Test Report issued under the responsibility of:

NCB TÜV SÜD Product Service GmbH
Ridlerstr. 65
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Germany

TEST REPORT

IEC 61215-series:2016

Terrestrial photovoltaic (PV) modules – Design qualification and type approval

Report Number. ..... :	704062409002-01 part 1 of 2
Date of issue ..... :	2024-09-03
Total number of pages ..... :	51
TÜV SÜD Branch ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Applicant's name ..... :	Jiangsu X-Solar Green-Building Technology Co., Ltd.
Address ..... :	No.502 Shenxin Road, ShengangStreet, 214400 Jiangyin City, PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard ..... :	☒ IEC 61215-1:2016 ☒ IEC 61215-2:2016 ☒ IEC 61215-1-1:2016 ☐ IEC 61215-1-2:2016 ☐ IEC 61215-1-3:2016 ☐ IEC 61215-1-4:2016
Test procedure ..... :	TÜV SÜD Mark
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC61215D_SE
Test Report Form(s) Originator .... :	TÜV SÜD Product Service GmbH
Master TRF ..... :	2017-11-30

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Test item description ..... :	Photovoltaic (PV) Module(s)
Trade Mark ..... :	兴晟能源 X-SOLAR ENERGY
Manufacturer ..... :	Jiangsu X-Solar Green-Building Technology Co., Ltd. No.502 Shenxin Road, ShengangStreet, 214400 Jiangyin City, PEOPLE'S REPUBLIC OF CHINA
Model/Type reference ..... :	See page 7~10 of this report
Ratings ..... :	See page 7~10 of this report

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

☒	**TÜV SÜD Branch:**	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch	
Location/address .....:		No. 151 Heng Tong Road, Shanghai 200070, P. R. China	
☒	**Associated Testing Laboratory:**	National Energy Testing Research Institute (Tianjin) Co.,Ltd.	
Testing location/address.....:		No.5, Jianfu Industrial Park, Xiqing Economic Development Zone,Tianjin,China	
Tested by (name + signature) .....:		Meng Wang	Meng Wang
Approved by (name + signature).....:		Yang Xu	Xu Yang
☐	**Testing procedure: TMP/CTF Stage 1:**		
Testing location/address.....:			
Tested by (name + signature) .....:			
Approved by (name + signature).....:			
☐	**Testing procedure: WMT/CTF Stage 2:**		
Testing location/address.....:			
Tested by (name + signature) .....:			
Witnessed by (name + signature).....:			
Approved by (name + signature).....:			
☐	**Testing procedure: SMT/CTF Stage 3 or 4:**		
Testing location/address.....:			
Tested by (name + signature) .....:			
Witnessed by (name + signature).....:			
Approved by (name + signature).....:			
Supervised by (name + signature) .....:			

List of Attachments (including a total number of pages in each attachment):	
	attachment number / number of pages
Installation manual	Attachment 1, total pages 29
Drawings mechanical	see report no.: 704062409002-01 part 2 Annex 2
Circuit diagram	see report no.: 704062409002-01 part 2 Annex 2
Photographs	Attachment 2, total pages 3
Component datasheets / certificates	/
Others:	
Product Description Sheet (Manufacturers and type references)	Annex 1, _3_ pages
Test table for verifying other stabilization procedure	Annex 2, _/_ pages
Lower and higher output power modules	Annex 3, _ 2 _ pages
List of test equipment used	Annex 4, _/_ pages

Summary of testing:	
Tests performed (name of test and test clause): Based on the project 704062409002-00, modification to electrical circuitry and add new module model XSFM-xxx-T2. According to clause 4.2.8 of IEC TS 62915:2018, the following tests were carried out on representative model XSFM-560-T2. Hot spot endurance test (MQT 09) Higher end power class tests are performed on model XSFM-590-T2. Lower end power class tests are performed on model XSFM-540-T2. The test samples can cover the following models: 144 cells module XSFM-xxx-T2 (xxx=540 to 590, in steps of 10) 132 cells module XSFM-xxx-T2 (xxx=500 to 530, in steps of 10) 120 cells module XSFM-xxx-T2 (xxx=450 to 490, in steps of 10) 108 cells module XSFM-xxx-T2 (xxx=410 to 440, in steps of 10) 96 cells module XSFM-xxx-T2 (xxx=360 to 390, in steps of 10) 84 cells module XSFM-xxx-T2 (xxx=320 to 340, in steps of 10)	**Testing location:** National Energy Testing Research Institute (Tianjin) Co.,Ltd. No.5, Jianfu Industrial Park, Xiqing Economic Development Zone,Tianjin,China

72 cells module XSFM-xxx-T2 (xxx=270 to 290, in steps of 10) 60 cells module XSFM-xxx-T2 (xxx=230 to 240, in steps of 10) 48 cells module XSFM-xxx-T2 (xxx=180 to 190, in steps of 10) 36 cells module XSFM-xxx-T2 (xxx=130 to 140, in steps of 10) 24 cells module XSFM-xxx-T2 (xxx=90 to 100, in steps of 10) xxx stands for rated output power at STC.	

Summary of compliance with National Differences (List of countries addressed):

N/A

☐ **The product fulfils the requirements of (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☒ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

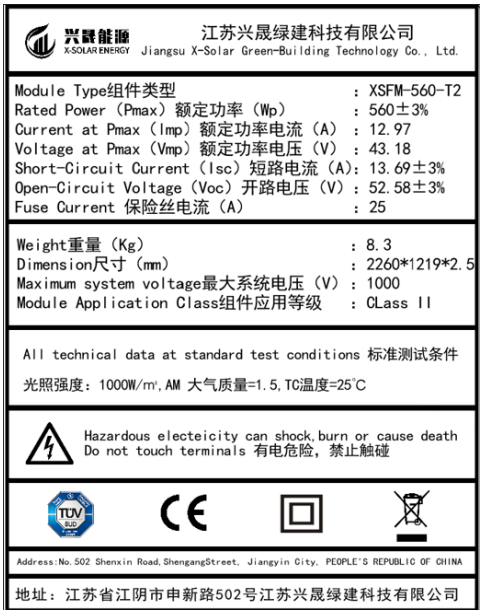
<<Evaluation procedure of measurement uncertainty>>, CITC/CX-12-2019, 2019-11-01.

Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

☐ **Statement not required by the standard used for type testing**

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



(Note: The marking plate represents all models covered by this report except for difference in electrical ratings and model designation. See “General product information” for electrical ratings for all models. As there will be other lower wattages to be covered under same report which follows same back label format.)

Test item particulars..... :	See test flow
Accessories and detachable parts included in the evaluation..... :	N/A
Mounting system used..... :	Refer to user manual
Other options included..... :	N/A
Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Abbreviations used in the report:	
Pmax – Maximum power	HF – Humidity Freeze
Vmp – Maximum power voltage	DH – Damp Heat
Imp – Maximum power current	TC – Thermal Cycling
Isc – Short circuit current	α – Current temperature coefficient
Voc – Open circuit voltage	β – Voltage temperature coefficient
FF – Fill factor	δ – power temperature coefficient
STC – Standard Test Conditions (25°C, 1 000 W/m²)	NMOT – Nominal Module Operating Temperature (20°C, 800 W/m²)
MQT – Module Quality Tests	$V_{FMrated}$ – Rated diode(s) forward voltage
VFM – Measured diode(s) forward voltage	NP – Nameplate
m_1 – the measurement uncertainty in % of laboratory for Pmax	m_2 – the measurement uncertainty in % of laboratory for Voc
m_3 – the measurement uncertainty in % of laboratory for Isc	t_1 – the manufacturer's rated lower production tolerance in % for Pmax
t_2 – the manufacturer's rated upper production tolerance in % for Voc	t_3– the manufacturer's rated upper production tolerance in % for Isc
r – Pmax measurement reproducibility	
Testing Dates (YYYY-MM-DD)	
Date of first test item received..... :	2024-07-17
Dates of tests (beginning/end)..... :	2024-07-18/2024-08-01

GENERAL REMARKS:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **This TRF has been created in cooperation with CTL ETF-9 and German National Committee (DKE).** **The originator's responsibility of this TRF in IECEE CB Scheme has been assigned to TÜV SÜD Product Service GmbH.** Throughout this report a ☐ comma / ☒ point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a TÜV SÜD Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the samples submitted for evaluation are representative of the products from each factory has been provided..... :	☐ Yes ☒ Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory ..... :	Jiangsu X-Solar Green-Building Technology Co., Ltd. No.502 Shenxin Road, ShengangStreet, 214400 Jiangyin City, PEOPLE'S REPUBLIC OF CHINA Customer No.: 124365

PRODUCT ELECTRICAL RATINGS:

