/2023		—
Module temperature [°C]	60 ± 5		
Ratio of UV-B irradiation (280 – 320 nm) [%]	4.48		
UV irradiation dose (280 – 400 nm) [kWh/m²]	60.16		
Operation mode	☒ Short-circuit	☐ Open-circuit	
Sample no.	—		
A003527777-030	—		P
Supplementary information: The sample back side was exposed.			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.30.1 Visual inspection after UV test – MST 01

Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
24/11/2023	A003527777-029	No major visual defects	No major visual defects	P
24/11/2023	A003527777-030		No major visual defects	P

Supplementary information: - None

9.30.2 Insulation test after UV test – MST 16

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
24/11/2023	A003527777-029	40.7	2.58	105.01	--	No	P
24/11/2023	A003527777-030	39.4	2.58	101.65	--	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.

9.31 Humidity-freeze test – MST 52

Test date (dd/mm/yyyy)	28/11/2023 - 08/12/2023	—
Total number of cycles	10	
Sample no.	Open circuits (yes/no)	
A003527777-029	No Open circuits	P
A003527777-030	No Open circuits	P

Supplementary information: - None

9.31.1 Visual inspection after Humidity-freeze test – MST 01

Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
08/12/2023	A003527777-029	No major visual defects	No major visual defects	P
08/12/2023	A003527777-030		No major visual defects	P

Supplementary information: - None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.31.2 **Insulation test after Humidity-freeze test – MST 16**

Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
08/12/2023	A003527777-029	38.3	2.58	98.81	--	No	P
08/12/2023	A003527777-030	37.2	2.58	95.98			
Supplementary information: Minimum requirement is 0.04 GΩ·m² for A > 0.1 m² and 0.4 GΩ for A ≤ 0.1 m².							

9.33.3 **Wet leakage current test after Humidity-freeze test – MST 17**

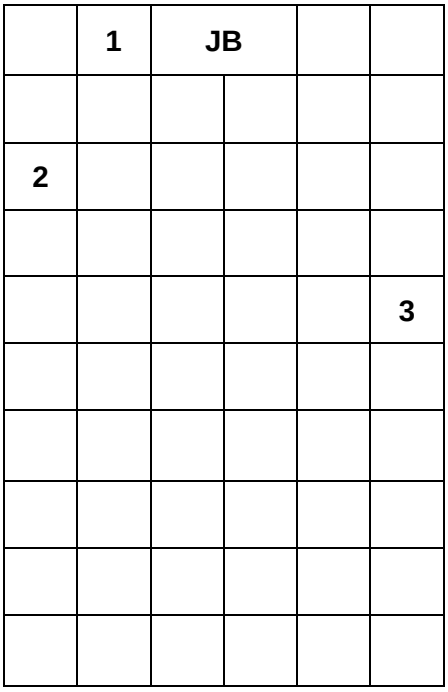
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
08/12/2023	A003527777-029	5800.00	2.58	14964.00	P
08/12/2023	A003527777-030	5100.00	2.58	13158.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.34	**Insulation thickness test – MST 04 -N/A**			
Test date (dd/mm/yyyy)				—
Sample no.				
Maximum system voltage [V]				
Test location 1		Centre, near the junction box, between two busbars		
Test location 2		Edge cell, between two busbars		
Test location 3		Corner cell, above a busbar		
—	Test location 1	Test location 2	Test location 3	
Thickness layer 1 [µm]				
Thickness layer 2 [µm]				
Thickness layer 3 [µm]				
Total thickness [µm]				
Min. requirement [µm]	300			

Supplementary information: ***Not applicable since submitted samples are having glass as Back sheet***
Min. requirement acc. to table 3/4 of IEC 61730-1.

Samples taken from positions as below (module view from backside):



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.35	**Cold conditioning 1 – MST 55**	
Test date (dd/mm/yyyy)	08/08/2023 to 10/08/2023	—
Temperature [°C]	-40 ± 3	
Duration [h]	48	
Sample no.	—	
A003527777-028	—	P
Supplementary information: - None		

9.35.1	**Visual inspection after Cold conditioning 1 – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
10/08/2023	A003527777-028	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.35.2	**Insulation test after Cold conditioning 1 – MST 16**							
Maximum system voltage [V_{DC}]			1500V					
Cemented joints?			☒ No……☐ Yes					
High voltage applied [V_{DC}]			8000V					
Insulation resistance measured at [V_{DC}]			1500V					
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown			
					Yes (description)	No		
10/08/2023	A003527777-028	40.3	2.58	103.97	--	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.								

9.36	**Dry heat conditioning – MST 56**	
Test date (dd/mm/yyyy)	14/08/2023 - 23/08/2023	—
Temperature [°C]	105 ± 5	
Relative humidity [%]	< 50	
Duration [h]	200	
Sample no.	—	
A003527777-028	—	P
Supplementary information: - None		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.36.1 Visual inspection after Dry heat conditioning – MST 01

Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
23/08/2023	A003527777-028	No major visual defects	No major visual defects	P

Supplementary information: - None

9.36.2 Insulation test after Dry heat conditioning – MST 16

Maximum system voltage [V_{DC}]	1500V
Cemented joints?	☒ No……☐ Yes
High voltage applied [V_{DC}]	8000V
Insulation resistance measured at [V_{DC}]	1500V

Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
23/08/2023	A003527777-028	39.4	2.58	101.65	--	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.

9.37 Humidity-freeze test 1 – MST 52

Test date (dd/mm/yyyy)	04/09/2023 - 14/09/2023	—
Total number of cycles	10	
Sample no.	Open circuits (yes/no)	
A003527777-028	No Open circuits	P

Supplementary information: -None

9.37.1 Visual inspection after Humidity-freeze test 1 – MST 01

Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
14/09/2023	A003527777-028	No major visual defects	No major visual defects	P

Supplementary information: - None

9.37.2 Insulation test after Humidity-freeze test 1 – MST 16

Maximum system voltage [V_{DC}]	1500V
Cemented joints?	☒ No……☐ Y
High voltage applied [V_{DC}]	8000V
Insulation resistance measured at [V_{DC}]	1500V

Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
14/09/2023	A003527777-028	34.2	2.58	88.23	--	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.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.38	**Cold conditioning 2 – MST 55**		
Test date (dd/mm/yyyy)		20/09/2023 - 22/09/2023	—
Temperature [°C]		-40 ± 3	
Duration [h]		48	
Sample no.	—		
A003527777-028	—		P
Supplementary information: -None			

9.38.1	**Visual inspection after Cold conditioning 2 – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
22/09/2023	A003527777-028	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.38.2	**Insulation test after Cold conditioning 2 – MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
22/09/2023	A003527777-028	40.10	2.58	103.45	--	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.							

9.39	**Humidity-freeze test 2 – MST 52)**		
Test date (dd/mm/yyyy)		23/10/2023 - 03/10/2023	—
Total number of cycles		10	
Sample no.	Open circuits (yes/no)		
A003527777-028	No Open circuits		P
Supplementary information: - None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.39.1	**Visual inspection after Humidity-freeze test 2 – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
03/10/2023	A003527777-028	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.39.2	**Insulation test after Humidity-freeze test 2 – MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
03/10/2023	A003527777-028	36.8	2.58	94.94	--	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.							

9.39.3	**Wet leakage current test after Humidity-freeze test 2 – MST 17**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
03/10/2023	A003527777-028	4100.00	2.58	10578.00	P
Supplementary information: None Minimum requirement is 40 MΩ·m².					

9.40	**Impulse voltage test – MST 14**	
Test date (dd/mm/yyyy)	08/11/2023	—
Maximum system voltage [V]	1500	
Rated impulse voltage [V]	16000	
Impulse test voltage [V]	18650	
Lab altitude [m]	900	
Sample no.	Test results	
A003562285-002	No evidence of dielectric breakdown or surface tracking observed	P
Supplementary information: - Test conducted on framed module		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.40.1	**Visual inspection after Impulse voltage test – MST 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
08/11/2023	A003562285-002	No major visual defects	No major visual defects	P
Supplementary information: - None				

9.40.2	**Insulation test after Impulse voltage test – MST 16**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
08/11/2023s	A003562285-002	40.2	2.58	103.72	--	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.							

9.41	**Module breakage test – MST 32**		
Test date (dd/mm/yyyy)		11//09/2023	—
Weight of impactor [kg]		45.5 ± 0.5	
Drop height [mm]		300	
Mounting technique used		Mounting holes	
Sample no.	Test results		
A003527777-011	☐	No breakage occurred	P
	☐	PV module separated from the mounting structure or from the framing	
	☒	Breakage occurred, but no shear or opening large enough for a 76 mm diameter sphere to pass freely has developed and no particles larger than 65 cm² have been ejected from the sample.	
Supplementary information: -None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.41	**Module breakage test – MST 32**		
Test date (dd/mm/yyyy)		13/10/2023	—
Weight of impactor [kg]		45.5 ± 0.5	
Drop height [mm]		300	
Mounting technique used		Mounting holes	
Sample no.	Test results		
A003527778-028	☐	No breakage occurred	P
	☐	PV module separated from the mounting structure or from the framing	
	☒	Breakage occurred, but no shear or opening large enough for a 76 mm diameter sphere to pass freely has developed and no particles larger than 65 cm² have been ejected from the sample.	
Supplementary information: -None			

9.42	**Ignitability test – MST 24**	
Test date (dd/mm/yyyy)	20/11/2023 - 21/11/2023	—
Sample no.	A003562285-001	
Back sheet foil exposures		
☐ Ignition occurs		N/A
☐ The flame tip reaches a height of 150 mm above the flame application point at < 20s.		N/A
Frame adhesive exposures		
☐ Ignition occurs		P
☐ The flame tip reaches a height of 150 mm above the flame application point at < 20s.		P
Junction box adhesive exposures		
☐ Ignition occurs		P
☐ The flame tip reaches a height of 150 mm above the flame application point at < 20s.		P
Edge sealing exposures		
☐ Ignition occurs		P
☐ The flame tip reaches a height of 150 mm above the flame application point at < 20s.		P
Type label		
☐ Ignition occurs		P
☐ The flame tip reaches a height of 150 mm above the flame application point at < 20s.		P
Supplementary information: -None		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.43	**Potential induced degradation test – MQT 21**	
Test date (dd/mm/yyyy)	23/08/2023 to 28/08/2023	—
Chamber air temperature [°C]	85	
Chamber relative humidity [%]	85	
Test duration [h]	96	
Mounting configuration	Modules mounted Horizontally	
Sample no.	—	
A003527777-015	-1500V(Positive terminal of power supply connected module earth ground)	P
A003527777-016	-1500V(Positive terminal of power supply connected module earth ground)	P
A003527777-017	+1500V(Negative terminal of power supply connected module earth ground)	P
A003527777-027	+1500V(Negative terminal of power supply connected module earth ground)	P
Supplementary information: -None		

9.43	**Potential induced degradation test – MQT 21**	
Test date (dd/mm/yyyy)	30/08/2023 - 04/09/2023	—
Chamber air temperature [°C]	85	
Chamber relative humidity [%]	85	
Test duration [h]	96	
Mounting configuration	Modules mounted Horizontally	
Sample no.	—	
A003527777-033	-1500V (Positive terminal of power supply connected module earth ground)	
A003527777-034	-1500V(Positive terminal of power supply connected module earth ground)	
A003527777-032	+1500V (Negative terminal of power supply connected module earth ground)	P
A003527777-035	+1500V(Negative terminal of power supply connected module earth ground)	P
Supplementary information: -None		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.43	**Potential induced degradation test – MQT 21**	
Test date (dd/mm/yyyy)	23/08/2023 - 28/08/2023	—
Chamber air temperature [°C]	85	
Chamber relative humidity [%]	85	
Test duration [h]	96	
Mounting configuration	Modules mounted Horizontally	
Sample no.	—	
A003527778-024	+1500V (Negative terminal of power supply connected module earth ground)	
A003527778-025	+1500V (Negative terminal of power supply connected module earth ground)	
A003527778-026	-1500V(Positive terminal of power supply connected module earth ground)	P
A003527778-027	-1500V(Positive terminal of power supply connected module earth ground)	P
Supplementary information: -None		

9.43.1	**Visual inspection after Potential induced degradation test – MQT 01**			
Test date (dd/mm/yyyy)	Sample no.	Requirement	Nature and position of findings	
28/08/2023	A003527777-015	No major visual defects	No major visual defects	P
28/08/2023	A003527777-016		No major visual defects	P
28/08/2023	A003527777-017		No major visual defects	P
28/08/2023	A003527777-027		No major visual defects	P
04/09/2023	A003527777-033		No major visual defects	P
04/09/2023	A003527777-034		No major visual defects	P
04/09/2023	A003527777-032		No major visual defects	P
04/09/2023	A003527777-035		No major visual defects	P
28/08/2023	A003527778-024		No major visual defects	P
28/08/2023	A003527778-025		No major visual defects	P
28/08/2023	A003527778-026		No major visual defects	P
28/08/2023	A003527778-027		No major visual defects	P
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.43.2	**Insulation test after Potential induced degradation test – MQT 03**						
Maximum system voltage [V_{DC}]			1500V				
Cemented joints?			☒ No……☐ Yes				
High voltage applied [V_{DC}]			8000V				
Insulation resistance measured at [V_{DC}]			1500V				
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [GΩ]	A [m²]	R_{iso}·A [GΩ·m²]	Dielectric breakdown		
					Yes (description)	No	
28/08/2023	A003527777-015	40.1	2.58	103.46	--	No	P
28/08/2023	A003527777-016	41.3	2.58	106.55	--	No	P
28/08/2023	A003527777-017	40.4	2.58	104.23	--	No	P
28/08/2023	A003527777-027	41.6	2.58	107.33	--	No	P
04/09/2023	A003527777-033	42.60	2.58	109.91	--	No	P
04/09/2023	A003527777-034	40.70	2.58	105.01	--	No	P
04/09/2023	A003527777-032	40.10	2.58	103.46	--	No	P
04/09/2023	A003527777-035	41.40	2.58	106.81	--	No	P
28/08/2023	A003527778-024	40.3	2.78	112.0	--	No	P
28/08/2023	A003527778-025	38.5	2.78	107.0	--	No	P
28/08/2023	A003527778-026	41.2	2.78	114.5	--	No	P
28/08/2023	A003527778-027	36.5	2.78	101.5	--	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.							

9.43.3	**Wet leakage current test after Potential induced degradation test – MQT 15**				
Insulation resistance measured at [V_{DC}]		1500V			
Solution resistivity [Ω·cm]		≤ 3500			
Solution temperature [°C]		22 ± 2			
Test date (dd/mm/yyyy)	Sample no.	R_{iso} [MΩ]	A [m²]	R_{iso}·A [MΩ·m²]	
28/08/2023	A003527777-015	6300.00	2.58	14706.00	P
28/08/2023	A003527777-016	6200.00	2.58	13158.00	P
28/08/2023	A003527777-017	6000.00	2.58	14190.00	P
28/08/2023	A003527777-027	5800.00	2.58	13416.00	P
04/09/2023	A003527777-033	4800.00	2.58	12384.00	P
04/09/2023	A003527777-034	4900.00	2.58	12642.00	P
04/09/2023	A003527777-032	6700.00	2.58	17286.00	P
04/09/2023	A003527777-035	4800.00	2.58	12384.00	P
28/07/2023	A003527778-024	880.0	2.78	2446.40	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

28/07/2023	A003527778-025	1040.0	2.78	2891.20	P
28/07/2023	A003527778-026	1280.0	2.78	3558.40	P
28/07/2023	A003527778-027	950.0	2.78	2641.00	P

Supplementary information: None

Minimum requirement is 40 MΩ·m².

