



Product Service

TEST REPORT	
IEC 61215-series:2021	
TUV SUD Test Report for Terrestrial photovoltaic (PV) modules – Design qualification and type approval	
Report No.:	704062316712-00 part 1 of 2
Date of issue:	April 11, 2024
Project handler:	Rongwei Jing
Testing laboratory:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Address:	No. 151 Heng Tong Road, Shanghai 200070, P. R. China
Testing location:	Yangzhou Opto-Electrical Products Testing Institute No. 10 West Kaifa Road, Yangzhou, 225009 Jiangsu, P. R. China
Client:	Q-SUN Anhui Co., Ltd.
Client number:	104991
Address:	West of Jingliu Road, North of Weisan Road, 239300 Tianchang City, Anhui Province, PEOPLE'S REPUBLIC OF CHINA
Contact person:	Mr. Rongyuan Gu
Standard:	This TUV SUD test report form is based on the following requirements: ☒ IEC 61215-1:2021 ☒ IEC 61215-2:2021 ☒ IEC 61215-1-1:2021 ☐ IEC 61215-1-2:2021 ☐ IEC 61215-1-3:2021 ☐ IEC 61215-1-4:2021
TRF number and revision:	IEC61215:2021, rev. 1
TRF originated by:	TUV SUD Product Service, Mr. Bo Xiangxi
Copyright blank test report:	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TUV SUD Product Service. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
General disclaimer:	This test report may only be quoted in full. Any use for advertising purposes must be granted in writing. This report is the result of a single examination of the object in question and is not generally applicable evaluation of the quality of other products in regular production.
Scheme:	☒ TUV Mark ☐ without certification
Non-standard test method:	☐ GS Mark ☐ NRTL Mark ☐ EU-Directive
National deviations:	☒ No ☐ Yes, see details under Summary of testing The product fulfils the requirements of EN IEC 61215-1:2021/AC:2021-06, EN IEC 61215-1-1:2021 & EN IEC 61215-2:2021



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Number of pages (Report):	140		
Number of pages (Attachments):	6		
Compiled by: (+ signature)	Rongwei Jing	Approved by: (+ signature)	Guangxia Fu 

Test Report IEC61215:2021

Test sample:	Photovoltaic (PV) Module(s)
Type of test object:	Mono-Crystalline Silicon Photovoltaic Module
Trademark:	Q-SUN solar
Model and/or type reference:	QN-685HT-01, QN-595HT-02, QN-580HT-05, QN-560HT-06, QN-615HT-06 (representative testing models)
Rating(s):	refer to page 5~24
Manufacturer:	Q-SUN Anhui Co., Ltd.
Manufacturer number:	104991
Address:	West of Jingliu Road, North of Weisan Road, 239300 Tianchang City, Anhui Province, PEOPLE'S REPUBLIC OF CHINA
Name and address of factory(ies)	
1. Q-SUN Anhui Co., Ltd. West of Jingliu Road, North of Weisan Road, 239300 Tianchang City, Anhui Province, PEOPLE'S REPUBLIC OF CHINA Factory No.: 104991 2. Q-SUN Jiangsu Co., Ltd. Fengfu No. 4 Road, Precision Manufacturing Industrial Park, 224200 DongTai City, Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA Factory No.: 118795	
Sub-contractors/ tests (clause):	N/A
Name:	N/A
Order description:	☒ Complete test according to TRF
	☐ Partial test according to manufacturer's specifications
	☐ Preliminary test
	☐ Spot check
	☐ Others:
Date of order:	November 20, 2023
Date of receipt of test item:	December 14, 2023
Date(s) of performance of test:	December 15, 2023 to April 03, 2024
Test item particulars: See below for details	
Purpose of the product (Description of intended use):	

The PV modules for electricity generation systems with max. voltage of 1500 V DC

Characteristic data *(not shown on the marking plate):*

N/A

Product Electrical Ratings:
Monofacial Module:

Module type	-			
Voc [V] /Tolerance	-			
Vmp [V]	-			
Imax [Adc]	-			
Isc [Adc] /Tolerance	-			
Pmp [W] /Tolerance	-			
Maximum system voltage [V]	-			
Maximum Over-Current Protection Rating [A]	-			
Note: Further qualification for higher and/or lower output power see annex 3				

Bifacial Module:

	Module type	QN-670HT-01	QN-675HT-01	QN-680HT-01	QN-685HT-01
STC condition	Pmp [W] /Tolerance	670±3%	675±3%	680±3%	QN-580HT-05
	Voc [V] /Tolerance	46.96±3%	47.16±3%	47.35±3%	47.55±3%
	Isc [Adc] /Tolerance	18.06±3%	18.12±3%	18.18±3%	18.24±3%
	Vmp [V]	39.39	39.57	39.74	39.92
	Imax [Adc]	17.01	17.06	17.11	17.16
BNPI condition	Pmp [W] /Tolerance	739±3%	744±3%	750±3%	755±3%
	Voc [V] /Tolerance	46.96±3%	47.16±3%	47.35±3%	47.55±3%
	Isc [Adc] /Tolerance	19.92±3%	19.98±3%	20.04±3%	20.11±3%
bifaciality coefficient	φPmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φVoc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φIsc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	35	35	35	35
	Module type	QN-690HT-01	QN-695HT-01	QN-700HT-01	QN-705HT-01
STC condition	Pmp [W] /Tolerance	690±3%	695±3%	700±3%	705±3%
	Voc [V] /Tolerance	47.74±3%	47.94±3%	48.13±3%	48.32±3%

	Isc [A] /Tolerance	18.29±3%	18.35±3%	18.41±3%	18.47±3%
	Vmp [V]	40.09	40.27	40.44	40.61
	I _{max} [A]	17.21	17.26	17.31	17.36
BNPI condition	P _{mp} [W] /Tolerance	761±3%	766±3%	772±3%	777±3%
	V _{oc} [V] /Tolerance	47.74±3%	47.94±3%	48.13±3%	48.32±3%
	Isc [A] /Tolerance	20.17±3%	20.23±3%	20.30±3%	20.36±3%
bifaciality coefficient	φP _{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φV _{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φI _{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	35	35	35	35
	Module type	QN-710HT-01	QN-610HT-01	QN-615HT-01	QN-620HT-01
STC condition	P _{mp} [W] /Tolerance	710±3%	610±3%	615±3%	620±3%
	V _{oc} [V] /Tolerance	48.51±3%	42.91±3%	43.12±3%	43.32±3%
	Isc [A] /Tolerance	18.52±3%	18.0 ± 3%	18.06±3%	18.11±3%
	Vmp [V]	40.78	35.8	35.99	36.17
	I _{max} [A]	17.41	17.04	17.09	17.14
BNPI condition	P _{mp} [W] /Tolerance	783±3%	673±3%	678±3%	684±3%
	V _{oc} [V] /Tolerance	48.51±3%	42.91±3%	43.12±3%	43.32±3%
	Isc [A] /Tolerance	20.43±3%	19.84±3%	19.91±3%	19.97±3%
bifaciality coefficient	φP _{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φV _{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φI _{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	35	35	35	35
	Module type	QN-625HT-01	QN-630HT-01	QN-635HT-01	QN-640HT-01
STC condition	P _{mp} [W] /Tolerance	625±3%	630±3%	635±3%	640±3%
	V _{oc} [V] /Tolerance	43.54±3%	43.74±3%	43.96±3%	44.16±3%
	Isc [A] /Tolerance	18.17±3%	18.23±3%	18.29±3%	18.34±3%

	Vmp [V]	36.36	36.54	36.73	36.91
	Imax [Adc]	17.19	17.24	17.29	17.34
BNPI condition	Pmp [W] /Tolerance	689±3%	695±3%	700±3%	706±3%
	Voc [V] /Tolerance	43.54±3%	43.74±3%	43.96±3%	44.16±3%
	Isc [Adc] /Tolerance	20.04±3%	20.10±3%	20.16±3%	20.23±3%
bifaciality coefficient	ϕ Pmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕ Voc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕ Isc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	35	35	35	35
	Module type	QN-645HT-01	QN-585HT-02	QN-590HT-02	QN-595HT-02
STC condition	Pmp [W] /Tolerance	645±3%	585±3%	590±3%	595±3%
	Voc [V] /Tolerance	44.37±3%	46.76±3%	46.98±3%	47.20±3%
	Isc [Adc] /Tolerance	18.40±3%	15.84±3%	15.90±3%	15.95±3%
	Vmp [V]	37.09	39.21	39.41	39.61
	Imax [Adc]	17.39	14.92	14.97	15.02
BNPI condition	Pmp [W] /Tolerance	711±3%	645±3%	650±3%	656±3%
	Voc [V] /Tolerance	44.37±3%	46.76±3%	46.98±3%	47.20±3%
	Isc [Adc] /Tolerance	20.29±3%	17.46±3%	17.53±3%	17.59±3%
bifaciality coefficient	ϕ Pmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕ Voc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕ Isc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	35	30	30	30
	Module type	QN-600HT-02	QN-605HT-02	QN-610HT-02	QN-615HT-02
STC condition	Pmp [W] /Tolerance	600±3%	605±3%	610±3%	615±3%
	Voc [V] /Tolerance	47.43±3%	47.65±3%	47.88±3%	48.10±3%
	Isc [Adc] /Tolerance	16.01±3%	16.07±3%	16.13±3%	16.19±3%
	Vmp [V]	39.81	40.01	40.21	40.41