Module type	XSFM-540-T2	XSFM-550-T2	XSFM-560-T2	XSFM-570-T2
Voc [V] /Tolerance(±3%)	51.98	52.32	52.58	52.77
Isc [Adc] /Tolerance(±3%)	13.58	13.65	13.69	13.78
Vmp [V]	42.23	42.63	43.18	43.68
Imp [Adc]	12.79	12.91	12.97	13.05
Pmp [W] /Tolerance(±3%)	540	550	560	570
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-580-T2	XSFM-590-T2	XSFM-500-T2	XSFM-510-T2
Voc [V] /Tolerance(±3%)	53.03	53.24	47.94	48.18
Isc [Adc] /Tolerance(±3%)	13.86	13.92	13.68	13.81
Vmp [V]	44.19	44.67	38.67	39.08
Imp [Adc]	13.13	13.21	12.93	13.06
Pmp [W]	580	590	500	510

/Tolerance(±3%)				
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-520-T2	XSFM-530-T2	XSFM-450-T2	XSFM-460-T2
Voc [V] /Tolerance(±3%)	48.42	48.66	43.61	43.81
Isc [Adc] /Tolerance(±3%)	13.87	13.97	13.52	13.67
Vmp [V]	39.58	40.04	35.24	35.56
Imp [Adc]	13.14	13.24	12.77	12.94
Pmp [W] /Tolerance(±3%)	520	530	450	460
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-470-T2	XSFM-480-T2	XSFM-490-T2	XSFM-410-T2
Voc [V] /Tolerance(±3%)	44.04	44.22	44.34	39.24
Isc [Adc] /Tolerance(±3%)	13.79	13.91	14.01	13.54
Vmp [V]	35.97	36.39	36.79	32.03
Imp [Adc]	13.07	13.20	13.32	12.81
Pmp [W] /Tolerance(±3%)	470	480	490	410
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-420-T2	XSFM-430-T2	XSFM-440-T2	XSFM-360-T2
Voc [V] /Tolerance(±3%)	39.42	39.58	39.74	34.88
Isc [Adc] /Tolerance(±3%)	13.69	13.84	13.98	13.66
Vmp [V]	32.38	32.76	33.12	27.85
Imp [Adc]	12.98	13.13	13.29	12.93
Pmp [W] /Tolerance(±3%)	420	430	440	360
Maximum system voltage [V]	1000	1000	1000	1000

Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-370-T2	XSFM-380-T2	XSFM-390-T2	XSFM-320-T2
Voc [V] /Tolerance(±3%)	35.01	35.13	35.24	28.47
Isc [Adc] /Tolerance(±3%)	13.77	13.83	13.91	13.59
Vmp [V]	28.34	28.92	29.48	24.87
Imp [Adc]	13.06	13.14	13.23	12.87
Pmp [W] /Tolerance(±3%)	370	380	390	320
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-330-T2	XSFM-340-T2	XSFM-270-T2	XSFM-280-T2
Voc [V] /Tolerance(±3%)	29.01	29.52	26.16	26.32
Isc [Adc] /Tolerance(±3%)	13.72	13.83	13.71	13.77
Vmp [V]	25.38	25.88	20.91	21.48
Imp [Adc]	13.01	13.14	12.92	13.04
Pmp [W] /Tolerance(±3%)	330	340	270	280
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-290-T2	XSFM-230-T2	XSFM-240-T2	XSFM-180-T2
Voc [V] /Tolerance(±3%)	26.46	21.95	22.08	17.45
Isc [Adc] /Tolerance(±3%)	13.85	13.55	13.76	13.72
Vmp [V]	22.09	17.93	18.39	13.93
Imp [Adc]	13.13	12.83	13.06	12.93
Pmp [W] /Tolerance(±3%)	290	230	240	180
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-190-T2	XSFM-130-T2	XSFM-140-T2	XSFM-90-T2

Voc [V] /Tolerance(±3%)	17.59	13.08	13.22	8.73
Isc [Adc] /Tolerance(±3%)	13.79	13.23	13.58	13.68
Vmp [V]	14.54	10.45	10.88	6.99
Imp [Adc]	13.07	12.45	12.87	12.89
Pmp [W] /Tolerance(±3%)	190	130	140	90
Maximum system voltage [V]	1000	1000	1000	1000
Maximum Over-Current Protection Rating [A]	25	25	25	25
Module type	XSFM-100-T2			
Voc [V] /Tolerance(±3%)	8.87			
Isc [Adc] /Tolerance(±3%)	13.89			
Vmp [V]	7.59			
Imp [Adc]	13.19			
Pmp [W] /Tolerance(±3%)	100			
Maximum system voltage [V]	1000			
Maximum Over-Current Protection Rating [A]	25			
Note: Further qualification for higher and/or lower output power see annex 3				

GENERAL PRODUCT INFORMATION AND OTHER REMARKS:

Modifications:

☐ Initial module design qualification

☒ Extension of module design qualification

☒ Original test report ref. No. .....: 704062409002-00

Model differences and modification:

☒ Test programs for crystalline silicon PV modules

- ☐ 4.2.1 Modification to frontsheet
- ☐ 4.2.2 Modification to encapsulation system
- ☐ 4.2.3 Modification to cell technology
- ☐ 4.2.4 Modification to cell and string interconnect material or technique
- ☐ 4.2.5 Modification to backsheet
- ☐ 4.2.6 Modification to electrical termination
- ☐ 4.2.7 Modification to bypass diode
- ☒ 4.2.8 Modification to electrical circuitry
- ☐ 4.2.9 Modification to edge sealing
- ☐ 4.2.10 Modification to frame and/or mounting structure
- ☐ 4.2.11 Change in PV module size
- ☐ 4.2.12 Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process
- ☐ 4.2.13 Increase of over-current protection rating
- ☐ 4.2.14 Increase of system voltage
- ☐ 4.2.15 Change in cell fixing tape
- ☒ Others (See summary of testing)

☐ Test programs for thin-film PV modules

- ☐ 4.3.1 Modification to frontsheet
- ☐ 4.3.2 Modification to encapsulation system
- ☐ 4.3.3 Modification to front contact (e. g. TCO)
- ☐ 4.3.4 Modification to cell technology
- ☐ 4.3.5 Modification to cell layout
- ☐ 4.3.6 Modification to back contact
- ☐ 4.3.7 Modification to edge deletion
- ☐ 4.3.8 Modification to interconnect material or technique
- ☐ 4.3.9 Modification to backsheet
- ☐ 4.3.10 Modification to electrical termination
- ☐ 4.3.11 Modification to bypass diode
- ☐ 4.3.12 Modification to edge sealing
- ☐ 4.3.13 Modification to frame and/or mounting structure
- ☐ 4.3.14 Change in PV module size
- ☐ 4.3.15 Higher or lower output power (by 10 % or more) with the identical design and size
- ☐ 4.3.16 Increase of over-current protection rating
- ☐ 4.3.17 Increase of system voltage

Note: The clause references modifications extracted from IEC 62915

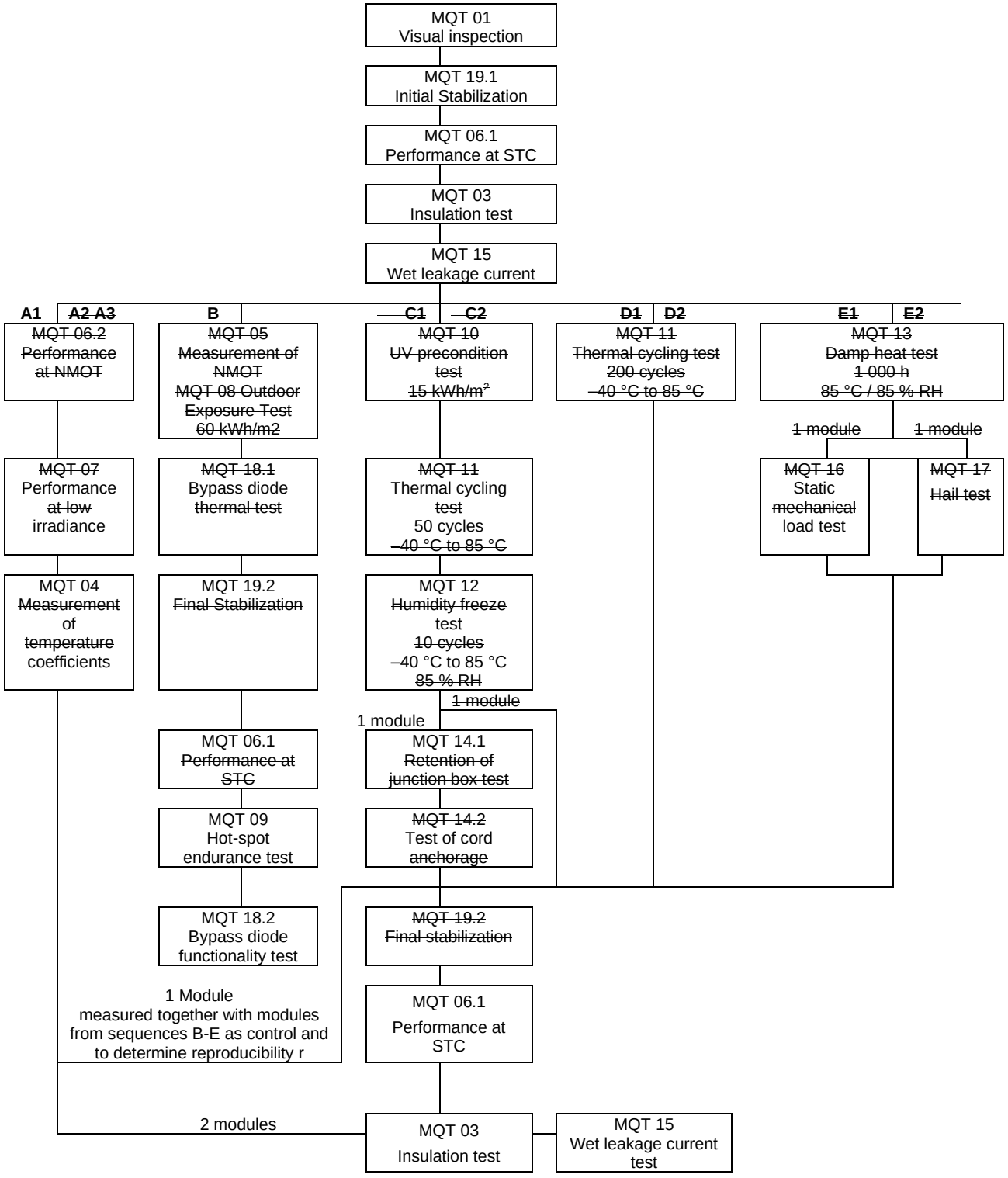
MODULE GROUP ASSIGNMENT:				
Sample #	Sample Group ID	Type/model	Sample S/N	Remark
240725001	A1	XSFM-560-T2	XSFM560T240701006	Control module
240725002	B	XSFM-560-T2	XSFM560T240701010	HS
240725004	—	XSFM-540-T2	XSFM540T240701012	Low 1
240725005	—	XSFM-540-T2	XSFM540T240701013	Low 2
240725006	—	XSFM-590-T2	XSFM590T240701016	High 1
240725007	—	XSFM-590-T2	XSFM590T240702010	High 2
Supplementary information: Further qualification for higher and/or lower output power see annex 3				