9.44	**Fire test – MST 23 (acc. to UL 790)**		
9.44.1	**Spread of flame test**		
Test date (dd/mm/yyyy)	06/10/2023		—
Sample no.	A003527777-012, A003527777-013		
Fire class test specification	6 feet or less in 10 min		
Test results			
Did any portion of the module blow off or fall off the test deck in the form of flaming / glowing brands?	☐ Yes	☒ No	
Did any portion of the roof desk fall away in the form of glowing particles?	☐ Yes	☒ No	
Was the flame spread beyond 6ft	☐ Yes	☒ No	
Was there a significant lateral spread-of-flame from the path directly exposed to the test flame?	☐ Yes	☒ No	

Supplementary information:

End to End, Class A performed and Confirmed to Class C (During the Application of test flame. The Test Sample observed a flame distnce of 8 feet or less in 10 min). Results declared as Type 40

9.44.2	**Burning brand test**		
Test date (dd/mm/yyyy)	06/10/2023		—
Sample no.	A003527777-014		
Burning Brand (BB) test specification	Brand C		
Test results			
Did any portion of the module blow off or fall off the test deck in the form of flaming / glowing brands?	☐ Yes	☒ No	
Did any portion of the roof desk fall away in the form of glowing particles?	☐ Yes	☒ No	
Did the brand burn a hole through the roof covering or through any part of the module?	☐ Yes	☒ No	
Sustained flaming of the module?	☐ Yes	☒ No	

Supplementary information: None

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.44.3	**Fire type classification result (acc. to UL 61730)**	
Module type	HYPERSOL VSMDH. 72.575.05	—
Thickness of front cover (superstrate) [mm]	2.0± 0.2	
Thickness of back cover (substrate) [mm]	2.0±0.2	
Material of back cover (substrate)	Glass	
Pre-lamination thickness of encapsulant (front cover / cell) [mm]	0.55± 10%	
Pre-lamination thickness of encapsulant (cell / back cover) [mm]	0.60± 10%	
Frame material	Anodized aluminum	
Best passed class of Spread of flame test	Class C	
Best passed class of Burning brand test	Class C	
Fire type classification	Type 40	
Supplementary information: None		

9.45	**Final stabilization – MQT 19.2 / MQT 19.3**

9.45.1	**Stress-specific stabilization – BO LID after Damp heat test – MQT 19.3**	
Test date (dd/mm/yyyy)	N/A	—
Test method	☐ Method 1 ☒ Method 2	
Chamber air temperature [°C]	N/A	
Total duration [h]	N/A	
Sample no.	—	
A003527777-009	—	N/A
A003527777-010	—	N/A
A003527777-023	—	N/A
A003527777-024	—	N/A
A003527778-020	—	N/A
A003527778-021	—	N/A
Supplementary information: Method 2 was used and directly passed. The modules were not stabilized and amount of observed degradation may be larger than if module had been stabilized		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.45.2	**Final stabilization after Potential induced degradation test – MQT 19.2**	
Test date (dd/mm/yyyy)	N/A	—
Test method	☐ Method 3 ☒ Method 4	
Ratio of UV-B irradiation (280 – 320 nm) [%]	N/A	
UV irradiation dose (280 – 400 nm) [kWh/m²]	N/A	
UV irradiation direction	☐ Front side ☐ Rear side	
Operation mode	☐ Short-circuit ☐ Open-circuit	
Module temperature [°C]	N/A	
Total duration [h]	N/A	
Sample no.	—	
A003527777-015	—	N/A
A003527777-016	—	N/A
A003527777-017	—	N/A
A003527777-027	—	N/A
A003527777-033	—	N/A
A003527777-034	—	N/A
A003527777-032	—	N/A
A003527777-035	—	N/A
A003527778-024	—	N/A
A003527778-025	—	N/A
A003527778-026	—	N/A
A003527778-027	—	N/A
Supplementary information: Method 4 was used and directly passed. The modules were not stabilized and amount of observed degradation may be larger than if module had been stabilized		

9.46	**Maximum power determination (final) – MST 03**		
Irradiance [W/m²]	1000 ± 10		
Module temperature [°C]	Corrected to 25		
Test method	☒ Simulator ☐ Natural sunlight		
Test date (dd/mm/yyyy)	Sample no.	Appearance of final IV-curve	
11/12/2023	A003527777-005	No kinks or other unusual characteristics	P
13/10/2023	A003527777-007	No kinks or other unusual characteristics	P
28/09/2023	A003527777-009	No kinks or other unusual characteristics	P
03/10/2023	A003527777-028	No kinks or other unusual characteristics	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

08/12/2023	A003527777-029	No kinks or other unusual characteristics	P
08/12/2023	A003527777-030	No kinks or other unusual characteristics	P
Supplementary information: -None			

9.46	**Maximum power determination (final) – MST 03**		
Irradiance [W/m²]	1000 ± 10		
Module temperature [°C]	Corrected to 25		
Test method	☒ Simulator	☐ Natural sunlight	
Test date (dd/mm/yyyy)	Sample no.	Appearance of final IV-curve	
14/09/2023	A003527777-025	No kinks or other unusual characteristics	P
13/10/2023	A003527777-021	No kinks or other unusual characteristics	P
28/09/2023	A003527777-023	No kinks or other unusual characteristics	P
Supplementary information: -None			

9.46	**Maximum power determination (final) – MST 03**		
Irradiance [W/m²]	1000 ± 10		
Module temperature [°C]	Corrected to 25		
Test method	☒ Simulator	☐ Natural sunlight	
Test date (dd/mm/yyyy)	Sample no.	Appearance of final IV-curve	
14/09/2023	A003527778-022	No kinks or other unusual characteristics	P
13/10/2023	A003527778-018	No kinks or other unusual characteristics	P
10/10/2023	A003527778-020	No kinks or other unusual characteristics	P
Supplementary information: -None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

For bifacial module

9.47	**Performance at STC (final) – MQT 06.1**

9.24	**Performance at STC (final) – MQT 06.1**								
Test method		☒ Simulator ☐ Natural sunlight							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 ± 10							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
28/08/2023	A003527777-015	566.7	42.50	13.33	51.63	13.96	78.6	-0.5	
28/08/2023	A003527777-016	567.6	42.60	13.32	51.60	13.90	79.1	-0.7	P
28/08/2023	A003527777-017	566.6	42.59	13.30	51.70	13.92	78.7	-0.6	
28/08/2023	A003527777-027	566.5	42.58	13.30	51.69	13.90	78.9	-0.6	
13/10/2023	A003527777-007	568.0	42.60	13.34	51.72	13.93	78.9	-1.4	
13/10/2023	A003527777-008	568.2	42.59	13.34	51.69	13.92	78.9	-0.5	
28/09/2023	A003527777-009	561.4	42.66	13.16	51.82	13.76	78.7	-2.9	
21/09/2023	A003527777-010	566.2	42.77	13.24	51.73	13.78	79.4	-0.7	
11/12/2023	A003527777-005	567.2	42.64	13.30	51.76	13.88	78.9	-0.7	
13/10/2023	A003527777-006	567.6	42.73	13.28	51.76	13.87	79.1	-0.6	
14/09/2023	A003527777-002	570.5	42.76	13.34	51.70	13.90	79.4	-0.2	
Supplementary information: *Negative* degradation means power *loss*.									

9.24	**Performance at STC (final) – MQT 06.1**								
Test method		☒ Simulator ☐ Natural sunlight							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 ± 10							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							P
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
04/09/2023	A003527777-032	569.0	42.73	13.32	51.79	13.90	79.0	-0.5	
04/09/2023	A003527777-033	569.2	42.72	13.32	51.73	13.88	79.3	-0.2	
04/09/2023	A003527777-034	569.6	42.79	13.31	13.31	13.94	78.9	-0.3	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

04/09/2023	A003527777-035	569.7	42.73	13.33	51.86	13.93	78.8	-0.2	
13/10/2023	A003527777-021	569.5	42.65	13.35	51.85	13.95	78.7	-0.1	
13/10/2023	A003527777-022	567.4	42.57	13.33	51.69	13.93	78.8	-0.7	
14/09/2023	A003527777-025	565.2	42.87	13.18	51.92	13.73	79.3	-0.8	
14/09/2023	A003527777-026	564.1	42.78	13.19	51.77	13.72	79.4	-1.1	
28/09/2023	A003527777-023	563.2	42.75	13.18	51.72	13.71	79.4	-1.1	
20/09/2023	A003527777-024	562.1	42.69	13.16	51.70	13.77	78.9	-1.3	
14/09/2023	A003527777-019	570.7	42.79	13.34	51.75	13.95	79.1	-0.1	

Supplementary information: *Negative* degradation means power *loss*.

9.24	**Performance at STC (final) – MQT 06.1**

Test method		☒ Simulator ☐ Natural sunlight							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 ± 10							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
28/08/2023	A003527778-024	583.1	45.61	12.78	54.30	13.37	80.3	-0.2	
28/08/2023	A003527778-025	582.6	45.60	12.78	54.16	13.37	80.4	-0.3	P
28/08/2023	A003527778-026	581.9	45.49	12.79	54.12	13.38	80.4	-0.3	
28/08/2023	A003527778-027	582.2	45.53	12.79	54.16	13.38	80.3	-0.4	
15/09/2023	A003527778-020	572.4	45.18	12.67	53.98	13.26	79.9	-2.3	
15/09/2023	A003527778-021	571.2	45.24	12.63	53.99	13.20	80.1	-2.2	
06/10/2023	A003527778-016	581.5	45.36	12.82	54.35	13.42	79.7	-0.2	
13/10/2023	A003527778-018	582.4	45.34	12.85	54.29	13.43	79.9	-0.2	
13/10/2023	A003527778-019	581.2	45.48	12.78	54.37	13.41	79.7	-0.5	
14/09/2023	A003527778-022	578.5	45.33	12.76	54.28	13.34	79.9	-1.3	
14/09/2023	A003527778-023	576.8	45.29	12.74	54.25	13.31	79.8	-1.3	

Supplementary information: *Negative* degradation means power *loss*.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.47.1	**Bifaciality Coefficients (final)**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	—
A003527777-015	76.58	98.84	75.51	—
A003527777-016	76.47	98.80	75.65	—
A003527777-017	76.36	98.80	75.59	—
A003527777-027	77.12	98.82	75.86	—
Supplementary information: - None				

9.47.1	**Bifaciality Coefficients (final)**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	—
A003527777-032	76.19	98.84	75.43	—
A003527777-033	76.73	98.82	75.95	—
A003527777-034	76.76	98.67	75.00	—
A003527777-035	76.24	98.84	75.51	—
Supplementary information: - None				

9.47.1	**Bifaciality Coefficients (final)**			
Sample no.	φ_{Isc}	φ_{Voc}	φ_{Pmax}	—
A003527778-024	75.99	98.78	71.65	—
A003527778-025	76.29	98.82	72.34	—
A003527778-026	75.56	98.78	71.25	—
A003527778-027	75.71	98.82	71.64	—
Supplementary information: - None				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.47.2 **Performance at BNPI (final) – MQT 06.1**

Test method		☒ Simulator ☐ Natural sunlight							P
Illuminated side		☒ Front side ☐ Rear side							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 + φ•135*(1096)							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
28/08/2023	A003527777-015	623.2	42.48	14.67	51.85	15.39	78.1	-0.9	
28/08/2023	A003527777-016	623.7	42.54	14.66	51.80	15.32	78.6	-0.9	
28/08/2023	A003527777-017	622.9	42.53	14.64	51.89	15.35	78.2	-0.8	
28/08/2023	A003527777-027	622.7	42.53	14.64	51.88	15.32	78.3	-0.9	
13/10/2023	A003527777-007	624.2	42.54	14.68	51.91	15.36	78.3	-0.9	
13/10/2023	A003527777-008	624.4	42.52	14.68	51.88	15.35	78.4	-0.5	
28/09/2023	A003527777-009	616.5	42.51	14.50	51.93	15.18	78.2	-2.7	
21/09/2023	A003527777-010	622.0	42.71	14.56	51.92	15.19	78.9	-1.1	
11/12/2023	A003527777-005	623.0	42.52	14.66	51.95	15.31	78.3	-0.8	
13/10/2023	A003527777-006	622.6	42.57	14.63	51.95	15.31	78.2	-0.8	
14/09/2023	A003527777-002	627.7	42.70	14.70	51.89	15.34	78.9	-0.1	

Supplementary information: *Negative* degradation means power *loss*.
The non-illuminated side was covered with non-reflective background and aperture.

9.47.2 **Performance at BNPI (final) – MQT 06.1**

Test method		☒ Simulator ☐ Natural sunlight							P
Illuminated side		☒ Front side ☐ Rear side							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 + φ•135*(1096)							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
04/09/2023	A003527777-032	625.1	42.67	14.65	51.98	15.31	78.5	-0.6	
04/09/2023	A003527777-033	625.8	42.67	14.67	51.93	15.33	78.6	-0.4	
04/09/2023	A003527777-034	625.4	42.75	14.63	51.96	15.35	78.4	-0.4	
04/09/2023	A003527777-035	626.2	42.69	14.67	52.06	15.36	78.3	-0.2	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

13/10/2023	A003527777-021	626.6	42.60	14.71	52.04	15.40	78.2	-0.3	
13/10/2023	A003527777-022	623.9	42.52	14.67	51.88	15.36	78.3	-0.7	
14/09/2023	A003527777-025	621.2	42.82	14.51	52.10	15.14	78.7	-1.3	
14/09/2023	A003527777-026	620.7	42.76	14.52	51.97	15.13	78.9	-1.3	
28/09/2023	A003527777-023	619.3	42.68	14.51	51.88	15.14	78.8	-1.6	
20/09/2023	A003527777-024	617.5	42.64	14.48	51.89	15.18	78.4	-1.8	
14/09/2023	A003527777-019	627.5	42.74	14.68	51.95	15.38	78.5	-0.1	

Supplementary information: *Negative* degradation means power *loss*.The non-illuminated side was covered with non-reflective background and aperture.

9.47.2	**Performance at BNPI (final) – MQT 06.1**								
Test method		☒ Simulator ☐ Natural sunlight							
Illuminated side		☒ Front side ☐ Rear side							
Ambient temperature [°C]		25 ± 2							
Irradiance [W/m²]		1000 + φ•135*(1096)							
Module temperature [°C]		25 ± 2							
Spectral mismatch		N/A							
Test date (dd/mm/yyyy)	Sample no.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	Degra-dation [%]	
28/08/2023	A003527778-024	638.5	45.57	14.01	54.49	14.66	79.9	-0.1	P
28/08/2023	A003527778-025	639.3	45.56	14.03	54.34	14.70	80.0	0.1	
28/08/2023	A003527778-026	637.0	45.45	14.02	54.29	14.67	79.9	-0.2	
28/08/2023	A003527778-027	637.6	45.48	14.02	54.34	14.68	79.9	-0.2	
15/09/2023	A003527778-020	627.0	45.15	13.89	54.18	14.56	79.5	-2.1	
15/09/2023	A003527778-021	625.4	45.16	13.85	54.16	14.49	79.7	-2.2	
06/10/2023	A003527778-016	636.5	45.32	14.05	54.53	14.72	79.3	-0.1	
13/10/2023	A003527778-018	637.8	45.29	14.08	54.47	14.74	79.4	-0.2	
13/10/2023	A003527778-019	636.3	45.42	14.01	54.55	14.72	79.2	-0.5	
14/09/2023	A003527778-022	632.8	45.26	13.98	54.46	14.63	79.4	-1.2	
14/09/2023	A003527778-023	631.2	45.22	13.96	54.41	14.61	79.4	-1.2	

Supplementary information: *Negative* degradation means power *loss*.
The non-illuminated side was covered with non-reflective background and aperture.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.48	**Gate #2 evaluation**		
Reproducibility r for P_{max} [%]		0.09	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max,meas,Gate\ \#1}$ [W]	$P_{max,meas,Gate\ \#1,r}$ [W]	$P_{max,meas,Gate\ \#2}$ [W]	—
A003527777-015	569.5	540.6	566.7	P
A003527777-016	571.8	542.8	567.6	P
A003527777-017	569.9	540.9	566.6	P
A003527777-027	569.9	540.9	566.5	P
A003527777-007	576.2	546.9	568.0	P
A003527777-008	570.8	541.8	568.2	P
A003527777-009	578.2	548.8	561.4	P
A003527777-010	570.0	541.0	566.2	P
A003527777-005	571.3	542.3	567.2	P
A003527777-006	571.1	542.1	567.6	P
A003527777-002	571.6	542.6	570.5	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,Gate\ \#1}$ = Measured initial maximum STC power
$P_{max,meas,Gate\ \#1,r}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account
$P_{max,meas,Gate\ \#2}$ = Measured final maximum STC power