	I _{max} [Adc]	15.07	15.12	15.17	15.22
BNPI condition	P _{mp} [W] /Tolerance	661±3%	667±3%	673±3%	678±3%
	V _{oc} [V] /Tolerance	47.43±3%	47.65±3%	47.88±3%	48.10±3%
	I _{sc} [Adc] /Tolerance	17.65±3%	17.72±3%	17.78±3%	17.85±3%
bifaciality coefficient	φP _{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φV _{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φI _{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-620HT-02	QN-535HT-02	QN-540HT-02	QN-545HT-02
STC condition	P _{mp} [W] /Tolerance	620±3%	535±3%	540±3%	545±3%
	V _{oc} [V] /Tolerance	48.32±3%	42.89±3%	43.13±3%	43.37±3%
	I _{sc} [Adc] /Tolerance	16.24±3%	15.79±3%	15.85±3%	15.91±3%
	V _{mp} [V]	40.6	35.79	36	36.21
	I _{max} [Adc]	15.27	14.95	15	15.05
BNPI condition	P _{mp} [W] /Tolerance	684±3%	590±3%	595±3%	601±3%
	V _{oc} [V] /Tolerance	48.32±3%	42.89±3%	43.13±3%	43.37±3%
	I _{sc} [Adc] /Tolerance	17.91±3%	17.41±3%	17.47±3%	17.54±3%
bifaciality coefficient	φP _{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φV _{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φI _{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-550HT-02	QN-555HT-02	QN-560HT-02	QN-565HT-02
STC condition	P _{mp} [W] /Tolerance	550±3%	555±3%	560±3%	565±3%
	V _{oc} [V] /Tolerance	43.61±3%	43.85±3%	44.08±3%	44.32±3%
	I _{sc} [Adc] /Tolerance	15.96±3%	16.02±3%	16.08±3%	16.14±3%
	V _{mp} [V]	36.42	36.63	36.84	37.05
	I _{max} [Adc]	15.1	15.15	15.20	15.25

BNPI condition	Pmp [W] /Tolerance	606±3%	612±3%	617±3%	623±3%
	Voc [V] /Tolerance	43.61±3%	43.85±3%	44.08±3%	44.32±3%
	Isc [Adc] /Tolerance	17.60±3%	17.66±3%	17.73±3%	17.79±3%
bifaciality coefficient	φPmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φVoc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φIsc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-480HT-02	QN-485HT-02	QN-490HT-02	QN-495HT-02
STC condition	Pmp [W] /Tolerance	480±3%	485±3%	490±3%	495±3%
	Voc [V] /Tolerance	38.74±3%	39.01±3%	39.26±3%	39.51±3%
	Isc [Adc] /Tolerance	15.68±3%	15.74±3%	15.80±3%	15.86±3%
	Vmp [V]	32.15	32.38	32.6	32.82
	I _{max} [Adc]	14.93	14.98	15.03	15.08
BNPI condition	Pmp [W] /Tolerance	529±3%	535±3%	540±3%	546±3%
	Voc [V] /Tolerance	38.74±3%	39.01±3%	39.26±3%	39.51±3%
	Isc [Adc] /Tolerance	17.29±3%	17.36±3%	17.42±3%	17.48±3%
bifaciality coefficient	φPmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φVoc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φIsc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-500HT-02	QN-505HT-02	QN-425HT-02	QN-430HT-02
STC condition	Pmp [W] /Tolerance	500±3%	505±3%	425±3%	430±3%
	Voc [V] /Tolerance	39.77±3%	40.02±3%	34.65±3%	34.93±3%
	Isc [Adc] /Tolerance	15.91±3%	15.97±3%	15.53±3%	15.58±3%
	Vmp [V]	33.05	33.27	28.6	28.84
	I _{max} [Adc]	15.13	15.18	14.86	14.91
	Pmp [W] /Tolerance	551±3%	557±3%	469±3%	474±3%