Note (1) Use the “General product information” field to give any information on model differences within a product type family covered by the test report and to describe the range of electrical and safety ratings, if the TRF covers a type family of modules.

Note (3) Use Annex 1 to list the used materials and components of the module (manufacturer/supplier and type reference).

Note (4) The module numbers/identifiers are set in accordance to IEC 62915 Photovoltaic (PV) modules – Retesting for type approval, design and safety qualification, Annex A3

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
11	**TEST FLOW (if it is not a full test, strikethrough non-performed test)** Note: Deviations from test sequence are possible but must be documented.		



IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
5. MARKING AND DOCUMENTATION			P
5.1	**Name Plate**		
	All electrical data is shown as relative to standard test conditions (1 000 W/m², 25 °C, AM 1,5 according to IEC TS 61836).	Marked on label	P
	International symbols are used where applicable.	Marked on label	P
	The module includes clear and indelible markings:		—
	a. Name, registered trade name or registered trade mark of manufacturer	兴晟能源 X-SOLAR ENERGY	P
	b. Type or model number designation	XSFM-560-T2	P
	c. Serial number (unless marked on other part of product)	Provided under superstrate near the top rail of frame	P
	d. Date and place of manufacture, alternatively serial number allowing to trace the date and place of manufacture;	serial number allowing to trace the date and place of manufacture	P
	e. Maximum system voltage	1000V DC	P
	f. Class of protection against electrical shock	Class II	P
	g. Voltage at open-circuit or Voc including tolerances.	52.58V ± 3% for example	P
	h. Current at short-circuit or Isc including tolerances	13.69A ± 3% for example	P
	i. Module maximum power or Pmax including tolerances	560W ± 3% for example	P
5.2	**Documentation**		
5.2.1	Minimum requirements		
	Modules are supplied with documentation describing the methods of electrical and mechanical installation as well as the electrical ratings of the module		P
	The documentation states the class of protection against electrical shock under which the module has been qualified and any specific limitations required for that class.		P
	The documentation assures that installers and operators receive appropriate and sufficient documentation for safe installation, use, and maintenance of the PV modules.		P
5.2.2	Information given in the documentation		P
	a. All information required under 5.1 e) to i)	Refer to manual document	P
	b. Overcurrent protection device type and rating are e.g. given in IEC 60269-6	Refer to manual document	P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Maximum series/parallel module configuration is recommended		P
	c. Manufacturer's stated tolerance for Voc, Isc and maximum power output under standard test conditions		P
	d. Temperature coefficient for voltage at open-circuit		P
	e. Temperature coefficient for maximum power		P
	f. Temperature coefficient for short-circuit current		P
	All electrical data mentioned above shown as relative to standard test conditions (1 000 W/m^2, 25 °C, AM 1,5 according to IEC TS 61836)		P
	g. Nominal module operating temperature (NMOT) is specified		N/A
	h. Performance at NMOT (MQT 06.2) is specified		N/A
	i. Performance at low irradiance (MQT 07) is specified		P
	International symbols used where applicable		P
	Compliance checked by inspection and MQT 04 through MQT 07		P
	The electrical documentation includes a detailed description of the electrical installation wiring method to be used		—
	j. The minimum cable diameters for modules intended for field wiring		P
	k. Any limitations on wiring methods and wire management that apply to the wiring compartment or box;		P
	l. The size, type, material and temperature rating of the conductors to be used		P
	m. Type of terminals for field wiring		N/A
	n. Specific PV connector model/types and manufacturer to which the module connectors are mated		P
	o. The bonding method(s) to be used (if applicable); all provided or specified hardware is identified in the documentation	Refer to manual document	P
	p. The type and ratings of bypass diode to be used (if applicable)	Refer to manual document	P
	q. limitations to the mounting situation (e.g., slope, orientation, mounting means, cooling)	Refer to manual document	P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	r. A statement indicating the fire rating(s) and the applied standard and the limitations to that rating (e.g., installation slope, sub-structure or other applicable installation information)		P
	s. A statement indicating the design load per each mechanical means for securing the module as evaluated during the static mechanical load test according to MQT 16. At discretion of the manufacturer the test load and/or the safety factor γ_m may be noted, too		P
	The installation instructions include relevant parameters specified by manufacturer or the following statement or the equivalent: *"Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{SC} and V_{OC} marked on this module should be multiplied by a factor of 1,25 when determining component voltage ratings, conductor current ratings, and size of controls connected to the PV output."*		P
5.2.3	Assembly instructions		N/A
	Provided with a product shipped in subassemblies, detailed and adequate to the degree required to facilitate complete and safe assembly of the product		N/A
Supplementary information: N/A			

7. PASS CRITERIA					P
7.2	**Power output and electric circuitry**				P
7.2.1	Verification of rated label values (Gate No. 1)				P
	Manufacturer's tolerances and Laboratory uncertainties				P
		t_1	t_2	t_3	—
	manufacturer's rated lower/upper production tolerance in %	-3	+3	+3	
		m_1	m_2	m_3	
	measurement uncertainty in % of laboratory	2.05	1.50	2.70	
	Laboratory reproducibility r .....:	+0.13%			
	After stabilization, each individual module meets the requirements				P
	P_{max}	See Table 03			P
	V_{oc}	See Table 03			P
	I_{sc}:.....	See Table 03			P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization the arithmetic average $\overline{P}\,\max$ of all modules meet the requirements.	See Table 03	P
7.2.2	Maximum power degradation during type approval testing (Gate #2)		P
	At the end of each test sequence or for sequence B after bypass diode test, each test sample meets the requirements for P_{max}		P
7.2.3	Electrical circuitry		P
	Samples do not exhibit an open-circuit during the tests		P
7.3	**Visual defects**		P
	There is no visual evidence of a major defect.		P
7.4	**Electrical safety**		P
	The insulation test (MQT 03) requirements are met after the tests		P
	The wet leakage current test (MQT 15) requirements met at the beginning and at the end of each sequence		P
	Specific requirements of the individual tests are met		N/A
Supplementary information: N/A			