9.48	**Gate #2 evaluation at STC**		
Reproducibility r for P_{max} [%]		0.09	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max,meas,Gate\ \#1}$ [W]	$P_{max,meas,Gate\ \#1,r}$ [W]	$P_{max,meas,Gate\ \#2}$ [W]	—
A003527777-032	571.8	542.7	569.0	P
A003527777-033	570.5	541.5	569.2	P
A003527777-034	571.3	542.2	569.6	P
A003527777-035	570.9	541.9	569.7	P
A003527777-021	570.1	541.1	569.5	P
A003527777-022	571.4	542.3	567.4	P
A003527777-025	569.9	540.9	565.2	P
A003527777-026	570.3	541.2	564.1	P
A003527777-023	569.5	540.5	563.2	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*
A003527777-024	569.4	540.5	562.1	P
A003527777-019	571.2	542.2	570.7	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,Gate\ \#1}$ = Measured initial maximum STC power
$P_{max,meas,Gate\ \#1,r}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account
$P_{max,meas,Gate\ \#2}$ = Measured final maximum STC power

9.48	**Gate #2 evaluation at STC**	
Reproducibility r for P_{max} [%]	0.05	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max,meas,Gate\ \#1}$ [W]	$P_{max,meas,Gate\ \#1,r}$ [W]	$P_{max,meas,Gate\ \#2}$ [W]	—
A003527778-024	584.5	555.0	583.1	P
A003527778-025	584.2	554.8	582.6	P
A003527778-026	583.8	554.4	581.9	P
A003527778-027	584.8	555.3	582.2	P
A003527778-020	585.7	556.2	572.4	P
A003527778-021	584.2	554.8	571.2	P
A003527778-016	582.7	553.3	581.5	P
A003527778-018	583.7	554.3	582.4	P
A003527778-019	584.2	554.8	581.2	P
A003527778-022	586.0	556.4	578.5	P
A003527778-023	584.3	554.9	576.8	P

Supplementary information:
Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.
$P_{max,meas,Gate\ \#1}$ = Measured initial maximum STC power
$P_{max,meas,Gate\ \#1,r}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account
$P_{max,meas,Gate\ \#2}$ = Measured final maximum STC power

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.48	**Gate #2 evaluation at BNPI**	
Reproducibility $r_{(BNPI)}$ for $P_{max(BNPI)}$ [%]	0.27	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ [W]	—
A003527777-015	628.7	595.6	623.2	P
A003527777-016	629.0	595.9	623.7	P
A003527777-017	628.1	595.1	622.9	P
A003527777-027	628.9	595.9	622.7	P
A003527777-007	629.9	596.9	624.2	P
A003527777-008	627.7	594.7	624.4	P
A003527777-009	633.4	600.1	616.5	P
A003527777-010	629.1	596.1	622.0	P
A003527777-005	627.9	594.9	623.0	P
A003527777-006	628.0	595.0	622.6	P
A003527777-002	628.0	595.0	627.7	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.

$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ = Measured initial maximum STC power

$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account

$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ = Measured final maximum STC power

9.48	**Gate #2 evaluation at BNPI**	
Reproducibility $r_{(BNPI)}$ for $P_{max(BNPI)}$ [%]	0.12	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ [W]	—
A003527777-032	628.7	596.6	625.1	P
A003527777-033	628.1	596.0	625.8	P
A003527777-034	628.1	595.9	625.4	P
A003527777-035	627.8	595.7	626.2	P
A003527777-021	628.4	596.3	626.6	P
A003527777-022	628.1	596.0	623.9	P
A003527777-025	629.2	597.1	621.2	P
A003527777-026	628.7	596.6	620.7	P

Absatz	**Photovoltaic (PV) modules**		Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*		*Measuring results - Remarks*	*Result*
A003527777-023	629.2	597.0	619.3	P
A003527777-024	628.9	596.8	617.5	P
A003527777-019	628.4	596.2	627.5	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.

$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ = Measured initial maximum STC power

$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account

$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ = Measured final maximum STC power

9.48	**Gate #2 evaluation at BNPI**	
Reproducibility $r_{(BNPI)}$ for $P_{max(BNPI)}$ [%]	0.14	—

9.48.1	**Evaluation of output power for each module**			
Sample no.	$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ [W]	$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ [W]	—
A003527778-024	638.9	606.1	638.5	P
A003527778-025	638.8	606.0	639.3	P
A003527778-026	638.3	605.6	637.0	P
A003527778-027	639.2	606.4	637.6	P
A003527778-020	640.2	607.3	627.0	P
A003527778-021	639.6	606.7	625.4	P
A003527778-016	637.3	604.6	636.5	P
A003527778-018	638.9	606.1	637.8	P
A003527778-019	639.4	606.5	636.3	P
A003527778-022	640.4	607.5	632.8	P
A003527778-023	639.0	606.3	631.2	P

Supplementary information: Pass criteria follow requirements of section 7.2.1 of IEC/EN 61215-1.

$P_{max(BNPI),meas,Gate\ \#1(BNPI)}$ = Measured initial maximum STC power

$P_{max(BNPI),meas,Gate\ \#1,r(BNPI)}$ = Measured initial maximum STC power taking reproducibility and degradation of 5% into account

$P_{max(BNPI),meas,Gate\ \#2(BNPI)}$ = Measured final maximum STC power

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.49	**Bypass diode functionality test (final) – MQT 18.2 / MST 07**				
Test method	☒ Method A.....☐ Method B				
Test date (dd/mm/yyyy)	Sample no.	Diode 1	Diode 2	Diode 3	
11/12/2023	A003527777-001	working properly	working properly	working properly	P
21/11/2023	A003527777-004	working properly	working properly	working properly	P
13/12/2023	A003527777-005	working properly	working properly	working properly	P
16/10/2023	A003527777-007	working properly	working properly	working properly	P
30/09/2023	A003527777-009	working properly	working properly	working properly	P
03/10/2023	A003527777-028	working properly	working properly	working properly	P
11/12/2023	A003527777-029	working properly	working properly	working properly	P
11/12/2023	A003527777-030	working properly	working properly	working properly	P

Supplementary information:
This test verifies that the sample shows the electrical characteristics of a functional photovoltaic device.

9.49	**Bypass diode functionality test (final) – MQT 18.2 / MST 07**				
Test method	☒ Method A.....☐ Method B				
Test date (dd/mm/yyyy)	Sample no.	Diode 1	Diode 2	Diode 3	
21/11/2023	A003527777-018	working properly	working properly	working properly	P
21/11/2023	A003527777-020	working properly	working properly	working properly	P
18/09/2023	A003527777-025	working properly	working properly	working properly	P
16/10/2023	A003527777-021	working properly	working properly	working properly	P
30/09/2023	A003527777-023	working properly	working properly	working properly	P

Supplementary information:
This test verifies that the sample shows the electrical characteristics of a functional photovoltaic device.

9.49	**Bypass diode functionality test (final) – MQT 18.2 / MST 07**				
Test method	☒ Method A.....☐ Method B				
Test date (dd/mm/yyyy)	Sample no.	Diode 1	Diode 2	Diode 3	
13/10/2023	A003527778-015	working properly	working properly	working properly	P
14/09/2023	A003527778-022	working properly	working properly	working properly	P
13/10/2023	A003527778-018	working properly	working properly	working properly	P
18/10/2023	A003527778-017	working properly	working properly	working properly	P
12/10/2023	A003527778-020	working properly	working properly	working properly	P

Supplementary information:
This test verifies that the sample shows the electrical characteristics of a functional photovoltaic device.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

9.50	**Cut susceptibility test – MST 12 -Not Applicable**		
Applied force [N]	8.9 ± 0.5		
Test date (dd/mm/yyyy)	Sample no.	Test results	
-	A003527777-005	No exposure of active circuitry of module	P
-	A003527777-007	No exposure of active circuitry of module	P
-	A003527777-009	No exposure of active circuitry of module	P
-	A003527777-028	No exposure of active circuitry of module	P
-	A003527777-029	No exposure of active circuitry of module	P
-	A003527777-030	No exposure of active circuitry of module	P
Supplementary information: -Not applicable since submitted module design is glass to glass			

9.51	**Accessibility test (final) – MST 11**			
Applied force [N]	10			
Test date (dd/mm/yyyy	Sample no.	Contact with live electrical part?	R_{iso} [MΩ]	
11/12/2023	A003527777-005	☐ Yes ☒ No	>1	P
13/10/2023	A003527777-007	☐ Yes ☒ No	>1	P
28/09/2023	A003527777-009	☐ Yes ☒ No	>1	P
03/10/2023	A003527777-028	☐ Yes ☒ No	>1	P
08/12/2023	A003527777-029	☐ Yes ☒ No	>1	P
08/12/2023	A003527777-030	☒ Yes ☒ No	>1	P
23/08/2023	A003527777-031	☒ Yes ☒ No	>1	P
Supplementary information: None				

9.52	**Continuity test of equipotential bonding (final) – MST 13**			
Maximum overcurrent protection rating [A]			25	
Current applied [A]			62.50	
Duration of applied current [min]			2	
Location of designated point for equipotential bonding			Long side of the frame	
No. of other conductive parts tested			2	
Test date (dd/mm/yyyy)	Sample no.	Max. measured voltage [mV]	Max. calculated resistance [mΩ]	
11/12/2023	A003527777-005	280.3	4.48	P
13/10/2023	A003527777-007	279.4	4.47	P
28/09/2023	A003527777-009	240.6	3.85	P
03/10/2023	A003527777-028	231.4	3.70	P
08/12/2023	A003527777-029	279.6	4.47	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

08/12/2023	A003527777-030	257.1	4.11	P
23/08/2023	A003527777-031	271.1	4.34	P
Supplementary information: None				

9.54	**Durability of markings – MST 05**		
Duration of rubbing with water [s]		15	
Duration of rubbing with petroleum spirits [s]		15	
Test date (dd/mm/yyyy)	Sample no.	Comments	
11/12/2023	A003527777-001	The marking is legible; the marking plate is not removable and without curling.	P
14/09/2023	A003527777-002	The marking is legible; the marking plate is not removable and without curling.	P
21/11/2023	A003527777-004	The marking is legible; the marking plate is not removable and without curling.	P
13/12/2023	A003527777-005	The marking is legible; the marking plate is not removable and without curling.	P
16/10/2023	A003527777-007	The marking is legible; the marking plate is not removable and without curling.	P
30/09/2023	A003527777-009	The marking is legible; the marking plate is not removable and without curling.	P
03/10/2023	A003527777-028	The marking is legible; the marking plate is not removable and without curling.	P
11/12/2023	A003527777-029	The marking is legible; the marking plate is not removable and without curling.	P
11/12/2023	A003527777-030	The marking is legible; the marking plate is not removable and without curling.	P
Supplementary information: - None			

9.54	**Durability of markings – MST 05**		
Duration of rubbing with water [s]		15	
Duration of rubbing with petroleum spirits [s]		15	
Test date (dd/mm/yyyy)	Sample no.	Comments	
21/11/2023	A003527777-018	The marking is legible; the marking plate is not removable and without curling.	P
14/09/2023	A003527777-019	The marking is legible; the marking plate is not removable and without curling.	P
21/11/2023	A003527777-020	The marking is legible; the marking plate is not removable and without curling.	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

18/09/2023	A003527777-025	The marking is legible; the marking plate is not removable and without curling.	P
16/10/2023	A003527777-021	The marking is legible; the marking plate is not removable and without curling.	P
30/09/2023	A003527777-023	The marking is legible; the marking plate is not removable and without curling.	P
Supplementary information: - None			

9.54	**Durability of markings – MST 05**		
Duration of rubbing with water [s]		15	
Duration of rubbing with petroleum spirits [s]		15	
Test date (dd/mm/yyyy)	Sample no.	Comments	
14/09/2023	A003527778-022	The marking is legible; the marking plate is not removable and without curling.	P
06/10/2023	A003527778-016	The marking is legible; the marking plate is not removable and without curling.	P
18/10/2023	A003527778-017	The marking is legible; the marking plate is not removable and without curling.	P
12/10/2023	A003527778-020	The marking is legible; the marking plate is not removable and without curling.	P
13/10/2023	A003527778-018	The marking is legible; the marking plate is not removable and without curling.	P
13/10/2023	A003527778-015	The marking is legible; the marking plate is not removable and without curling.	P
Supplementary information: - None			

9.55	**Sharp edge test – MST 06**		
Test date (dd/mm/yyyy)	Sample no.	Comments	
11/12/2023	A003527777-001	The accessible PV module surfaces are smooth and free from sharp edges.	P
14/09/2023	A003527777-002	The accessible PV module surfaces are smooth and free from sharp edges.	P
21/11/2023	A003527777-004	The accessible PV module surfaces are smooth and free from sharp edges.	P
13/12/2023	A003527777-005	The accessible PV module surfaces are smooth and free from sharp edges.	P
16/10/2023	A003527777-007	The accessible PV module surfaces are smooth and free from sharp edges.	P
30/09/2023	A003527777-009	The accessible PV module surfaces are smooth and free from sharp edges.	P
03/10/2023	A003527777-028	The accessible PV module surfaces are smooth and free from sharp edges.	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*
11/12/2023	A003527777-029	The accessible PV module surfaces are smooth and free from sharp edges.	P
11/12/2023	A003527777-030	The accessible PV module surfaces are smooth and free from sharp edges.	P
Supplementary information: -None			

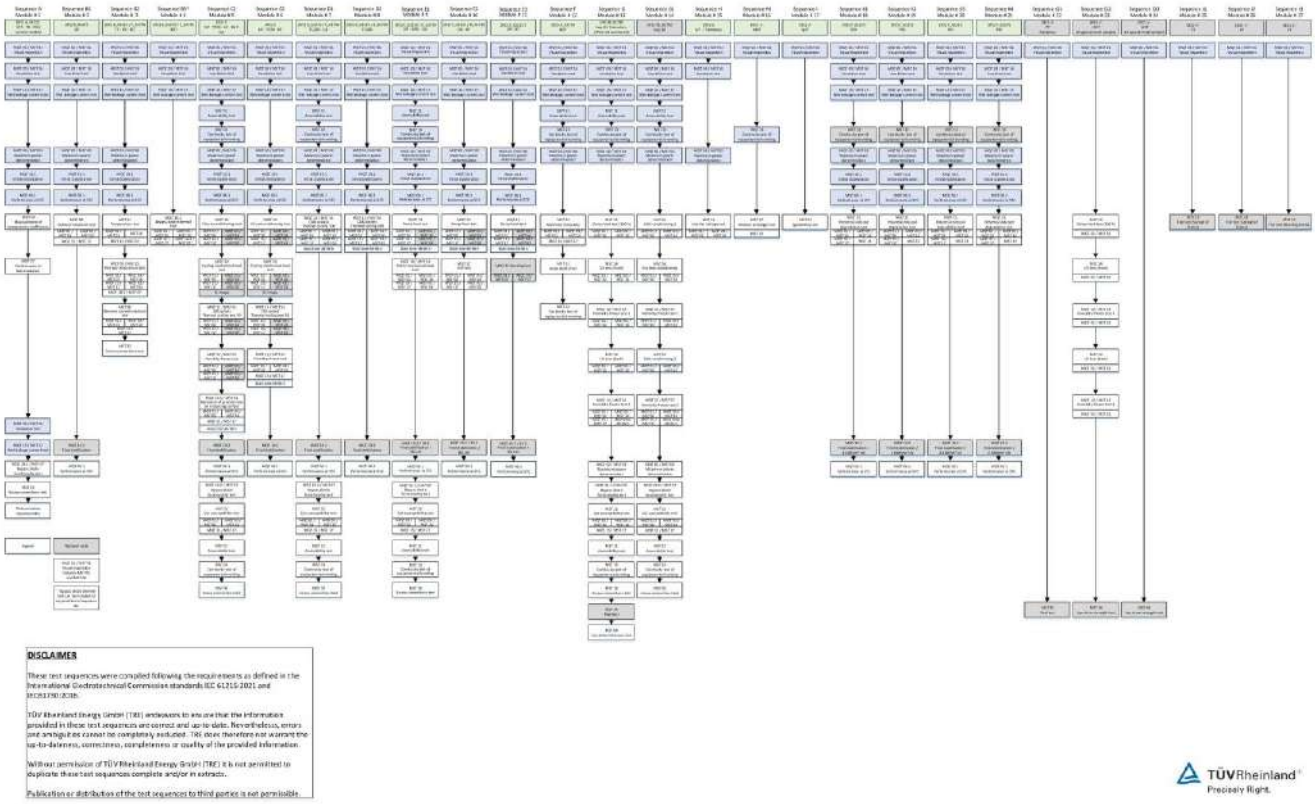
9.55	**Sharp edge test – MST 06**		
Test date (dd/mm/yyyy)	Sample no.	Comments	
21/11/2023	A003527777-018	The accessible PV module surfaces are smooth and free from sharp edges.	P
14/09/2023	A003527777-019	The accessible PV module surfaces are smooth and free from sharp edges.	P
21/11/2023	A003527777-020	The accessible PV module surfaces are smooth and free from sharp edges.	P
18/09/2023	A003527777-025	The accessible PV module surfaces are smooth and free from sharp edges.	P
16/10/2023	A003527777-021	The accessible PV module surfaces are smooth and free from sharp edges.	P
30/09/2023	A003527777-023	The accessible PV module surfaces are smooth and free from sharp edges.	P
Supplementary information: -None			

9.55	**Sharp edge test – MST 06**		
Test date (dd/mm/yyyy)	Sample no.	Comments	
14/09/2023	A003527778-022	The accessible PV module surfaces are smooth and free from sharp edges.	P
06/10/2023	A003527778-016	The accessible PV module surfaces are smooth and free from sharp edges.	P
18/10/2023	A003527778-017	The accessible PV module surfaces are smooth and free from sharp edges.	P
12/10/2023	A003527778-020	The accessible PV module surfaces are smooth and free from sharp edges.	P
13/10/2023	A003527778-018	The accessible PV module surfaces are smooth and free from sharp edges.	P
13/10/2023	A003527778-015	The accessible PV module surfaces are smooth and free from sharp edges.	P
Supplementary information: -None			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Appendix A: Test charts

Acc. to IEC 61215:2021 / CAN/CSA-C22.2 No. 61730:19



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Appendix B: Abbreviations used in the report

STC	Standard Test Conditions
P_{max}	Maximum power
I_{mpp}	Maximum power point current
V_{mpp}	Maximum power point voltage
I_{sc}	Short circuit current
V_{oc}	Open circuit voltage
FF	Fill factor
α	Current temperature coefficient
β	Voltage temperature coefficient
γ	Power temperature coefficient
S	Series connection
SP	Series-parallel connection
PS	Parallel-series connection
R_{iso}	Electrical insulation resistance
A	Module area
BNPI	Bifacial nameplate irradiance
BSI	Bifacial stress irradiance
G_{BNPI}	Equivalent bifacial nameplate irradiance
G_{BSI}	Equivalent bifacial stress irradiance
φ	Bifaciality refers to the ratios between the main I-V characteristics of the rear side and the front side of a bifacial device, typically at Standard Test Conditions (STC) unless otherwise specified. It is quantified with reference to bifaciality coefficients, namely as φ.
φ_{Pmax}	Maximum power bifaciality coefficient
φ_{Voc}	Open-circuit voltage bifaciality coefficient
φ_{Isc}	Short-circuit current bifaciality coefficient

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Subject	**Module type**	**Project no./ Report no.**	**Certificate no./ Declaration on extension**	**Date of issue**
Basic Qualification to CAN/CSA Certification	SOMERA VSMH.75.AAA.05	31985240 004	CA 72203482 01	10/11/2020
Extension Qualification to CAN/CSA Certification with additional poly and mono cells	ELODORA VSP.72.AAA.05 SOMERA VSM.72.AAA.05	31985240 005	CA 72203482 02,03	10/11/2020
Extension Qualification to CAN/CSA Certification with half cut cell modules along with additional components	ELODORA VSP.72.AAA.05 SOMERA VSM.72.AAA.05 ELDORA VSPH.72.AAA.05	31985240 006	CA 72203482 04	11/11/2020
Extension qualification to additional cell, Black Back sheet, Ribbons, frame and JB	SOMERA VSMH.78.AAA.05 SOMERA VSMH.72.AAA.05 SOMERA VSMHBB.78.AAA.05	31985240 007	CA 72203482 05	25/06/2021
Extension qualification to additional Bifacial cells, Front cover, Transparent BS, POE and Cell fixing tape	SOMERA VSMDT.72.AAA.05 SOMERA VSMDHT.72.AAA.05 PREXOS VSMDHT.78.AAA.05 PREXOS VSMDHT.72.AAA.05 PREXOS VSMDHT.60.AAA.05	31985240 008	CA 72203482 06	30/08/2021
Extension qualification to additional cell, ribbons,frame, higher wattage and additional location	SOMERA VSMH.78.AAA.05 SOMERA VSMH.72.AAA.05 SOMERA VSMHBB.72.AAA.05 SOMERA VSMH.60.AAA.05	31985240 009	CA 72203482 07	22/12/2021
Extension qualification additional cell, front cover, Back cover and higher power	PREXOS VSMDHT.72.AAA.05 PREXOS VSMDHT.60.AAA.05	31985240 010	CA 72203482 08	07/12/2021
Extension qualification to additional Glass to Glass Bifacial modules	PARADEA VSMDH.72.AAA.05 PARADEA VSMDH.60.AAA.05	31985240 011	CA 72203482 09	24/05/2022
Extension qualification to PD1, 10% higher wattage inclusion and additional cell with SOMERA series,	SOMERA VSMH.78.AAA.05 SOMERA VSMH.72.AAA.05 SOMERA VSMHBB.72.AAA.05 SOMERA VSMH.60.AAA.05	31985240 012	CA 72203482 10	24/11/2022
Extension qualification to additional 10bb bifacial cell, Back cover,Front cover,EVA, Adhessive and frame profile and PD1 Conversion	PREXOS VSMDHT.54.AAA.05 PARADEA VSMDH.72.AAA.05 PARADEA VSMDH.60.AAA.05	31985240 013	CA 72203482 11	09/03/2023
Extension qualification to additional cell, front cover, Back cover, Junction box, EVA, Adhesive,	SOMERA VSMH.66.AAA.05 SOMERA VSMH.60.AAA.05 SOMERA VSMH.48.AAA.05 SOMERA VSMH.72.AAA.05 SOMERA VSMH.54.AAA.05	31985240 014	CA 72203482 12	08/09/2023

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Appendix D: Reviewed documents

Zertifikat ***Certificate***

TÜVRheinland®

Zertifikat Nr. ***Certificate No.***
R 50415465

Blatt ***Sheet***
0009

Ihr Zeichen ***Client Reference***
Z.S.X.

Unser Zeichen ***Our Reference***
01-LWP-50172934 016

Ausstellungsdatum ***Date of Issue***
08.04.2022 *(day/mo/yr)*

Genehmigungsinhaber ***License Holder***
Zhejiang Renhe Photovoltaic
Technology Co., Ltd.
99#, Jing'er Road, Xinpu Town
Cixi City
315322 Zhejiang
P.R. China

Fertigungsstätte ***Manufacturing Plant***
Zhejiang Renhe Photovoltaic
Technology Co., Ltd.
99#, Jing'er Road, Xinpu Town
Cixi City
315322 Zhejiang
P.R. China

Prüfzeichen ***Test Mark***
TÜVRheinland ZERTIFIZIERT
Bauart geprüft
Sicherheit
Regelmäßige Produktions-überwachung
www.tuv.com
ID 1419061000

Geprüft nach ***Tested acc. to***
IEC 62790:2020
EN IEC 62790:2020

Zertifiziertes Produkt (Geräteidentifikation)
Certified Product ***(Product Identification)***

Lizenzentgelte - Einheit
License Fee - Unit

PV Komponente (elektrisch) für BOS (PV Components for BOS – electrical)

as page 0001

Addition

Type Designation : FT50xy (ZJRH)
(x=7, 8, 9 or A; y=G, H, J or K)

16

Rated Voltage : 1000VDC for FT50xy(y=G or J);
1500VDC for FT50xy(y=H or K)

Rated Current : 20A for FT50xy(x=7);
25A for FT50xy(x=8);
30A for FT50xy(x=9 or A)

16

ANLAGE (Appendix): 1.14

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg
http://www.tuv.com/safety E-mail: markcheck@tuv.com
Fax: +49 221 806-3935

Dipl.-Ing. (FH) Bernd Scherer

TÜV, TÜEV and TÜV are registered trademarks. Utilisation and application requires prior approval.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Zertifikat *Certificate*

TÜVRheinland®

Zertifikat Nr. *Certificate No.*
R 50452023

Blatt *Sheet*
0001

Ihr Zeichen *Client Reference*
Z.S.X.

Unser Zeichen *Our Reference*
01-SYF-15081600 012

Ausstellungsdatum *Date of Issue*
16.01.2020 *(day/mo/yr)*

Genehmigungsinhaber *License Holder*
Zhejiang Renhe Photovoltaic
Technology Co., Ltd.
99#, Jing'er Road, Xinpu Town
Cixi City, Zhejiang 315322
P. R. China

Fertigungsstätte *Manufacturing Plant*
Refer to latest revision
of the annex list of factories

Prüfzeichen *Test Mark*

TÜVRheinland CERTIFIED
Type Approved
Safety
Regular Production
Surveillance
www.tuv.com
ID 1419075270

Geprüft nach *Tested acc. to*
IEC 62930:2017

Zertifiziertes Produkt (Geräteidentifikation)
Certified Product (Product Identification)

Lizenzentgelte - Einheit
License Fee - Unit

Cable (Electric Cables for Photovoltaic Systems)

Type Designation	: 376332	12
Code Designation	: 62930 IEC 131 Renhe	
Additional Marking	: HALOGEN FREE LOW SMOKE	
Scope of Sizes	: 1X1,5...35mm²	
Rated Voltage	: DC 1,5kV	
Max. Storage Temperature	: +45°C	
Min.Temperature for Installation and Handling	: -25°C	
Max.Temperature at Conductor	: 120°C	

12

ANLAGE (Appendix): 1.0

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
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Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH
TÜVRheinland
Zertifizierungsstelle

Bo Liu

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg
Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com
Fax: +49 221 806-3935 http://www.tuv.com/safety

13020 d 04.08 TÜV, TÜEV and TUV are registered trademarks. Utilisation and application requires prior approval.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Zertifikat *Certificate*

TÜVRheinland®

Zertifikat Nr. *Certificate No.*
R 50334688

Blatt *Page*
0001

Ihr Zeichen *Client Reference*	**Unser Zeichen** *Our Reference*	**Ausstellungsdatum**	*Date of Issue*
D.L.J.	01-LXL-15094989 001	27.04.2016	*(day/mo/yr)*

Genehmigungsinhaber *License Holder*
Zhejiang Renhe Photovoltaic
Technology Co., Ltd.
99#, Jing'er Road, Xinpu Town
Cixi City, Zhejiang 315322
P.R. China

Fertigungsstätte *Manufacturing Plant*
Zhejiang Renhe Photovoltaic
Technology Co., Ltd.
99#, Jing'er Road, Xinpu Town
Cixi City, Zhejiang 315322
P.R. China

Prüfzeichen *Test Mark*

TÜVRheinland ZERTIFIZIERT
Bauart geprüft
Sicherheit
Regelmäßige Produktions-überwachung
www.tuv.com
ID 1419033232

Geprüft nach *Tested acc. to*
IEC 62852:2014

Zertifiziertes Produkt (Geräteidentifikation)
Certified Product (Product Identification)

Lizenzentgelte - Einheit
License Fee - Unit

Steckverbinder (Connector for Photovoltaic System)

Type Designation : 05-6 ; 05-8 (ZJRH) 7

Rated Voltage : 1000VDC for 05-6; 1500V for 05-8
Rated Current : 30A
Ambient Temperature : -40°C to +85°C
Upper Limit Temperature: 100°C
Cross Section Range : 1 x 4,0mm² for 05-6 and 05-8
1 x 2,5mm²,1 x 6,0mm² for 05-6
Protection Degree : IP67
Application Class : Class A

Remark: The labelling requirements acc. to EU Directive 2001/95 have to be observed for distribution within the EEA.

7

ANLAGE (Appendix): 1.0

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH Zertifizierungsstelle

Dipl.-Ing. (FH) Bernd Scheirer

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg
Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com
Fax: +49 221 806-3935 http://www.tuv.com/safety

18020 d 04.08 ® TÜV, TÜEV and TÜV are registered trademarks. Utilisation and application requires prior approval.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

JTPV 捷泰科技

N182CG16D1

N-型TOPCon

N 型电池领跑者

产品特点

无光致衰减
光致衰减为"0"

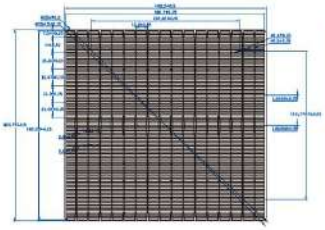
抗PID
优越的抗PID性能

封损低
封损更低，更适合高效组件

温度系数低
功率温度系数低至-0.30%/K

弱光响应强
200W/m²弱光下相对转换效率≥97%

高转换效率
正面效率≥26%，双面率≥80%

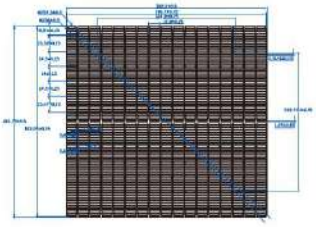


温度系数

电流温度系数	0.045%/K
功率温度系数	-0.30%/K
电压温度系数	-0.25%/K

产品特征

产品型号	182单晶双面电池(N182CG16D1)
尺寸规格	182.2mmx183.75mm±0.5mm，Φ256mm±0.5mm
电池厚度	130μm±13μm
正面	16主栅，正12段，172栅，主栅宽度0.036±0.02mm
背面	16主栅，背12段，200栅，主栅宽度0.036±0.02mm



品质管控

±0.1% 效率公差

效率测试的准确性控制在±0.1%
电性能、外观、EL 100%全自动检验
校准片溯源到Fraunhofer ISE

www.jietaisolar.cn

捷泰科技营销中心
江苏省苏州市苏州协鑫广场27F
marketing@jietaisolar.cn

电池片规格书_12_2023_V2.0

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

JTPV

N182CG16D1

N-type TOPCon

The Pioneer of N-type Solar Cell

Product Characteristics

LID
Lower LID

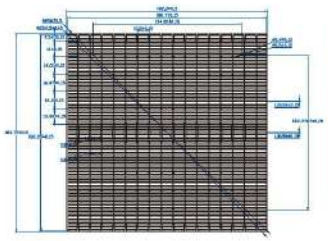
PID Resistance
Superior anti-PID performance

Lower CTM Loss
Lower Cell to Module (CTM) Loss Rate, more suitable for high-efficiency module

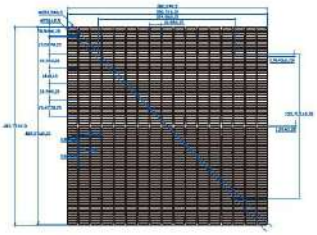
Lower Power Temperature Coefficient
Temperature coefficient of Power as low as -0.30%/ K

Better Performance In Low Irradiance Environment
Relative conversion efficiency≥97% under low light (200W/m²)

High Conversion Efficiency
Front efficiency≥26% , Bifacial rate ≥80%



Temperature Coefficients	
TkCurrent	0.045%/K
TkPower	- 0.30%/K
TkVoltage	- 0.25%/K



Mechanical Characteristics

Model	182 mono-crystalline Bifacial solar cell (N182CG16D1)
Dimension	182.2mmX183.75mm±0.5mm, Φ 256mm±0.5mm
Thickness	130μm±13μm
Front	16 busbars
Back	16 busbars

www.jietaisolar.com

Marketing Center of Jietai Solar
27F, GCL Plaza, Suzhou, Jiangsu Province, China.
marketing@jietaisolar.com

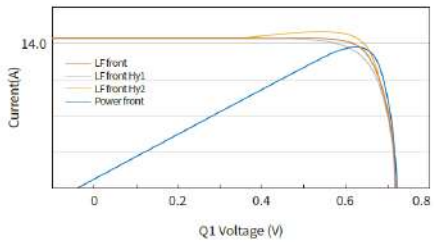
Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Electrical Characteristics

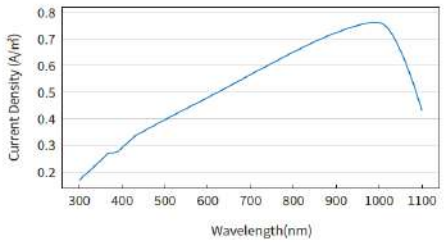
Efficiency(%)	Power Pmpp(W)	Max.Power Current Impp(A)	Short Circuit Current Isc(A)	Max.Power Voltage Vmpp(V)	Open Circuit Voltage Voc(V)
>25.5	8.54	13.280	13.924	0.6427	0.7227
25.4~25.5	8.50	13.264	13.894	0.6410	0.7204
25.3~25.4	8.47	13.246	13.924	0.6393	0.7210
25.2~25.3	8.43	13.241	13.900	0.6370	0.7176
25.1~25.2	8.40	13.252	13.900	0.6339	0.7153
25.0~25.1	8.37	13.237	13.900	0.6322	0.7139
24.9~25.0	8.33	13.256	13.884	0.6289	0.7095
24.8~24.9	8.30	13.227	13.897	0.6281	0.7132
24.7~24.8	8.27	13.223	13.885	0.6260	0.7103
24.6~24.7	8.23	13.197	13.867	0.6250	0.7083
24.5~24.6	8.20	13.231	13.897	0.6211	0.7041
24.4~24.5	8.17	13.201	13.884	0.6203	0.7084
24.3~24.4	8.13	13.209	13.902	0.6177	0.7019
24.2~24.3	8.10	13.196	13.863	0.6161	0.6997
24.1~24.2	8.07	13.199	13.867	0.6137	0.6974
24.0~24.1	8.03	13.243	13.927	0.6094	0.6932
23.9~24.0	8.00	12.868	13.916	0.6250	0.7210

* Standard Test Condition (STC): 1000W/ m², AM 1.5G, 25°C /Solar Cell Efficiency Positive Tolerance / Specifications and data for reference only

IV Curve



Spectral Response



SHANGRAO JIETAI NEW ENERGY TECHNOLOGY CO., LTD.
No.8, Xingye Avenue, Shangrao Economic and Technological Development Zone, Jiangxi Province, China.