IEC 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict
4. TESTING OVERVIEW			P
	Initial examination	All modules	P
4.1	Visual inspection (MQT 01)) .....:	See Table 01	P
4.19.5	Initial stabilization (MQT 19.1) .....:	See Table 02	P
4.6	Performance at STC (MQT 06.1)	See Table 03	P
4.3	Insulation test(MQT 03) .....:	See Table 04	P
4.15	Wet leakage current test(MQT 15) .....:	See Table 05	P
Sequence A	**3 Modules**	Samples A1;A2;A3	N/A
4.6	Performance at NMOT(MQT 06.2) .....:	See Table 06	N/A
4.7	Performance at low irradiance(MQT 07).....:	See Table 07	N/A
4.4	Measurement of temperature coefficients(MQT 04) .....:	See Table 08	N/A
Sequence B	**1 Module**	Sample B	P
4.5	Measurement of nominal module operating temperature (NMOT, °C) (MQT 05) .....:	See Table 09	N/A
4.8	Outdoor exposure test(MQT 08).....:	See Table 10	N/A
4.18.1	Bypass diode thermal test (MQT 18.1)		N/A
	Maximum allowed junction temperature .....:		—
	Calculated junction temperature .....:		—
	Final measurements.....:	See Table 11	N/A
4.18.2	Bypass diode functionality test (MQT 18.2) .....:	See Table 12	N/A
4.19.6	Final stabilization (MQT 19.2).....:	See Table 12.1 – 12.3	N/A
4.9	Hot spot endurance test (MQT 09) .....:	See Table 13.1 - 13.5	P
Sequence C	**2 Modules**	Samples C1; C2	N/A
4.10	UV preconditioning test (MQT 10) .....:	See Table 14.1 - 14.4	N/A
4.11	Thermal cycling test 50 cycles (MQT 11).....:	See Table 15.1 - 15.4	N/A
4.12	Humidity-freeze test (MQT 12).....:	See Table 16.1 - 16.4	N/A
Sequence C1	**1 Module**	Sample C1	N/A
4.14	Robustness of terminations test (MQT 14)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4.14.2	Retention of junction box on mounting surface (MQT 14.1) .....:	See Table 17.1 - 17.7	N/A
4.14.3	Test of cord anchorage (MQT 14.2)		—
4.14.3.1	This test omitted if junction box is qualified to IEC 62790 .....:	See list of attachments	—
4.14.3.2.1	Junction boxes intended to be used with cables specified by the manufacturer……:	See Table 17.4	—
4.14.3.2.2	Junction boxes intended to be used with generic cables……..:	See Table 17.4	—
Sequence D	**2 Modules**	Sample D1; D2	N/A
4.11	Thermal cycling test 200 cycles (MQT 11) .....:	See Table 18.1 - 18.2	N/A
Sequence E	**2 Modules**	Samples E1; E2	N/A
4.13	Damp heat test (MQT 13) .....:	See Table 19.1 - 19.4	N/A
Sequence E1	**1 Module**	Sample E1	N/A
4.16	Static mechanical load test (MQT 16).....:	See Table 19.5 - 19.7	N/A
Sequence E2	**1 Module**	Sample E2	N/A
4.17	Hail test (MQT 17)	See Table 19.8 - 19.10	N/A
	Final measurement	All modules for Sequence C, D, E; Control module for Sequence A	N/A
4.19.6	Final stabilization (MQT 19.2).....:	See Table 20.1 - 20.2	N/A
4.6	Performance at STC (MQT 06.1) .....:	See Table 20.3	P
4.3	Insulation test(MQT 03) .....:	See Table 21	P
4.15	Wet leakage current test(MQT 15) .....:	See Table 22	P

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 01: MQT 01 ini: Initial Visual inspection		P
Test Date [YYYY-MM-DD]..... :	2024-07-18	—
Sample #	Nature and position of initial findings – comments or attach photos	—
240725001	No major visual defects found	P
240725002	No major visual defects found	P
240725004	No major visual defects found	P
240725005	No major visual defects found	P
240725006	No major visual defects found	P
240725007	No major visual defects found	P
Supplementary information: N/A		

TABLE 02: MQT 19.1 ini: Initial stabilization							—
TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization							—
Test Date [YYYY-MM-DD]..... :	2024-07-18						—
Test method..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
240725001	13.71	52.74	12.95	43.25	560.23	77.48	—
240725002	13.70	52.77	12.95	43.39	561.98	77.73	—
Supplementary information: N/A							

TABLE 02.3: MQT 19.1 ini: Initial Stabilization procedure							P
Light exposure method..... :	☐ Simulator ☒ Natural sunlight						
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x ..... :	1						
Sample #	240725001	Test Date (YYYY-MM-DD) start/end			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	560.23	—	—
1	5	＞500	55±10	MPPT	561.11	—	—
2	5	＞500	55±10	MPPT	560.58	0.16	Yes
Sample #	240725002	Test Date (YYYY-MM-DD) start/end			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)

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Initial	—	—	—	—	561.98	—	—
1	5	＞500	55±10	MPPT	561.66	—	—
2	5	＞500	55±10	MPPT	561.40	0.10	Yes

Supplementary information: N/A

☐ Other stabilization procedures

Sample #	Test Date (YYYY-MM-DD) start/end
—	—
—	—
—	—
—	—
—	—
—	—
—	—
—	—
—	—

Test method description: —

Supplementary information: see Annex 3 for verification of this alternative stabilization procedure

TABLE 03: MQT 06.1 ini: Performance at STC after initial stabilization		P
Test Date [YYYY-MM-DD] ..... :	2024-07-29	—
Pmax(lab) lower limit (W) ..... :	See table below: Pmax [W] – Min calc.	—
$\bar{P}_{max}(Lab)$ lower limit (W) ..... :	546.35	—
Voc(lab) upper limit (V) ..... :	See table below: Voc [V] Max. calc.	—
Isc (lab) upper limit (A) ..... :	See table below: Isc [A] Max. calc.	—
Test method ..... :	☒ Simulator ☐ Natural sunlight	—

Sample #	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	Pmax [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
240725001	13.71	13.72	52.79	53.35	12.95	43.29	560.58	529.96	77.44	P
240725002	13.68	13.72	52.83	53.35	12.93	43.43	561.40	529.96	77.70	P
Average	—						560.99	546.35	—	P

Supplementary information: The limit values are calculated considering manufacturer's tolerances ***t*** of rated nameplate values and laboratory measurement uncertainties ***m***.

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 04: MQT 03 ini: Initial Insulation test				P
Test Date [YYYY-MM-DD]..... :	2024-07-29			—
Test Voltage applied [V] ..... :	6000/1000			—
Size of module [m²] ..... :	2.75			—
Required Resistance [MΩ]..... :	≥14.56			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
240725001	>2000	No Dielectrical breakdown	x	P
240725002	>2000	No Dielectrical breakdown	x	P
Supplementary information: The maximum resistance measurement range is 2000MΩ.				

TABLE 05: MQT 15 ini: Initial Wet leakage current test			P
Test Date [YYYY-MM-DD] ..... :	2024-07-29		—
Test Voltage applied [V] ..... :	1000		—
Solution temperature [°C]..... :	22.8		—
Solution resistivity [Ω cm] ..... :	2746		—
Size of module [m²] ..... :	2.75		—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
240725001	≥14.56	>2000	P
240725002	≥14.56	>2000	P
Supplementary information: The maximum resistance measurement range is 2000MΩ.			

TABLE 06: MQT 06.2 - Performance at NMOT							—
Test Date [YYYY-MM-DD]..... :	—						—
Module temperature (°C) ..... :	—						—
Test method ..... :	☐ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
Supplementary information: N/A							

TABLE 07: MQT 07 - Performance at low irradiance		
Test Date [YYYY-MM-DD] ..... :	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Test method ..:	☐ Outdoor measurement		
	Ambient air temperature [°C]:		—
	Irradiance [W/m²]:		
	Module temperature [°C]:		
	☐ Data corrected to a 25°C cell temperature and 200 W/m² irradiance		
	☐ Directly measured		—

Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—

Supplementary information: N/A

TABLE 08: MQT 04 - Measurement of temperature coefficients				—
Test Date [YYYY-MM-DD] .....:	—			—
Ambient air temperature [°C] high/low .....:	—			—
Irradiance [W/m²] high/low.....:	—			—
Module temperature [°C] high/low.....:	—			—
Sample #	α [%/°C]	β [%/°C]	δ [%/°C]	—
—	—	—	—	—
—	—	—	—	—
—	—	—	—	—

Supplementary information: N/A

TABLE 09: MQT 05 - Measurement of Nominal Module Operating Temperature (NMOT, °C)	—
Test Date [YYYY-MM-DD].....:	—
Electrical load.....	☐ Restive load ☐ MPPT
All details for the measurements are kept on file and are available on request.	
Sample #	
Calculated u_0 [W/(m².°C)]	—
Calculated u_1 [W.s/(m³.°C)]	—
Calculated NMOT	—

Supplementary information: N/A

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 10: MQT 08 - Outdoor exposure test			—
Test Date [YYYY-MM-DD] start/end..... :	—		—
Sample #..... :	—		—
Total irradiation dosage [kWh/m²] ..... :	—		—
Angle of tilt the test module..... :	—		—
Electrical load ..... :	☐Restive load	☐ MPPT	—
Supplementary information: N/A			

Table 10.1: MQT 01: Visual inspection after outdoor exposure test		—
Test Date [YYYY-MM-DD] ..... :	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
Supplementary information: N/A		

Table 10.2: MQT 15: Wet leakage current test after outdoor exposure test			—
Test Date [YYYY-MM-DD] .....:	—		—
Test Voltage applied [V] ..... :	—		—
Solution temperature [°C] ..... :	—		
Size of module [m²] .....:	—		—
Solution resistivity [Ω cm].....:	< 3,500 Ω cm at 22 ± 2°C	—	
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—
Supplementary information: N/A			