CHUZHOU JIETAI NEW ENERGY TECHNOLOGY CO., LTD.
No.18 Wenshan Road, Economic Development Zone, Chahe Town, An County, Chuzhou City, Anhui Province, China.

HUAI'AN JIETAI NEW ENERGY TECHNOLOGY CO., LTD.
No.8 Yingbin Avenue, Lianshui County, Huai'an City, Jiangsu Province, China.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Electrical Performance

Grade	Unit	24.80	24.70	24.60	24.50	24.40	24.30	24.20	24.10	24.00
Voc	V	0.712	0.711	0.711	0.711	0.710	0.710	0.710	0.709	0.708
Isc	A	13.907	13.905	13.903	13.902	13.899	13.899	13.898	13.897	13.896
Vmpp	V	0.608	0.606	0.605	0.603	0.601	0.600	0.598	0.596	0.595
Impp	A	13.469	13.450	13.431	13.415	13.395	13.376	13.363	13.350	13.328
Pmpp	W	8.19	8.15	8.12	8.09	8.05	8.02	7.99	7.95	7.93
Efficiency	%	24.8	24.7	24.6	24.5	24.4	24.3	24.2	24.1	24.0

Standard Test Conditions: 1000W/m2, AM1.5,25 °C

Temperature Coefficient

TkPower	-(0.39±0.02) %/k
TkVoltage	-(0.33±0.03) %/k
TkCurrent	+(0.06±0.015) %/k

Physical Charaacteristics

Substrate material	N-type mono-crystalline silicon wafer-TOPCon
Cell thickness	140μm±14μm
Dimension	182mm*182mm±0.5mm
Diagonal	247mm±0.5mm
Front (-)	16*0.036mm±0.02mm bus bars (silver) 132 lines, Silicon oxide + bule silicon nitride compound anti-reflection coating(PID Free)
Back (+)	16*0.036mm±0.02mm bus bars (silver) 142 lines, Blue silicon nitride compound anti-reflection coating

Light induced degradation test

Using Xenon lamp (Irradiance of 1000W/m2,with spectrum AM 1.5) to irradiate test cells, after a total irradiation of 5 kwh/m2 ,the degradation of maximum output power of cells is ≤2%

CTM

Lower cell to module(CTM) power loss:<3%

Anti-PID

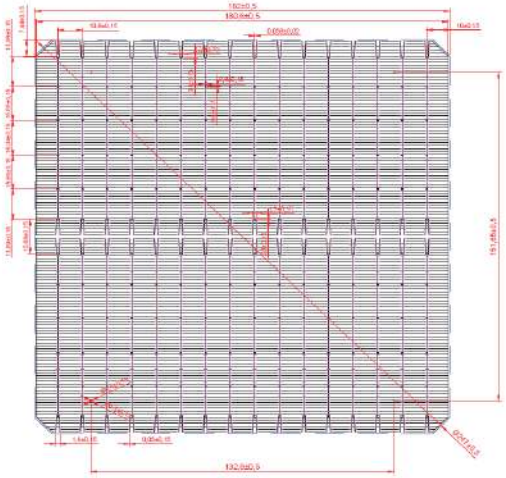
Potential Induced Degradation(-1500V,192h):<5%

Packaging, Storage

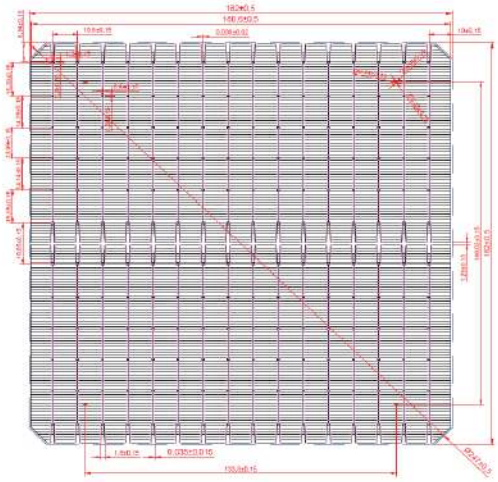
Solar cells are closely packed with soft sponge around and heat shrink is used around the box unit. Outer packing box must have shock buffer, to be suitable for long-distance delivery.
After packaging, cells should be stored indoors in the conditions of good ventilation, dry, humidity below 60%, and temperature ≤40 °C . Cells should be sampling inspected again if the storage time over 45 days

Product Appearance

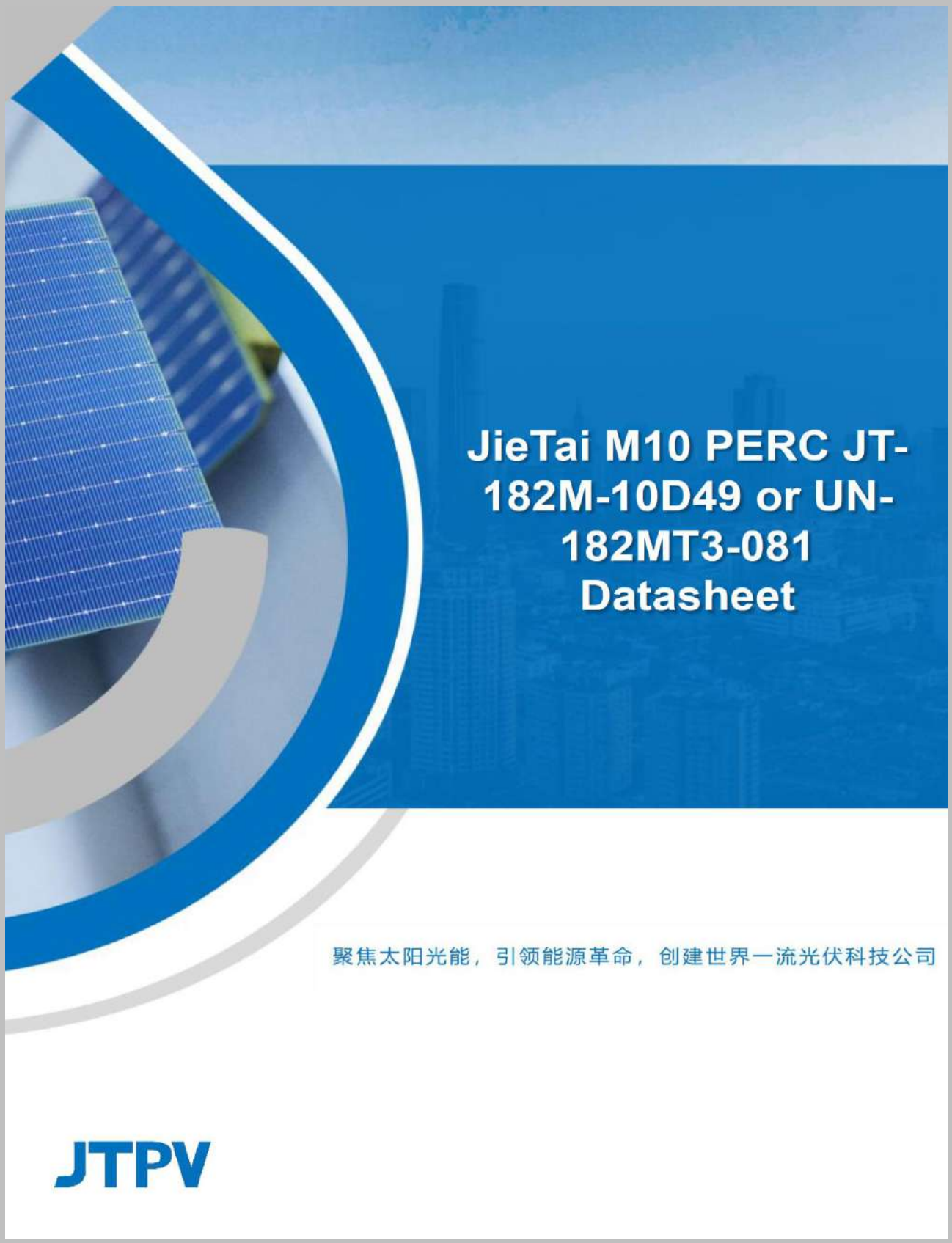
Front



Back



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Product characteristics

- High conversion efficiency, front efficiency≥23.6%
- Bifacial rate≥70%
- Superior anti-PID performance
- Half-piece design internal friction reduction by 1/4
- Multiple bus bars effectively reduce the power loss
- Lower Cell to Module (CTM) Loss Rate, more suitable for high-efficiency module

Temperature Coefficients

- TkCurrent:0.07%/K
- TkVoltage:-0.36%/K
- TkPower:-0.36%/K

Quality Control

- The accuracy of the efficiency test is controlled within ±0.1%
- Electrical performance, appearance, EL 100% automatic inspection

Geometry characteristics

Model	182 mono-crystalline Bifacial solar cell（JT-182M-10D49 or UN-182MT3-081）
Geometry	182mmx182mm±0.5mm， Φ 247mm±0.5mm
Thickness	175μm±17.5μm
Front	10 busbars, 14 pads, 170 fingers, busbar width 1.2±0.3mm
Back	10 busbars, 12 pads, 180 fingers, PAD width 1.5±0.3mm

JTPV

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

F•RST

Version 1.5
Rev: 2020-11-15

1. Introduction

F•RST® EP304 & EP308 products are a type of EVA and POE co-extruded encapsulant film. EP-series product provides a high cost-effective encapsulant solution for the PID-free requirement of P type or N type bifacial PV modules, which could withstand 192h PID test at the test condition of 85℃, RH 85%, -1500Vdc. Besides, EP-series film also exhibits excellent durability.

The material and structure of EP-series product is as below:

EVA
POE
EVA

The main characteristics of F•RST® EP304 & EP308 film are as follows:

1) Excellent long-term PID resistance ;
2) Excellent durability, such as weather resistance, high-temperature and high-humidity resistance, UV light resistance;
3) Excellent adhesion to glass, metal and polymer backsheet, maintaining long term adhesion.
4) Good light transmittance and transparency;
5) Good manoeuvrability during lamination process, no slipping issue.

2. Category

F•RST® EP304 & EP308 products have below popular category:

Type	EP304		EP308	
Gram weight & Tolerance	(430±20) g/m²	(560±20) g/m²	(390±20) g/m²	(560±20) g/m²
Thickness & Tolerance	0.50±0.05mm [a]	0.65±0.05mm [a]	0.50±0.05mm [a]	0.65±0.05mm [a]
Length per roll	130m / 350m	110m / 290m	150m / 390m	110m / 290m
Width tolerance	(0/+7) mm	(0/+7) mm	(0/+7) mm	(0/+7) mm

Notes: The above specification values can be adjusted for customization.

[a]: 0.50mm and 0.65mm are the name of general thickness specifications, the final apparent thickness should be determined by the embossed pattern.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

FIRST

Version 1.5
Rev: 2020-11-15

3. Technical specification

Properties		Test Method	Units	Technical Index	
				EP304	EP308
Optical					
Transmittance	1100nm-380nm	GB/T 29848-2018	%	≥90.5	≥90.5
	380nm-290nm	GB/T 29848-2018	%	≥80	≤30
Physical					
Gel content ※		GB/T 29848-2018	Gel%	≥80	≥80
Electrical					
Volume Resistivity		IEC62788-1-2	Ω•cm	$\geq 1.0\times10^{15}$	$\geq 1.0\times10^{15}$
Dielectric Strength		GB/T 29848-2018	kV/mm	≥25.0	≥25.0
Mechanical					
Strength of Peeling from Glass		GB/T 29848-2018	N/cm	≥60	>60
Strength of Peeling from Backsheet		GB/T 29848-2018	N/cm	≥40	>40
Shrinkage Rate					
MD		GB/T 29848-2018	%	≤3.0	≤3.0
TD		GB/T 29848-2018	%	≤2.0	≤2.0
PID Resistance					
Power Loss of PV Modules [1]		IEC62804 [2]	%	≤5.0	≤5.0
Durability					
UV Light Resistance (60kWh/m²)		GB/T 29848-2018	△YI	<5.0	<5.0
Heat/Humidity Resistance (DH1000h)		GB/T 29848-2018	△YI	<5.0	<5.0

Notes:
[1]: The P type or N type bifacial PV modules are encapsulated by EP304/EP308 film.
[2]: Test condition: 85°C, 85%RH, -1500V, 192h.
- GB: Standardization of P. R. China

※ **NOTE: When preparing gel content samples, the sample preparation structure should be stacked according to the BOM of the actual PV modules.**

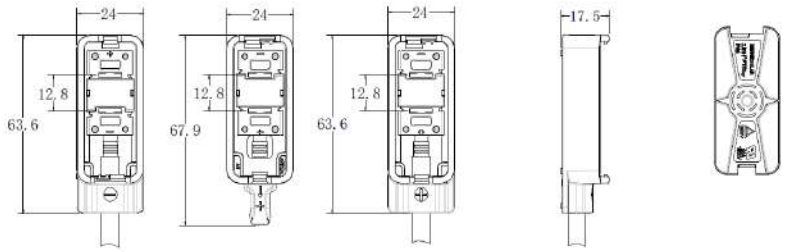
For example: when EP304 film is used in a glass-glass module, if the front layer film is EVA, and the rear layer film is EP304, the sample preparation structure shall be Glass / release film / EVA / release film / EP304 / release film / glass. After lamination, the gel content of the rear layer EP304 film shall be tested.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

浙江人和光伏科技有限公司
ZHEJIANG RENHE PHOTOVOLTAIC TECHNOLOGY CO.,LTD.