Table 10.3: MQT 02 - Maximum power determination after outdoor exposure test - Optional						—
Test Date [YYYY-MM-DD] ..... :	—					—
Module temperature [°C]..... :	—					—
Irradiance [W/m²]..... :	—					—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
—	—	—	—	—	—	—
Supplementary information: N/A						

Table 10.4: MQT 03 - Insulation test after outdoor exposure test - Optional		—
Test Date [YYYY-MM-DD] .....:	—	—
Test Voltage applied [V] .....:	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Size of module [m²] .....:			—		—
Required Resistance [MΩ].....:			—		—
Sample #	Measured (MΩ)	Required (MΩ)	Dielectric breakdown		Result
			Yes (description)	No	
—	—	—	—	—	—
Supplementary information: N/A					

TABLE 11: MQT 18: Bypass diode thermal test					—
Test Date [YYYY-MM-DD] start/end .....:		—			—
Sample #		—			—
Module temperature [°C].....:		—			—
Number of diodes in junction box .....:		—			—
Diode manufacturer .....:		—			—
Diode type designation .....:		—			—
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet) .....:		—			—
Detailed description of sample preparation procedure .....:		—			—
Step 1, Determination of *V*D versus *T*J characteristic					—
	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	
Ambient temperature of the junction box ... :	—	—	—	—	
Pulsed current.....:	—	—	—	—	
Voltage drop [V] .....:	—	—	—	—	
	—	—	—	—	
	—	—	—	—	
V_D versus T_J characteristic .....:	—				—
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet) ..... :	—				—
Step 2, Bypass diode thermal test					
	Diode 1	Diode 2	Diode 3		Result
Current flow applied [A] .....:	—	—	—		—
Max. diode surface temperature allowed Tj_{max} [°C] :	—	—	—		—
Voltage drop [V] after 1h.....:	—	—	—		—
Calculated max. junction temperature Tj_{calc} [°C] ....:	—	—	—		—
$Tj_{calc} < Tj_{max}$ (test passed)? yes/no .....:	—	—	—		—

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Current flow (1.25 * Isc) [A] .....:	—	—	—	—
Bypass diode remain(s) functional (yes/no) .....:	—	—	—	—

Remarks: See Table 12 for the test details of bypass diode functionality test.

3 Diodes are considered as representative number. These diodes have to be selected as worst case. In case that additional bypass diodes tests are performed the results shall be listed in an attachment.

For bifacial modules, use the value of the short-circuit current at elevated irradiance BSI (equivalent to 1 000 W/m^2 on the front side and 300 W/m^2 on the back side).

Extrapolate Isc-BSI, these quantities are combined as follows: $I_{sc\text{-}BSI}=I_{sc\text{-}BNPI}+(I_{sc\text{-}BNPI}-I_{sc})(G_{BSI}-G_{BNPI})/(G_{BNPI}-1\ 000)$, $G_{BSI}=1\ 000+300\varphi$, $G_{BNPI}=1\ 000+135\varphi$, $\varphi=\mathrm{Min}(\varphi I_{sc}, \varphi P_{max})$

TABLE 11.1: MQT 01 - Visual inspection after bypass diode thermal test		—
Test Date [YYYY-MM-DD]..... :	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—

Supplementary information: N/A

TABLE 11.2: MQT 15 - Wet leakage current test after bypass diode thermal test			—
Test Date [YYYY-MM-DD] ..... :		—	—
Test Voltage applied [V]..... :		—	—
Solution temperature [°C] ..... :		—	—
Size of module [m²] ..... :		—	—
Solution resistivity [Ω cm]..... :		—	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—

Supplementary information: N/A

TABLE 11.3: MQT 02 – Max. power determination after bypass diode thermal test - Optional							—
Test Date [YYYY-MM-DD].....:	—						—
Module temperature [°C].....:	—						—
Irradiance [W/m^2) .....:	—						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—

Supplementary information: N/A

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 11.3: MQT 02 – Max. power determination after bypass diode thermal test – Optional (Equivalent irradiance)							—
Test Date [YYYY-MM-DD] ..... :			—				—
Module temperature [°C] ..... :			—				—
Irradiance [W/m²] ..... :			—				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
—	—	—	—	—	—	—	—
Supplementary information: N/A							

TABLE 11.4: MQT 03 - Insulation test after bypass diode thermal test - Optional					—
Test Date [YYYY-MM-DD] .....:			—		—
Test Voltage applied [V] .....:			—		—
Size of module [m²] .....:			—		—
Required Resistance [MΩ] .....:			—		—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
—	—	—	—	—	—
Supplementary information: N/A					

TABLE 12: MQT 18.2 - Bypass diode functionality test after bypass diode thermal test				
Test Date [YYYY-MM-DD] .....:		—		—
☐ Method A				—
Ambient temperature [°C] .....:		—		—
Current flow applied [A] ..... :		—		—
Sample #	VFM	$V_{FMrated}$	VFM = (N × $V_{FMrated}$) ± 10 %	Result
—	—	—	☐ Yes ☐ No	—
Supplementary information: N/A				
☐ Method B				
Sample #	Diode	IV curve after shading		Result
—	—	—		—
	—	—		—
	—	—		—
Supplementary information: N/A				

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 12.1: MQT 19.1 Fin: Final stabilization							—
TABLE 12.2: MQT 06.1: Performance at STC before final stabilization							—
Test Date [YYYY-MM-DD] ..... :			—				—
Test method ..... :			☐ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
Supplementary information: N/A							

TABLE 12.3: MQT 19.1 Final Stabilization procedure							—
Light exposure method..... :			☐ Simulator ☐ Natural sunlight				—
Stabilization criterion x per IEC 61215-1-x .... :			—				—
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight							
Sample #	—	Test Date (YYYY-MM-DD) start/end.....:			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	($P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
Supplementary information: N/A							
☐ Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end						
—	—						
—	—						
Test method description: —							
Supplementary information: N/A							

TABLE 13: MQT 09 - Hot-spot endurance test		P
Test Date [YYYY-MM-DD] start/end .....:	2024-07-30/2024-07-30	—
Sample #	240725002	—
Procedure of technology.....:	☒ wafer-based technologies (WBT) MQT 09.1 ☐ monolithically integrated (MLI) thin film technologies MQT 09.2	—
Cell interconnection circuit.....:	☐ S ☒ SP ☐ PS	—

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Type of light source .....:	☐ Pulse Simulator ☒ Steady state Simulator ☐ Natural sunlight	—
Module temperature at thermal equilibrium [°C] .:	55.3/53.3/56.2/54.7	—

TABLE 13.1: MQT 09 - Hot-spot endurance test for WBT					P
Selected hot-spot cells.....:	LOW	LOW	LOW	HIGH	—
	—	—	—	—	
Shading rate [%].....:	10	20	25	20	—
Max. measured cell temperature in each cell [°C]:	152.3	154.3	149.9	148.9	—
Test duration of each shading [h] .....:	1	1	1	1	—
Irradiance during shading [W/m²] …… .....:	1000	1000	1000	1000	—

TABLE 13.2: MQT 09 - Hot-spot endurance test for MLI		N/A
Selected hot-spot cells.....:	—	—
Number of cells shaded .....:	—	—
Max. measured cell temperature [°C] .....:	—	—
Test duration during shading [h] .....:	—	—
Irradiance during shading [W/m²] …… .....:	—	—
Supplementary information:N/A		

TABLE 13.3: MQT 01 - Visual inspection after hot-spot endurance test		P
Test Date [YYYY-MM-DD].....:	2024-07-30	—
Sample #	Nature and position of initial findings – comments or attach photos	—
240725002	No major visual defects found	P
Supplementary information: N/A		

TABLE 13.4: MQT 02 - Maximum power determination after hot-spot endurance test							P
Test Date [YYYY-MM-DD].....:	2024-07-30						—
Module temperature [°C].....:	25						—
Irradiance [W/m²) .....:	1000						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
240725002	13.66	52.82	12.91	43.42	560.58	77.67	P
Supplementary information: N/A							

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 13.5: MQT 03 - Insulation test after hot-spot endurance test					P
Test Date [YYYY-MM-DD]:			2024-07-30		—
Test Voltage applied [V]:			6000/1000		—
Size of module [m²]:			2.75		—
Required Resistance [MΩ]:			≥14.56		—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
240725002	>2000	≥14.56	No dielectric breakdown	X	P
Supplementary information: The measurement limit of the equipment is 2000 MΩ.					

TABLE 13.6: MQT 15 - Wet leakage current test after hot-spot endurance test			P
Test Date [YYYY-MM-DD]:		2024-07-30	—
Test Voltage applied [V]:		1000	—
Solution temperature [°C]:		22.6	—
Size of module [m²]		2.75	—
Solution resistivity [Ω cm]		2757	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
240725002	>2000	≥14.56	P
Supplementary information: The measurement limit of the equipment is 2000 MΩ.			