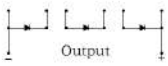
地 址：中国浙江省慈溪市新浦镇经二路99号
ADD.: 99#, Jing'er Road, Xinpu Town, Cixi City, Zhejiang, China 电话/TEL:+86-574-63578128 传真/FAX:+86-574-63573858

FT50xy Basic Technical Data/基本技术参数



Certifications/认证	TUV	TUV SUD	UL
Certificate No./证书号码	R 50516081	B 0738440014	E312261
Rated Voltage/额定电压	1000V &1500V DC		
Temperature Range/温度范围	-40℃~+85℃		
Safety Class/安全等级	Class II		
Protection Degree/保护等级	IP65/IP68(1m,1h)		
Wire Size Range/线缆尺寸范围	4mm²		
Flame Resistance/阻燃等级	V-0,5VA		
Waterproofing Structure/防水结构	Potting sealant/灌封胶		
Volume Of Silicon Gel/灌胶量	Appr. 3*7.5=22.5mll		
Width Of Copper Ribbons/焊带宽度	Up to 8.0 mm		
Connection Method/连接方式	Soldering/焊接		
Insulation Material/绝缘材料	PPE+PS		
Contact Material/接触材料	Copper tin plating/铜镀锡		
Overall Dimension/外形尺寸	24*63.6*17.5mm(positive、negative) ; 24*67.9*17.5mm (middle)		
Optional Connector/可选连接器	1000V:05-6,05-8,MC4,H4,UTX,EVO2,PV4-S1,RHC2xyzu 1500V:05-8,UTX,EVO2,PV4-S1,RHC2xyzu		1000V:05-6,05-8,MC4,H4,UTX,EVO2,PV4-S1,RHC2xyzB 1500V: 05-8,MC4,H4,UTX,EVO2,PV4-S1,RHC2xyzC

Product Family/产品族

Product number 产品型号	Typical Circuit 典型电路	Distance between the terminals 端子间距	No. of diode 二极管数量	Rated current 额定电流	Diode type 二极管型号	Certifications 认证
FT50xy		12.8+4.7mm	3	20A	MK3045	TUV
				25A	MK4045	
				30A	MK5045	
					XND38-V30P	
				35A	MK6045	
				20A	MK3045	UL
				20A&35A	MK4045 MK5045 XND38-V30P MK6045	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

ARBITAL Solutions

Product Data Sheet : ARSOL-313 Flux

DESCRIPTION

ARSOL- 313 is a Halogen, Rosin and Halide Free No clean flux, with fine wetting properties, used for both Pb free and Sn/Pb applications. Designed to meet the pull strength requirements in PV Module assembly process.
ARSOL-313 is a Low solid, solvent based, low pollution high reliability flux, it provides excellent solder joints with uniform tack free, colour less residues.
It can use in manual, dip or spray applications as a tabbing and stringing application.

FEATURES AND BENEFITS

- Complies with Halogen free standards, which is environment friendly.
- Tack-free residues.
- Excellent Peel Strength.
- Fast wetting.
- High reliability.
- Defect-free soldering
- Can be applied by spray or dipping application methods.
- Low pollution material.

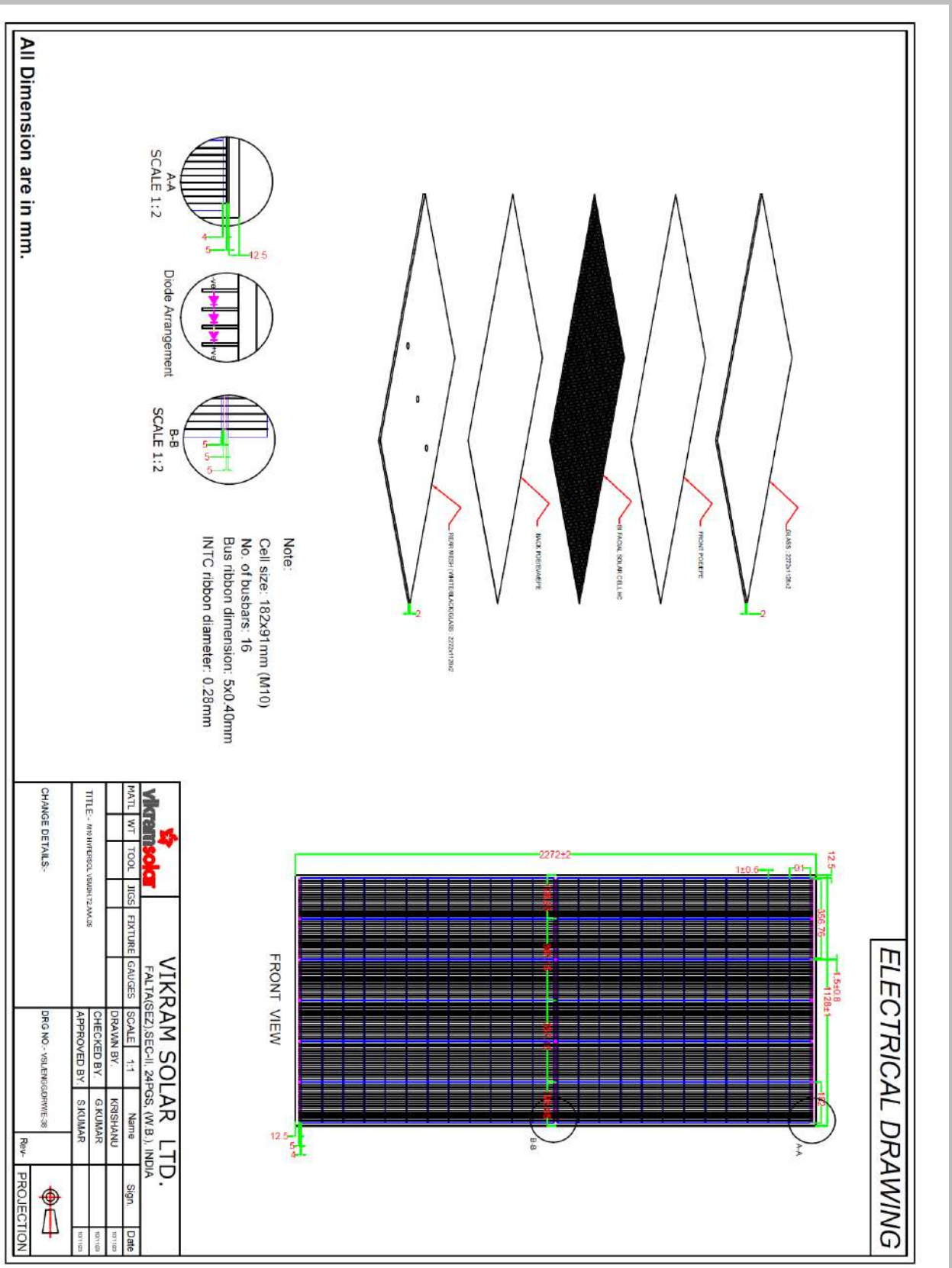
PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear, Clear colourless liquid.
Acid number mg KOH/g:	20 +/- 2 %
IPC-J-STD-0004 Designation:	ORL0
Flash point:	17°C
Solids Content, wt/wt	1.8% +/- 0.2 %
Specific gravity @ 25°C:	0.795 +/- 0.02
Halogen Class:	Meets Halogen Class IEC 61249-2-21 and JEDEC requirements.
Reliability :	Meets IPC, JIS for corrosion and copper mirror tests, Bellcore Surface Insulation Resistance and Electro migration requirements.
Shelf Life :	18 months

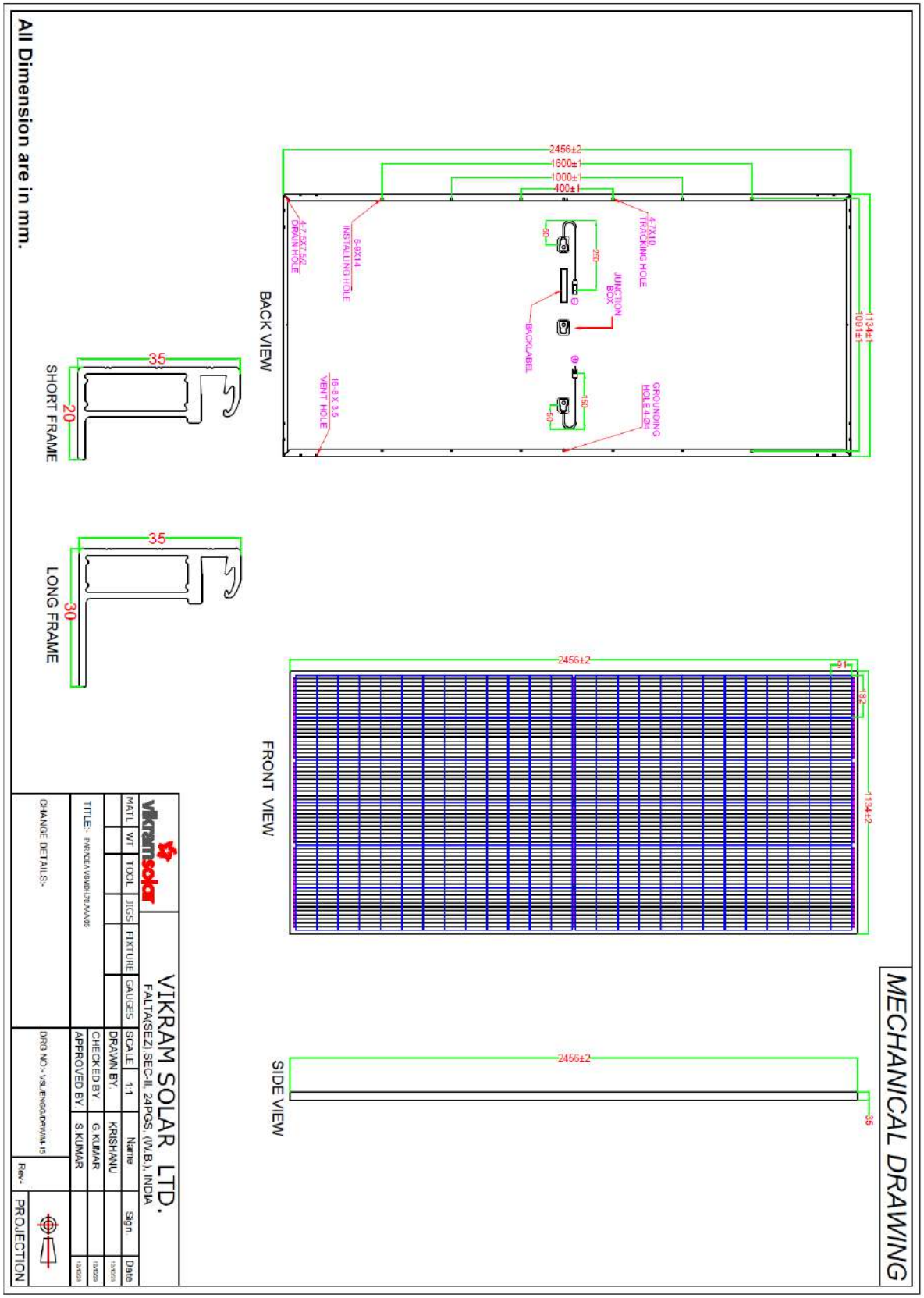
RESIDUE REMOVAL:

ARSOL-313 Flux is a no-clean, flux residues are designed to be left on the board.
If desired, Flux residues can be removed with water Based cleaner AS Aqua Clean-7, Solvent based cleaners Biosol G-10, Biosol G-25 cleaner or EG grade IPA.

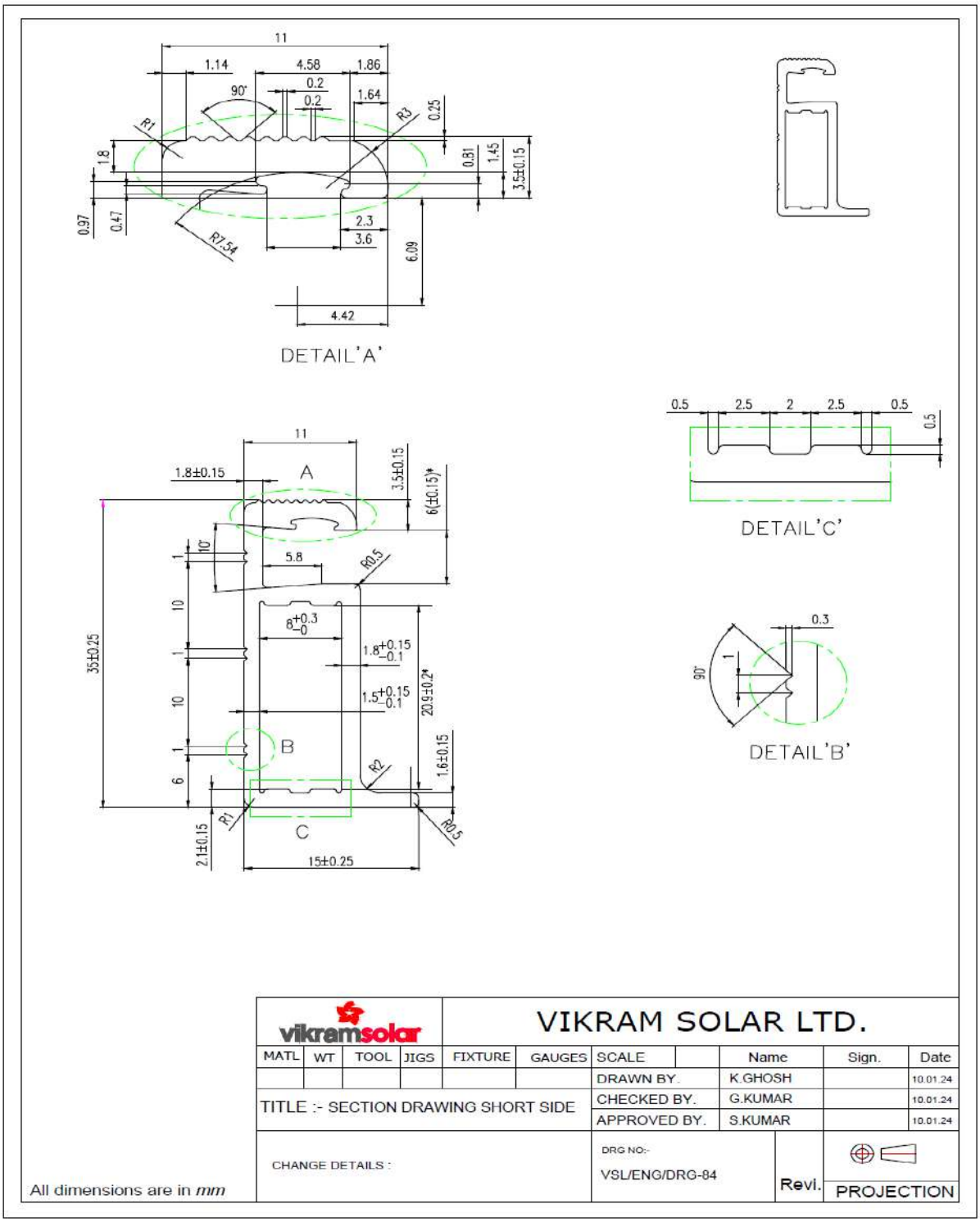
Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*



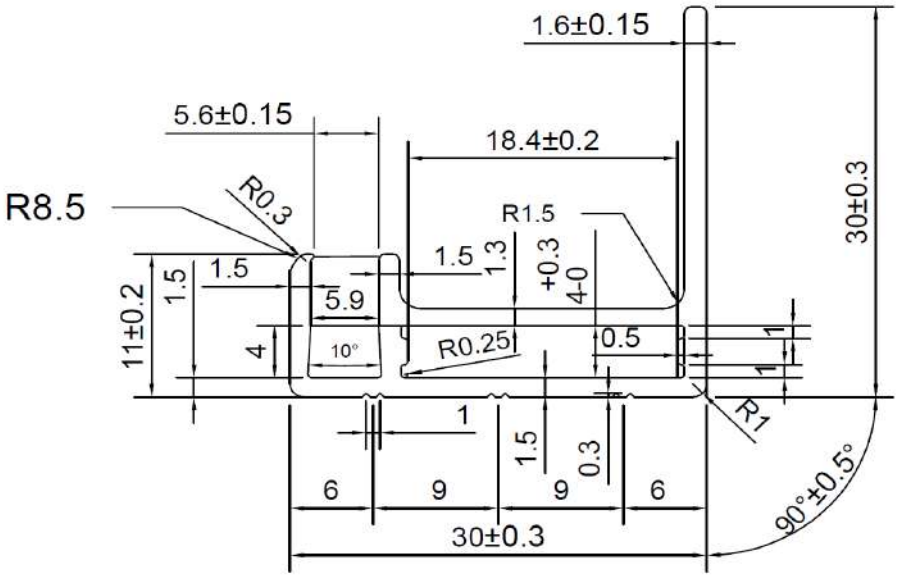
Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*



Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Ergebnis
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Result*

CORNER CONNECTION



NOTE:

1. **Anodic oxidation film thickness AA15 microns**
2. **UNSPEC thickness ±0.15**
3. **Angle NO specified R0.5**
4. **Executive standard: GB5237-2017 high precision grade**

vikramsolar	VIKRAM SOLAR LTD.								
MATL	WT	TOOL	JIGS	FIXTURE	GAUGES	SCALE		Name	Sign.	Date
						DRAWN BY.		SK SAMIM		20.11.2021
TITLE :- SECTION DRAWING M10 M12 G TO G MODULE						CHECKED BY.		G.KUMAR		20.11.2021
						APPROVED BY.		M. DAS		20.11.2021
CHANGE DETAILS :						DRG NO:- VSL/ENG/DRG-		Revi.	PROJECTION	

All dimensions are in *mm*.

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Appendix F: Photos - HYPERSOL VSMDH. 72.575.05

Fig. 1: front view of test sample

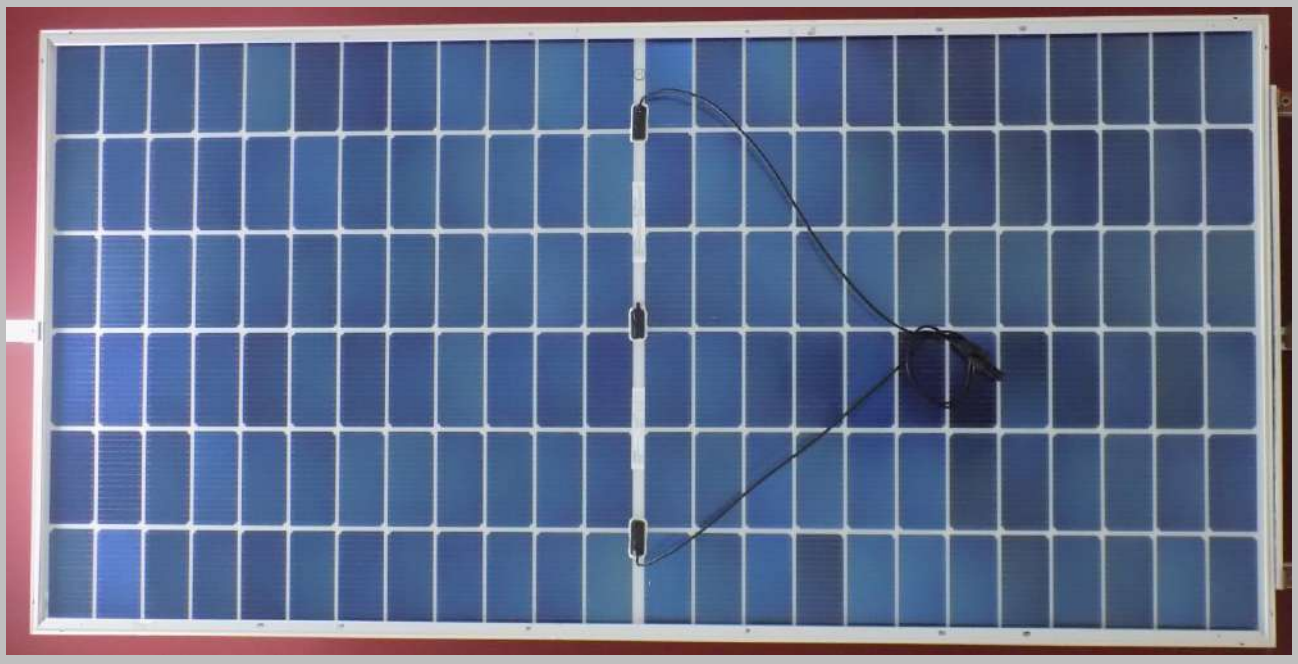


Fig. 2: rear view of test sample

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

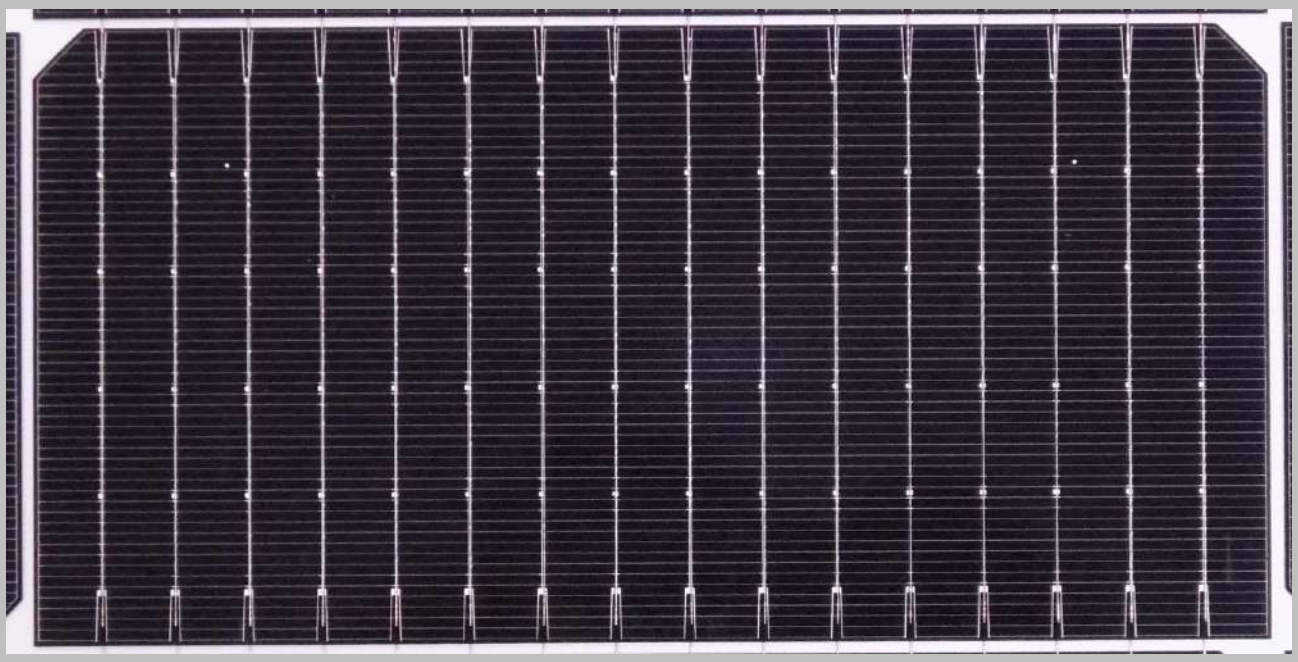


Fig.3: detail view of solar cell

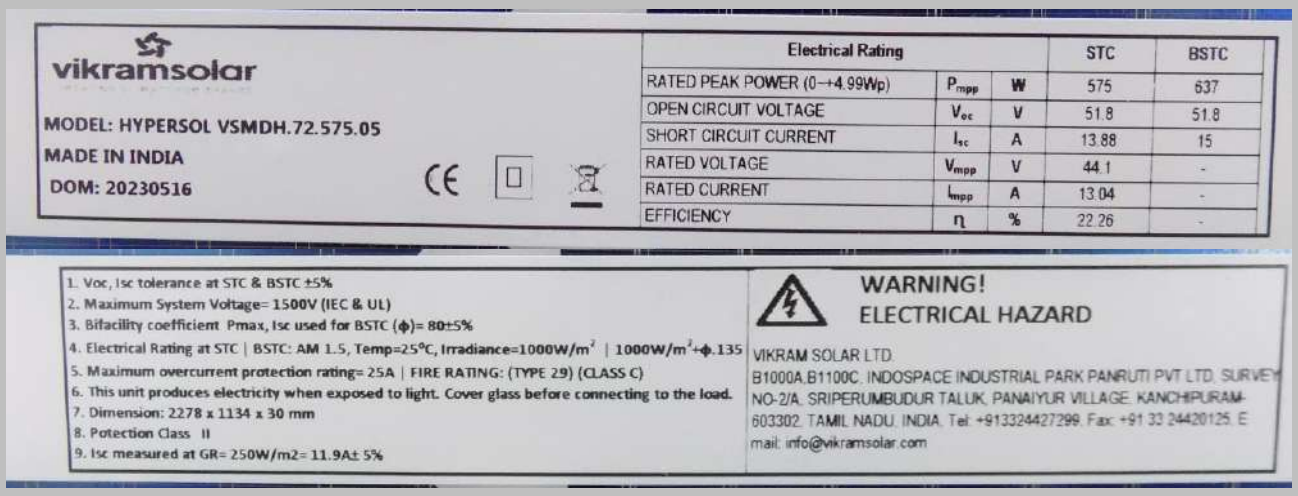


Fig.4: detail view of type label –Initial Visual Inspection

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Fig.5: detail view of open junction box

Fig.6: detail view of closed junction box

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Fig.7: detail view of connector

Fig.8: detail view of cable

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

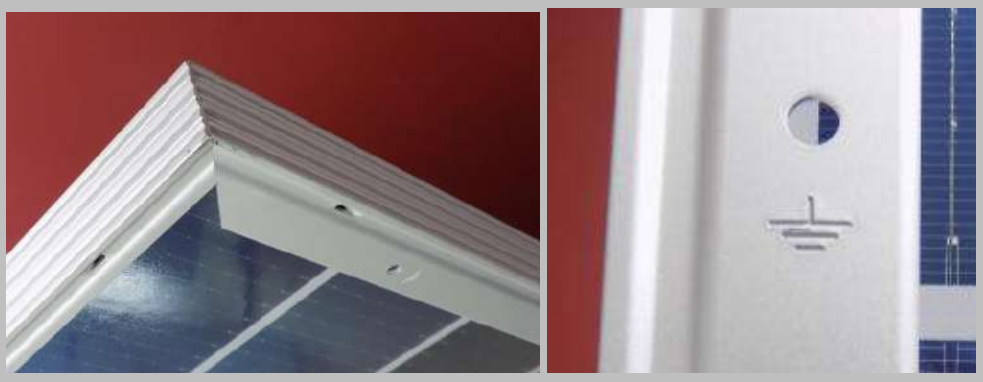
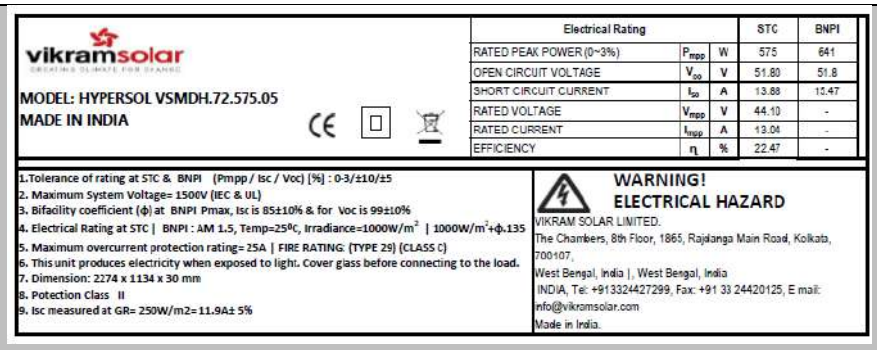


Fig.9: detail view of equipotential bonding hole along with Frame profile

Fig.10: detail view of serial number inside laminate

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION



vikramsolar

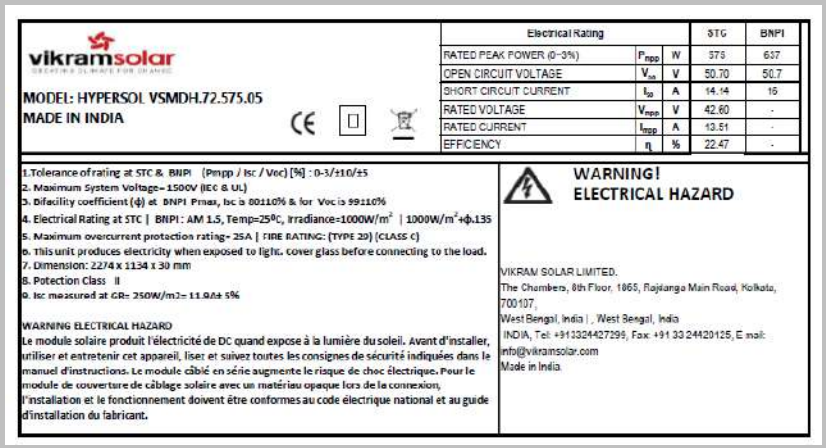
MODEL: HYPERSOL VSMDH.72.575.05
MADE IN INDIA

Electrical Rating			STC	BNPI
RATED PEAK POWER (0~3%)	P_{mpp}	W	575	641
OPEN CIRCUIT VOLTAGE	V_{oc}	V	51.80	51.8
SHORT CIRCUIT CURRENT	I_{sc}	A	13.88	15.47
RATED VOLTAGE	V_{mpp}	V	44.10	-
RATED CURRENT	I_{mpp}	A	13.04	-
EFFICIENCY	η	%	22.47	-

1.Tolerance of rating at STC & BNPI (Pmpp / Isc / Voc) [%] : 0-3/±10/±5
2. Maximum System Voltage= 1500V (IEC & UL)
3. Bifacility coefficient (ϕ) at BNPI Pmax, Isc is 85±10% & for Voc is 99±10%
4. Electrical Rating at STC | BNPI : AM 1.5, Temp=25°C, Irradiance=1000W/m² | 1000W/m²+ϕ.135
5. Maximum overcurrent protection rating= 25A | FIRE RATING: (TYPE 29) (CLASS C)
6. This unit produces electricity when exposed to light. Cover glass before connecting to the load.
7. Dimension: 2274 x 1134 x 30 mm
8. Potection Class II
9. Isc measured at GR= 250W/m2= 11.9A± 5%

WARNING!
ELECTRICAL HAZARD

VIKRAM SOLAR LIMITED.
The Chambers, 8th Floor, 1865, Rajdanga Main Road, Kolkata, 700107,
West Bengal, India |, West Bengal, India
INDIA, Tel: +913324427299, Fax: +91 33 24420125, E mail: info@vikramsolar.com
Made in India.



vikramsolar

MODEL: HYPERSOL VSMDH.72.575.05
MADE IN INDIA

Electrical Rating			STC	BNPI
RATED PEAK POWER (0~3%)	P_{mpp}	W	575	637
OPEN CIRCUIT VOLTAGE	V_{oc}	V	50.70	50.7
SHORT CIRCUIT CURRENT	I_{sc}	A	14.14	15
RATED VOLTAGE	V_{mpp}	V	42.60	-
RATED CURRENT	I_{mpp}	A	13.51	-
EFFICIENCY	η	%	22.47	-

1.Tolerance of rating at STC & BNPI (Pmpp / Isc / Voc) [%] : 0-3/±10/±5
2. Maximum System Voltage= 1500V (IEC & UL)
3. Bifacility coefficient (ϕ) at BNPI Pmax, Isc is 80±10% & for Voc is 99±10%
4. Electrical Rating at STC | BNPI : AM 1.5, Temp=25°C, Irradiance=1000W/m² | 1000W/m²+ϕ.135
5. Maximum overcurrent protection rating= 25A | FIRE RATING: (TYPE 29) (CLASS C)
6. This unit produces electricity when exposed to light. Cover glass before connecting to the load.
7. Dimension: 2274 x 1134 x 30 mm
8. Potection Class II
9. Isc measured at GR= 250W/m2= 11.9A± 5%

WARNING ELECTRICAL HAZARD
Le module solaire produit l'électricité de DC quand expose à la lumière du soleil. Avant d'installer, utiliser et entretenir cet appareil, lisez et suivez toutes les consignes de sécurité indiquées dans le manuel d'instructions. Le module câblé en série augmente le risque de choc électrique. Pour le module de couverture de câblage solaire avec un matériau opaque lors de la connexion, l'installation et le fonctionnement doivent être conformes au code électrique national et au guide d'installation du fabricant.

WARNING!
ELECTRICAL HAZARD

VIKRAM SOLAR LIMITED.
The Chambers, 8th Floor, 1865, Rajdanga Main Road, Kolkata, 700107,
West Bengal, India |, West Bengal, India
INDIA, Tel: +913324427299, Fax: +91 33 24420125, E mail: info@vikramsolar.com
Made in India.