TABLE 13.7: MQT 18.2 - Bypass diode functionality test after Hot-spot endurance test				P
Test Date [YYYY-MM-DD]:		2024-07-30		—
☐ Method A				—
Ambient temperature [°C]:		—		—
Current flow applied [A]:		—		—
Sample #	VFM	$V_{FMrated}$	VFM = (N × $V_{FMrated}$) ± 10 %	Result
—	—	—	☐ Yes ☐ No	—
Supplementary information: N/A				
☒ Method B				—
	IV curve after shading			Result
Diode 1	Turn on			P
Diode 2	Turn on			P
Diode 3	Turn on			P
Supplementary information: 240725002				

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 14: MQT 10 - UV preconditioning test (Front side)		—
Test Date (YYYY-MM-DD) start/end .....:	—	—
Module temperature [°C] .....:	—	—
UV irradiance (280-400nm) [W/m²] .....:	—	—
Ratio of UV irradiance (280-320nm) (%) .....:	—	—
UV dose (280-400nm) [kWh/m²] .....:	—	—
Module operation condition .....:	☐ Short circuited ☐ Pmax	—
Supplementary information: Light sources not emitting a significant portion of light in the visible spectrum where the module exhibits a power equal to or larger than 20 % of its STC measured power. UV preconditioning test was performed on front side of the module.		

TABLE 14.1: MQT 01 - Visual inspection after UV preconditioning test		—
Test Date [YYYY-MM-DD] .....:	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 14.2: MQT 15 - Wet leakage current test after UV preconditioning test				—
Test Date [YYYY-MM-DD] .....:		—		—
Test Voltage applied [V] .....:		—		—
Solution temperature [°C] .....:		—		—
Size of module [m²] .....:		—		—
Solution resistivity [Ω cm] .....:		< 3,500 Ω cm at 22 ± 2°C	—	—
Sample #	Measured [MΩ]	Required Resistance [MΩ]		Result
—	—	—		—
—	—	—		—
Supplementary information: N/A				

TABLE 14.3: MQT 02 – Max. power determination after UV preconditioning test - Optional							—
Test Date [YYYY-MM-DD] .....:			—				—
Module temperature [°C] .....:			—				—
Irradiance [W/m²] .....:			—				—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]	Result

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Clause	Requirement + Test	Result - Remark	Verdict

—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—

Supplementary information: N/A

TABLE 14.4: MQT 03 - Insulation test after UV preconditioning test - Optional				—
Test Date [YYYY-MM-DD] ..... :	—			—
Test Voltage applied [V] ..... :	—			—
Size of module [m²]	—			—
Required Resistance [MΩ] ..... :	—			—
Sample #	Measured	Dielectric breakdown		Result
	[MΩ]	Yes (description)	No	
—	—	—	—	—
—	—	—	—	—

Supplementary information: N/A

TABLE 15: MQT 11 - Thermal cycling 50 test			
Test Date [YYYY-MM-DD] start/end..... :	—		—
Total cycles (50) ..... :	—		—
Applied current (A) ..... :	During the heat up cycle from -40 °C to 80 °C	—	—
	Other stages	—	—

Sample #	Open circuits (yes/no)	—
—	—	—
—	—	—

Supplementary information: N/A

TABLE 15.1: MQT 01 - Visual inspection after thermal cycling 50 test		
Test Date [YYYY-MM-DD] ..... :	—	—

Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—

Supplementary information: N/A

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 15.2: MQT 15 - Wet leakage current test after thermal cycling 50 test				—
Test Date [YYYY-MM-DD] ..... :	—			—
Test Voltage applied [V] ..... :	—			—
Solution temperature [°C] ..... :	—			—
Size of module [m²] ..... :	—			—
Solution resistivity [Ω cm] ..... :	< 3,500 Ω cm at 22 ± 2°C	—		—
Sample #	Measured [MΩ]	Required Resistance [MΩ]		Result
—	—	—		—
—	—	—		—
Supplementary information: N/A				

TABLE 15.3: MQT 03 – Max. power determination after thermal cycling 50 test - Optional						—
Test Date [YYYY-MM-DD] ..... :	—					—
Module temperature [°C] ..... :	—					—
Irradiance [W/m²] ..... :	—					—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
—	—	—	—	—	—	—
—	—	—	—	—	—	—
Supplementary information: N/A						

TABLE 15.4: MQT 03 - Insulation test after thermal cycling 50 test - Optional				—
Test Date [YYYY-MM-DD] ..... :	—			—
Test Voltage applied [V] ..... :	—			—
Size of module [m²] ..... :	—			—
Required Resistance [MΩ] ..... :	—			—
Sample #	Measured	Dielectric breakdown		Result
	[MΩ]	Yes (description)	No	
—	—	—	—	—
—	—	—	—	—
Supplementary information: N/A				

TABLE 16: MQT 12 - Humidity freeze 10 test		—
Test Date [YYYY-MM-DD] start/end ..... :	—	—
Total cycles (10) ..... :	—	—
Applied current (A) ..... :	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Sample #	Open circuits (yes/no)	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 16.1: MQT 01 - Visual inspection after humidity freeze 10 test		—
Test Date [YYYY-MM-DD] ..... :	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 16.2: MQT 15 - Wet leakage current test after humidity freeze 10 test			—
Test Date [YYYY-MM-DD] ..... :	—		—
Test Voltage applied [V] ..... :	—		—
Solution temperature [°C] ..... :	—		—
Size of module [m²] ..... :	—		—
Solution resistivity [Ω cm] ..... :	< 3,500 Ω cm at 22 ± 2°C	—	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—
—	—	—	—
Supplementary information: N/A			

TABLE 16.3: MQT 02-Maximum power determination after humidity freeze 10 test -Optional						—
Test Date [YYYY-MM-DD] ..... :	—					—
Module temperature [°C] ..... :	—					—
Irradiance [W/m²] ..... :	—					—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
—	—	—	—	—	—	—
—	—	—	—	—	—	—
Supplementary information: N/A						

TABLE 16.4: MQT 03 Insulation test after humidity freeze 10 test -Optional		—
Test Date [YYYY-MM-DD] ..... :	—	—
Test Voltage applied [V] ..... :	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Size of module [m²] ..... :			—		—
Required Resistance [MΩ] ..... :			—		—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
—	—	—	—	—	—
—	—	—	—	—	—
Supplementary information: N/A					

TABLE 17: MQT 14 - Robustness of terminations test		—
Test Date [YYYY-MM-DD] start/end..... :	—	—

TABLE 17.1: MQT 14.1 Retention of junction box on mounting surface		—
Sample #	—	—
Supplementary information: N/A		

TABLE 17.2: MQT 01- Visual inspection after retention of junction box on mounting surface		—
Test Date [YYYY-MM-DD] .....:	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 17.3: MQT 15 - Wet leakage current test after retention of junction box on mounting surface				—
Test Date [YYYY-MM-DD] .....:		—		—
Test Voltage applied [V] .....:		—		—
Solution temperature [°C] ..... :		—		—
Size of module [m²] .....:		—		—
Solution resistivity [Ω cm] ..... :		< 3,500 Ω cm at 22 ± 2°C	—	—
Sample #	Measured [MΩ]	Limit [MΩ]		Result
—	—	—		—
—	—	—		—
Supplementary information: N/A				

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 17.4: MQT 14.2 - Test of cord anchorage							—
Sample #	—						—
☐ Junction boxes intended to be used with cables specified by the manufacturer							—
	Cable diameter, [mm]		Tension Force, [N]	Permissible displacement, [mm]		Measured displacement, [mm]	Result
Pull test	—		—	—		—	—
	Cable diameter, [mm]		Torque Force, [Nm]	Permissible angle [°]		Measured angle [°]	Result
Torque test	—		—	—		—	—
☐ Junction boxes intended to be used with generic cables							—
	Anchorage diameter range [mm]		Test mandrel [mm]	Tension Force, [N]	Permissible displacement [mm]	Measured displacement [mm]	Result
Pull test	Min	—	—	—	—	—	—
	Anchorage diameter range [mm]		Test mandrel [mm]	Torque Force [Nm]	Permissible angle [°]	Measured angle [°]	Result
Torque test	Max	—	—	—	—	—	—
Supplementary information: N/A							

TABLE 17.5: MQT 01 - Visual inspection after retention of test of cord anchorage		—
Test Date [YYYY-MM-DD] ..... :	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
Supplementary information: N/A		

TABLE 17.6: MQT 15 - Wet leakage current test after retention of test of cord anchorage			—
Test Date [YYYY-MM-DD] ..... :	—		—
Test Voltage applied [V] ..... :	—		—
Solution temperature [°C] ..... :	—		—
Size of module [m²]	—		—
Solution resistivity [Ω cm] ..... :	< 3,500 Ω cm at 22 ± 2°C	—	—
Sample #	Measured [MΩ]	Required Resistance [MΩ]	Result
—	—	—	—
Supplementary information: N/A			