Fig.11: detail view of type label along with bilingual type label with safety information in French language –final updated

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Appendix F: Photos – PARADEA VSMDH.78.590.05

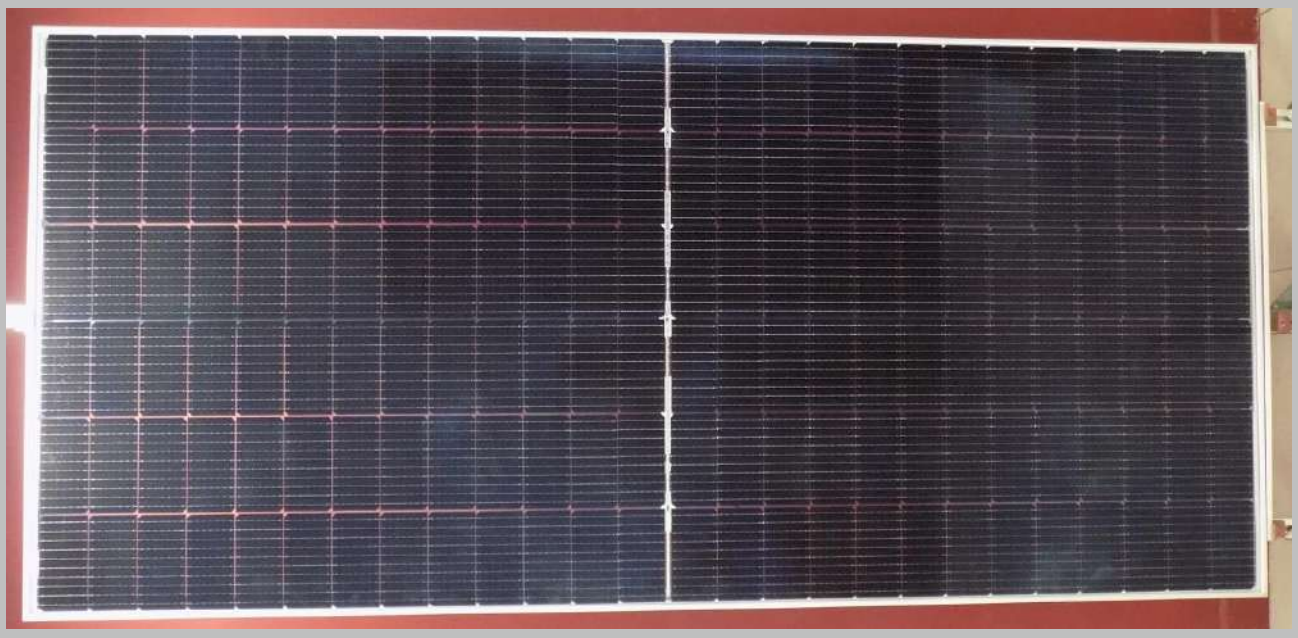


Fig. 12: front view of test sample

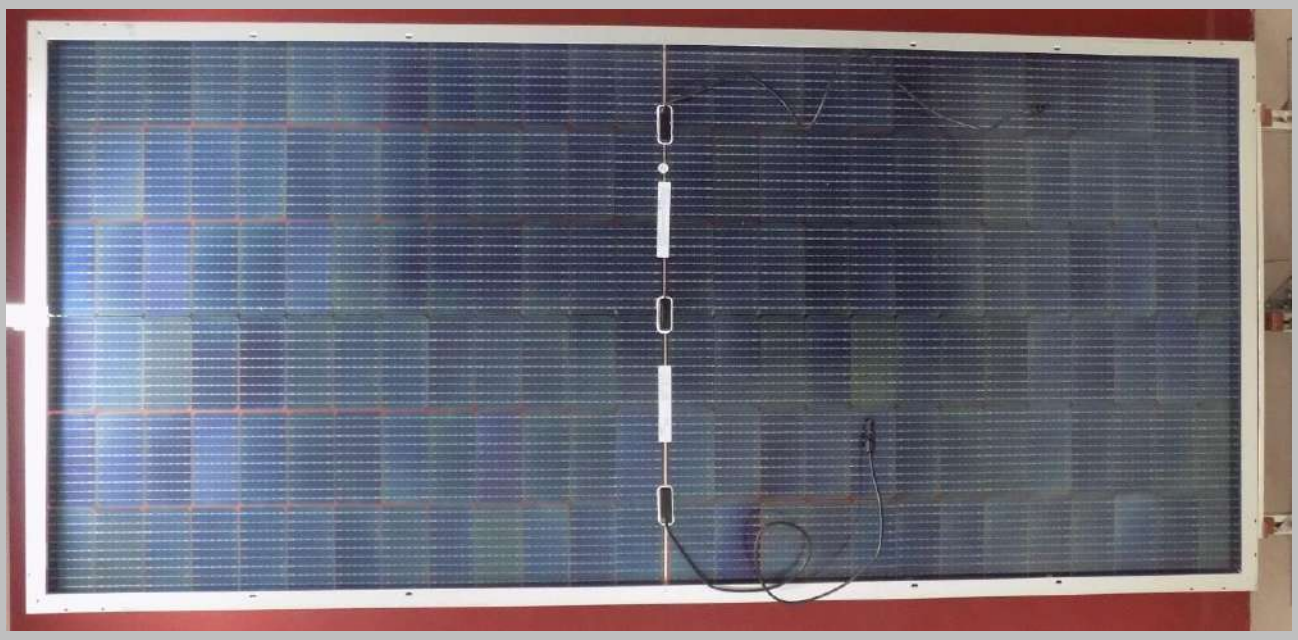


Fig. 13: rear view of test sample

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

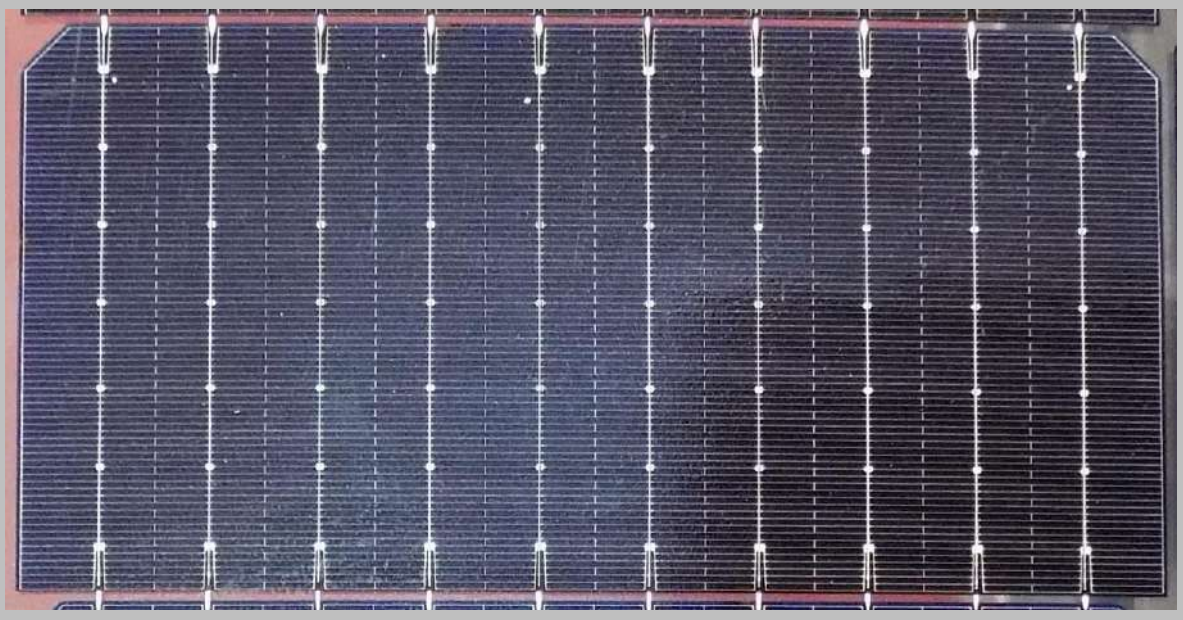


Fig.14: detail view of solar cell

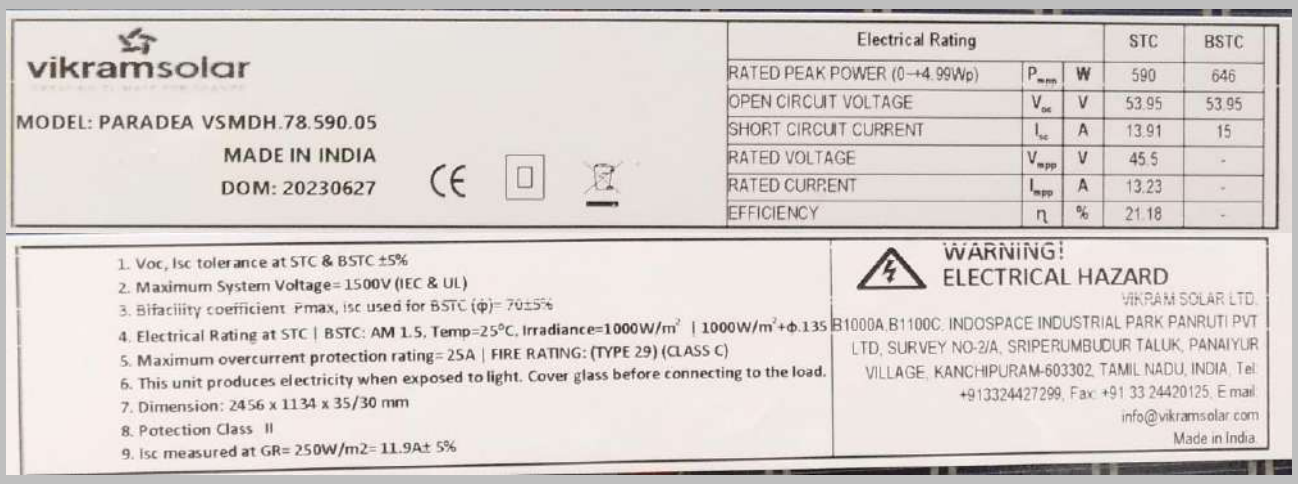


Fig.15: detail view of type label –Initial Visual Inspection

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Fig.16: detail view of closed junction box

Fig.17: detail view of open junction box

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Fig.18: detail view of connector

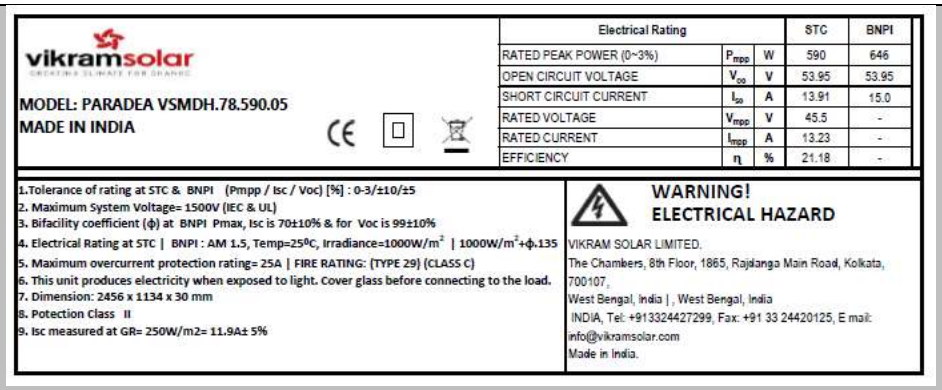
Fig.19: detail view of cable

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION

Fig.20: detail view of equipotential bonding hole along with Frame profile

Fig.21: detail view of serial number inside laminate

FOTO-DOKUMENTATION
PHOTO DOCUMENTATION



vikramsolar

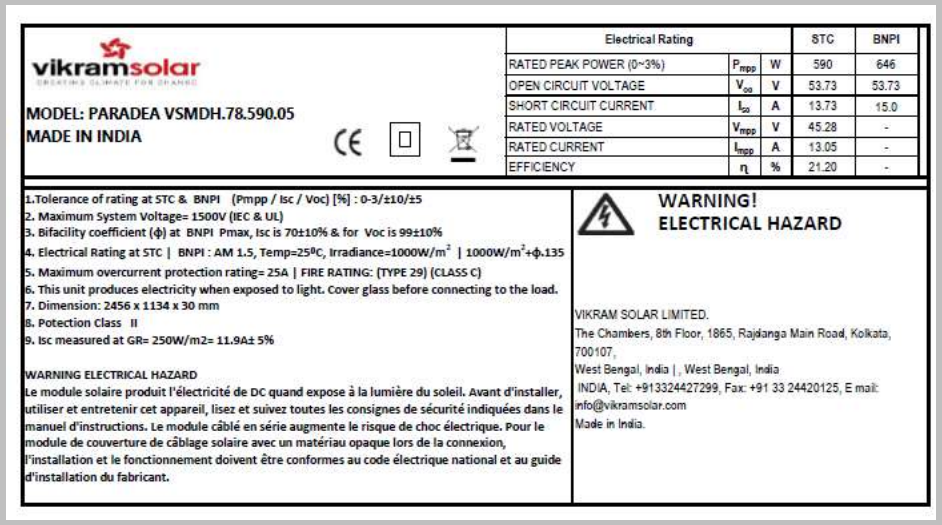
MODEL: PARADEA VSMDH.78.590.05
MADE IN INDIA

Electrical Rating			STC	BNPI
RATED PEAK POWER (0~3%)	P_{mpp}	W	590	646
OPEN CIRCUIT VOLTAGE	V_{oc}	V	53.95	53.95
SHORT CIRCUIT CURRENT	I_{sc}	A	13.91	15.0
RATED VOLTAGE	V_{mpp}	V	45.5	-
RATED CURRENT	I_{mpp}	A	13.23	-
EFFICIENCY	η	%	21.18	-

1.Tolerance of rating at STC & BNPI (Pmpp / Isc / Voc) [%] : 0-3/±10/±5
2. Maximum System Voltage= 1500V (IEC & UL)
3. Bifacility coefficient (ϕ) at BNPI Pmax, Isc is 70±10% & for Voc is 99±10%
4. Electrical Rating at STC | BNPI : AM 1.5, Temp=25⁰C, Irradiance=1000W/m² | 1000W/m²+ϕ.135
5. Maximum overcurrent protection rating= 25A | FIRE RATING: (TYPE 29) (CLASS C)
6. This unit produces electricity when exposed to light. Cover glass before connecting to the load.
7. Dimension: 2456 x 1134 x 30 mm
8. Potection Class II
9. Isc measured at GR= 250W/m2= 11.9A± 5%

WARNING!
ELECTRICAL HAZARD

VIKRAM SOLAR LIMITED.
The Chambers, 8th Floor, 1865, Rajdanga Main Road, Kolkata, 700107,
West Bengal, India | , West Bengal, India
INDIA, Tel: +913324427299, Fax: +91 33 24420125, E mail: info@vikramsolar.com
Made in India.



vikramsolar

MODEL: PARADEA VSMDH.78.590.05
MADE IN INDIA

Electrical Rating			STC	BNPI
RATED PEAK POWER (0~3%)	P_{mpp}	W	590	646
OPEN CIRCUIT VOLTAGE	V_{oc}	V	53.73	53.73
SHORT CIRCUIT CURRENT	I_{sc}	A	13.73	15.0
RATED VOLTAGE	V_{mpp}	V	45.28	-
RATED CURRENT	I_{mpp}	A	13.05	-
EFFICIENCY	η	%	21.20	-

1.Tolerance of rating at STC & BNPI (Pmpp / Isc / Voc) [%] : 0-3/±10/±5
2. Maximum System Voltage= 1500V (IEC & UL)
3. Bifacility coefficient (ϕ) at BNPI Pmax, Isc is 70±10% & for Voc is 99±10%
4. Electrical Rating at STC | BNPI : AM 1.5, Temp=25⁰C, Irradiance=1000W/m² | 1000W/m²+ϕ.135
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8. Potection Class II
9. Isc measured at GR= 250W/m2= 11.9A± 5%

WARNING ELECTRICAL HAZARD
Le module solaire produit l'électricité de DC quand expose à la lumière du soleil. Avant d'installer, utiliser et entretenir cet appareil, lisez et suivez toutes les consignes de sécurité indiquées dans le manuel d'instructions. Le module câblé en série augmente le risque de choc électrique. Pour le module de couverture de câblage solaire avec un matériau opaque lors de la connexion, l'installation et le fonctionnement doivent être conformes au code électrique national et au guide d'installation du fabricant.

WARNING!
ELECTRICAL HAZARD

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Fig.22: detail view of type label along with bilingual type label with safety information in French language –final updated

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