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 17.7: MQT 03 - Insulation test after test of cord anchorage					—
Test Date [YYYY-MM-DD] .....:		—			—
Test Voltage applied [V] .....:		—			—
Size of module [m²] .....:		—			—
Required Resistance [MΩ].....:		—			—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
—	—	—	—	—	—
Supplementary information: N/A					

TABLE 18: MQT 11 - Thermal cycling 200 test			
Test Date [YYYY-MM-DD] start/end .....:	—		—
Total cycles (200).....:	—		—
Applied current (A) .....:	During the heat up cycle from –40 °C to 80 °C	—	—
	Other stages	—	—
Sample #	Open circuits (yes/no)		—
—	—		—
—	—		—
Supplementary information: N/A			

TABLE 18.1: MQT 01 - Visual inspection after thermal cycling 200 test		
Test Date [YYYY-MM-DD].....:	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 18.2: MQT 15 - Wet leakage current test after thermal cycling 200 test			
Test Date [YYYY-MM-DD].....:	—		—
Test Voltage applied [V] .....:	—		—
Solution temperature [°C].....:	—		—
Size of module [m²] .....:	—		—
Solution resistivity [Ω cm].....:	—		—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—

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Clause	Requirement + Test	Result - Remark	Verdict
—	—	—	—
Supplementary information: N/A			

TABLE 19: MQT 13 - Damp heat 1000 test		—
Test Date [YYYY-MM-DD] start/end .....:	—	—
Total hours (1000h) .....:	—	—
Sample #		—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 19.1: MQT 01 - Visual inspection after damp heat 1000 test		—
Test Date [YYYY-MM-DD].....:	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
—	—	—
Supplementary information: N/A		

TABLE 19.2: MQT 15 - Wet leakage current test after damp heat 1000 test			—
Test Date [YYYY-MM-DD].....:	—		—
Test Voltage applied [V].....:	—		—
Solution temperature [°C].....:	—		—
Size of module [m²].....:	—		—
Solution resistivity [Ω cm].....:	—		—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—
—	—	—	—
Supplementary information: N/A			

TABLE 19.3: MQT 02 - Maximum power determination after damp heat 1000 test - Optional							N/A
Test Date [YYYY-MM-DD].....:	—						—
Module temperature [°C].....:	—						—
Irradiance [W/m²) .....:	—						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
M6	—	—	—	—	—	—	—
M7	—	—	—	—	—	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information: N/A

TABLE 19.4: MQT 03 - Insulation test after damp heat 1000 test - Optional					N/A
Test Date [YYYY-MM-DD]..... :			—		—
Test Voltage applied [V] ..... :			—		—
Size of module [m²]			—		—
Sample #	Measured	Required Resistance	Dielectric breakdown		Result
	[MΩ]	[MΩ]	Yes (description)	No	
—	—	—	—	—	—
—	—	—	—	—	—
Supplementary information: N/A					

TABLE 19.5: MQT 16 Static mechanical load test			—
Sample # :	—		—
Design load(front side/ back side)..... :	—		—
Safety factors ..... :	—		—
Test Date [YYYY-MM-DD].....	—		—
Mounting method ..... :	—		—
Load applied to..... :	—	—	—
Mechanical load [Pa].....:	—	—	—
First cycle time (start/end).....:	—	—	—
Intermittent open-circuit (yes/no) .....:	—	—	—
Second cycle time (start/end) .....:	—	—	—
Intermittent open-circuit (yes/no) .....:	—	—	—
Third cycle time (start/end) .....:	—	—	—
Intermittent open-circuit (yes/no) .....:	—	—	—
Supplementary information: N/A			

TABLE 19.6: MQT 01 - Visual inspection after static mechanical load test		—
Test Date [YYYY-MM-DD].....:	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
Supplementary information: N/A		
TABLE 19.7: MQT 15 - Wet leakage current test after static mechanical load test		—
Test Date [YYYY-MM-DD].....:	—	—

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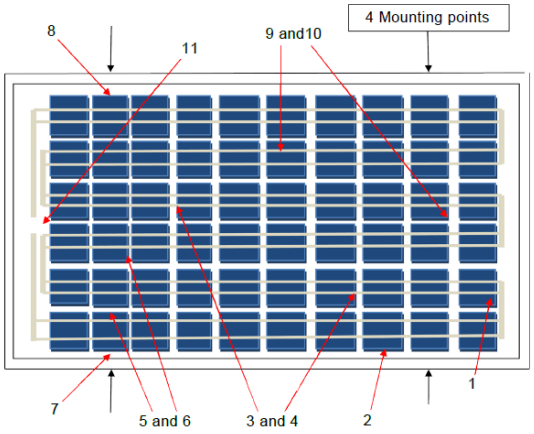
Clause	Requirement + Test	Result - Remark	Verdict

Test Voltage applied [V] ..... :		—	—
Solution temperature [°C]..... :		—	—
Size of module [m²] ..... :		—	—
Solution resistivity [Ω cm] ..... :		—	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
—	—	—	—
Supplementary information: N/A			

TABLE 19.8: MQT 17 - Hail impact test							—
Test Date [YYYY-MM-DD]..... :	—						—
Sample #	—						—
Ice ball size [mm] ..... :	1	2	3	4	5	6	—
	—	—	—	—	—	—	
	7	8	9	10	11	/	
	—	—	—	—	—	/	
Ice ball weight [g] ..... :	1	2	3	4	5	6	—
	—	—	—	—	—	—	
	7	8	9	10	11	/	
	—	—	—	—	—	/	
Ice ball velocity [m/s]..... :	1	2	3	4	5	6	—
	—	—	—	—	—	—	
	7	8	9	10	11	/	
	—	—	—	—	—	/	
Number of impact locations ..... :	11						—

Supplementary information: (impact location descriptions)



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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 19.9: MQT 01 - Visual inspection after hail impact test		
Test Date [YYYY-MM-DD]..... :	—	—
Sample #	Nature and position of initial findings – comments or attach photos	—
—	—	—
Supplementary information: N/A		

TABLE 19.10: MQT 15 - Wet leakage current test after hail impact test			—
Test Date [YYYY-MM-DD]..... :	—		—
Test Voltage applied [V]..... :	—		—
Solution temperature [°C]..... :	—		—
Solution resistivity [Ω cm] ..... :	—		—
Size of module [m²] ..... :	—		—
Sample #	Measured [MΩ]	Required Resistance [MΩ]	Result
—	—	—	—
Supplementary information: N/A			

TABLE 20: MQT 19.2 Fin: Final stabilization							N/A
TABLE 20.1: MQT 06.1: Performance at STC before final stabilization							—
Test Date [YYYY-MM-DD]..... :	—						—
Test method..... :	☐ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
M10	—	—	—	—	—	—	—
M4	—	—	—	—	—	—	—
M5	—	—	—	—	—	—	—
M8	—	—	—	—	—	—	—
M9	—	—	—	—	—	—	—
M6	—	—	—	—	—	—	—
M7	—	—	—	—	—	—	—
Supplementary information:N/A							

TABLE 20.2: MQT 19.1 Final Stabilization procedure		N/A
Light exposure method:	☐ Simulator ☐ Natural sunlight	
Stabilization criterion x per IEC 61215-1-x :	—	

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Clause	Requirement + Test	Result - Remark	Verdict

Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight

Sample #	M10	Test Date (YYYY-MM-DD) start/end..:			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	M4	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	M5	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	M8	Test Date (YYYY-MM-DD) start/end..:			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

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Clause	Requirement + Test	Result - Remark	Verdict

Sample #	M9	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	M6	Test Date (YYYY-MM-DD) start/end..... :			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	M7	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Supplementary information: N/A

☐ Other stabilization procedures

Sample #	Test Date (YYYY-MM-DD) start/end
M10	—
M4	—
M5	—
M8	—
M9	—
M6	—
M7	—

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Clause	Requirement + Test	Result - Remark	Verdict

Test method description:N/A
Supplementary information: see Annex 3 for verification of this alternative stabilization procedure

TABLE 20.3: MQT 06.1: Final Performance at STC (Front side)									P
Test Date [YYYY-MM-DD] ..... :					2024-08-01				—
Test method ..... :					☒ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab_GateNo.1)	Power Degradation [%]	Result
240725001	13.72	52.77	12.95	43.30	560.89	77.49	554.974	0.06%	P
240725002	13.65	52.80	12.93	43.44	561.50	77.90	560.670	0.15%	P
Supplementary information: Pmax [W] (Lab_GateNo.1) is calculated by considering the reproducibility *r* of control module.									

TABLE 21: MQT 03 fin: Final Insulation test					P
Test Date [YYYY-MM-DD] ..... :			2024-08-01		—
Test Voltage applied [V] ..... :			6000/1000		—
Size of module [m²] ..... :			2.75		—
Sample #	Required	Measured	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
240725001	≥14.56	>2000	No Dielectrical breakdown	X	P
240725002	≥15.15	>2000	No Dielectrical breakdown	X	P
Supplementary information: The maximum resistance measurement range is 2000MΩ.					

TABLE 22: MQT 15 fin: Final Wet leakage current test			P
Test Date [YYYY-MM-DD] ..... :		2024-08-01	—
Test Voltage applied [V] ..... :		1000	—
Solution temperature [°C] ..... :		22.7	—
Size of module [m²] ..... :		2.75	—
Solution resistivity [Ω cm] ..... :		2540	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
240725001	>2000	≥14.56	P
240725002	>2000	≥14.56	P
Supplementary information: The maximum resistance measurement range is 2000MΩ.			

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Annex 1: Product Description Sheet (Manufacturers and type references)

A1.1	**MODULE TYPE/S**
	XSFM-560-T2

A1.2	**MODULE DESIGN**	
	Module dimensions (L x W x H) [mm] ..... :	2260 x 1219 x 2.5 mm
	Weights..... :	8.3 kg(approx)
	Front/Rear cover bonding classification ..... :	☐ rigid/flexible ☐ rigid/rigid ☒ flexible/flexible

A1.3	**SOLAR CELL**	
	Cell type reference ..... :	Jiangsu Runergy New Energy Technology Co.,Ltd Cell type: NM1016BF1B3, Bifacial N type Cell, 16BB Mono-Crystalline Silicon Solar cell
	Cell dimensions L x W x T (± %) [mm] ..... :	182 x 91(Half cut)
	Cell thickness [µm] ..... :	130 ± 10%
	Cell area [cm²] ..... :	165.62

A1.4	**IDENTIFICATION OF MATERIALS**	
	Front cover..... :	Hangzhou Foremost Material Technology Co.,Ltd Type: HPC315 Material: weathering coating/ Transparent PET/ weathering coating Total Thickness: 0.300 (mm)
	Rear cover ..... :	Hangzhou Foremost Material Technology Co., Ltd. Type: MS4700 Material: Coating/ Composite material/ Coating Thickness: 25µm/700µm/25µm Total Thickness: 0.750 (mm), white color
	Encapsulation material ..... :	SHANGHAI TIANYANG HOT MELT ADHESIVES CO., LTD. Type: JCC-205T (between frontsheet and solar cell), POE Thickness: 0.5±0.05mm Type: JCC-205T (between solar cell and backsheet), POE Thickness: 0.5±0.05mm

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	Frame parts ..... :	N/A
	Mounting parts ..... :	N/A
	Adhesive for frame ..... :	N/A
	Edge sealing ..... :	N/A
	Internal wiring ..... :	N/A
	Cell connector ..... :	Suzhou Xiangbang New Material Technology Co., Ltd. Cross section: 0.38*0.17(mm) Coating Sn60Pb40, Tu2, ≥99.97%
	String connector ..... :	Suzhou Xiangbang New Material Technology Co., Ltd. Cross section: 0.35x7.0(mm), Coating Sn60Pb40, Tu2, ≥99.97%
	Soldering material ..... :	N/A
	Fluxing agent ..... :	Shenzhen Witteven New Materials Co., Ltd Type: WTO-PV107
	Junction box ..... :	Zhejiang Zhonghuan Sunter PV Technology Co., Ltd. Type: PV-ZH011C-5M
	Cable ..... :	Zhejiang Zhonghuan Sunter PV Technology Co., Ltd. Type: 62930 IEC 131 1 x 4,0mm^2, 1 x6,0mm^2, -40℃~+90℃
	Connector ..... :	Zhejiang Zhonghuan Sunter PV Technology Co., Ltd. Type: PV-ZH202B
	Bypass diode ..... :	Zhejiang Zhonghuan Sunter PV Technology Co., Ltd. Type: MK5045
	Potting material ..... :	Shanghai Huitian New Material Co., Ltd. Type: 5299W-S
	Adhesive for junction box ..... :	Shanghai Huitian New Material Co., Ltd. Type: HT906Z
	Additional material (e. g. fixing tape, insulation tape) ..... :	Fixing tape: 3M Type: UV-1 Label: Jiangyin Huaru photovoltaic materials Co., LTD. Type: PET Insulation material between string connectors: Kunshan Aifangxing Electronic Material Co., Ltd. Type: EPE-300W, black Thickness: 300μm±5%

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A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....:	2.0 mm
	Between cell and accessible surfaces.....:	21.5mm
	Between any current carrying part and accessible surfaces .....:	21.5mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells .....:	144
	Serial-parallel connection of cells .....:	SP
	Cells per bypass diode .....:	48
	No. of bypass diodes .....:	3

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Annex 2: Test table for verifying other alternative stabilization procedure

Step 1: Alternative stabilization				N/A
Test Date (YYYY-MM-DD) start/end: —				—
Test method description: —				—
	—	—	—	—
Power before alternative stabilization (W)	—	—	—	—
Power after alternative stabilization (W)	—	—	—	—
Supplementary information:N/A				
Step 2: Light exposure				—
☐ Simulator ☐ Natural sunlight				
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight				

Sample M10	Test Date (YYYY-MM-DD) start/end.....:	—

Test cycle	Light source	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—
Supplementary information:N/A								

Sample M11	Test Date (YYYY-MM-DD) start/end.....:	—

Test cycle	Light source	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—
Supplementary information:N/A								

Sample M12	Test Date (YYYY-MM-DD) start/end.....:	—

Test cycle	Light source	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—	—
Supplementary information:N/A								

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Step 3: Stabilization determination				—
	—	—	—	Result
Stable power P_{max1} after alternative stabilization (W)	—	—	—	—
Stable power P_{max2} after light exposure (W)	—	—	—	—
Power change P_{max2} to P_{max1} (%)	—	—	—	—
Allowed power change P_{max2} to P_{max1} (%)	—	—	—	—
Is alternative stabilization method valid? (Yes/No)	—	—	—	—
Supplementary information:N/A				

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Annex 3: Lower and higher output power modules

TABLE A.4.1 Performance at STC before initial stabilization (Front)							—
Test Date [YYYY-MM-DD]..... :	2024-07-18						—
Test method ..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
240725004	13.56	52.05	12.81	42.98	550.56	78.01	—
240725005	13.57	52.04	12.82	42.96	550.61	77.96	—
240725006	13.89	52.55	13.20	43.95	580.15	79.51	—
240725007	13.88	52.52	13.17	44.10	580.71	79.64	—
Supplementary information: N/A							

TABLE A.4.2: MQT 19.1 ini: Initial Stabilization procedure (Front)							P
Light exposure method ..... :	☐ Simulator ☒ Natural sunlight						—
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x.... :	1						—
Sample #	240725004	Test Date (YYYY-MM-DD) start/end ..... :			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	550.56	—	—
1	5	＞500	55±10	MPPT	551.66	—	—
2	5	＞500	55±10	MPPT	551.47	0.20	Yes
Sample #	240725005	Test Date (YYYY-MM-DD) start/end ..... :			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	550.61	—	—
1	5	＞500	55±10	MPPT	551.23	—	—
2	5	＞500	55±10	MPPT	551.78	0.21	Yes
Sample #	240725006	Test Date (YYYY-MM-DD) start/end ..... :			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	580.15	—	—
1	5	＞500	55±10	MPPT	580.79	—	—
2	5	＞500	55±10	MPPT	581.27	0.19	Yes

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Sample #	240725007	Test Date (YYYY-MM-DD) start/end .....:			2024-07-18/2024-07-29		
Test cycle	Integrated irradiation (kWh/m^2)	Irradiance (W/m^2)	Module temperature (°C)	Resistive load	P_{max} (W) at the end of cycle	$P_{max} – P_{min}$) / $P_{average}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	580.71	—	—
1	5	＞500	55±10	MPPT	581.01	—	—
2	5	＞500	55±10	MPPT	581.44	0.13	Yes

Supplementary information:N/A

☐ Other stabilization procedures

Sample #	Test Date (YYYY-MM-DD) start/end.....:	—
—	—	
—	—	
—	—	
—	—	

Test method description:N/A

Supplementary information: N/A

TABLE A.4.3: MQT 6.1 Performance at STC after initial stabilization (Front)							P
Test Date [YYYY-MM-DD].....:	2024-07-29						—
	Lower end power class		Higher end power class				—
Pmax(lab) (W) .....:	≥ 511.03 ,		≥ 558.35 ,				—
$\bar{P}_{max}(Lab)$ (W)	≥ 526.83 ,		≥ 575.61 ,				—
Voc(lab) (V) .....:	≤ 52.74 ,		≤ 52.74 ,				—
Isc (lab) (A) .....:	≤ 13.61 ,		≤ 13.96 ,				—
Test method.....:	☒ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
240725004	13.55	52.06	12.81	43.06	551.47	78.16	P
240725005	13.57	52.03	12.80	43.09	551.78	78.17	P
240725006	13.88	52.56	13.20	44.03	581.27	79.68	P
240725007	13.86	52.55	13.14	44.25	581.44	79.82	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

---------- End of TRF No. IEC61215 series----------