BNPI condition	Voc [V] /Tolerance	39.77±3%	40.02±3%	34.65±3%	34.93±3%
	Isc [Adc] /Tolerance	17.55±3%	17.61±3%	17.12±3%	17.18±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-435HT-02	QN-440HT-02	QN-445HT-02	QN-450HT-02
STC condition	Pmp [W] /Tolerance	435±3%	440±3%	445±3%	450±3%
	Voc [V] /Tolerance	35.20±3%	35.47±3%	35.75±3%	36.02±3%
	Isc [Adc] /Tolerance	15.64±3%	15.70±3%	15.76±3%	15.82±3%
	Vmp [V]	29.08	29.31	29.55	29.78
	I _{max} [Adc]	14.96	15.01	15.06	15.11
BNPI condition	Pmp [W] /Tolerance	480±3%	485±3%	491±3%	496±3%
	Voc [V] /Tolerance	35.20±3%	35.47±3%	35.75±3%	36.02±3%
	Isc [Adc] /Tolerance	17.25±3%	17.31±3%	17.38±3%	17.44±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-605HT-03	QN-610HT-03	QN-615HT-03	QN-620HT-03
STC condition	Pmp [W] /Tolerance	605±3%	610±3%	615±3%	620±3%
	Voc [V] /Tolerance	50.76±3%	50.98±3%	51.21±3%	48.32±3%
	Isc [Adc] /Tolerance	15.09±3%	15.15±3%	15.21±3%	16.24±3%
	Vmp [V]	42.79	42.99	43.19	40.6
	I _{max} [Adc]	14.14	14.19	14.24	15.27
BNPI condition	Pmp [W] /Tolerance	667±3%	673±3%	678±3%	683.57±3%
	Voc [V] /Tolerance	50.76±3%	50.98±3%	51.21±3%	48.32±3%

	Isc [Adc] /Tolerance	16.64±3%	16.70±3%	16.77±3%	17.91±3%
bifaciality coefficient	φPmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φVoc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φIsc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over- Current Protection Rating [A]	30	30	30	30
	Module type	QN-625HT-03	QN-630HT-03	QN-635HT-03	QN-640HT-03
STC condition	Pmp [W] /Tolerance	625±3%	630±3%	635±3%	640±3%
	Voc [V] /Tolerance	51.63±3%	51.85±3%	52.07±3%	52.29±3%
	Isc [Adc] /Tolerance	15.32±3%	15.38±3%	15.44±3%	15.49±3%
	Vmp [V]	43.58	43.78	43.97	44.17
	I _{max} [Adc]	14.34	14.39	14.44	14.49
BNPI condition	Pmp [W] /Tolerance	689±3%	695±3%	700±3%	706±3%
	Voc [V] /Tolerance	51.63±3%	51.85±3%	52.07±3%	52.29±3%
	Isc [Adc] /Tolerance	16.89±3%	16.96±3%	17.02±3%	17.08±3%
bifaciality coefficient	φPmax	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	φVoc	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	φIsc	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over- Current Protection Rating [A]	30	30	30	30
	Module type	QN-555HT-03	QN-560HT-03	QN-565HT-03	QN-570HT-03
STC condition	Pmp [W] /Tolerance	555±3%	560±3%	565±3%	570±3%
	Voc [V] /Tolerance	46.71±3%	46.95±3%	47.18±3%	47.42±3%
	Isc [Adc] /Tolerance	15.04±3%	15.10±3%	15.16±3%	15.21±3%
	Vmp [V]	39.17	39.38	39.59	39.8
	I _{max} [Adc]	14.17	14.22	14.27	14.32
BNPI condition	Pmp [W] /Tolerance	612±3%	617±3%	623±3%	628±3%
	Voc [V] /Tolerance	46.71±3%	46.95±3%	47.18±3%	47.42±3%
	Isc [Adc] /Tolerance	16.58±3%	16.65±3%	16.71±3%	16.78±3%

bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-575HT-03	QN-580HT-03	QN-585HT-03	QN-505HT-03
STC condition	Pmp [W] /Tolerance	575±3%	580±3%	585±3%	505±3%
	Voc [V] /Tolerance	47.65±3%	47.89±3%	48.12±3%	42.78±3%
	Isc [Adc] /Tolerance	15.27±3%	15.33±3%	15.39±3%	14.94±3%
	Vmp [V]	40.01	40.22	40.43	35.69
	I _{max} [Adc]	14.37	14.42	14.47	14.15
BNPI condition	Pmp [W] /Tolerance	634±3%	639±3%	645±3%	557±3%
	Voc [V] /Tolerance	47.65±3%	47.89±3%	48.12±3%	42.78±3%
	Isc [Adc] /Tolerance	16.84±3%	16.90±3%	16.97±3%	16.48±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-510HT-03	QN-515HT-03	QN-520HT-03	QN-525HT-03
STC condition	Pmp [W] /Tolerance	510±3%	515±3%	520±3%	525±3%
	Voc [V] /Tolerance	43.04±3%	43.29±3%	43.54±3%	43.80±3%
	Isc [Adc] /Tolerance	15.00±3%	15.06±3%	15.12±3%	15.17±3%
	Vmp [V]	35.92	36.14	36.36	36.59
	I _{max} [Adc]	14.2	14.25	14.3	14.35
BNPI condition	Pmp [W] /Tolerance	562±3%	568±3%	573±3%	579±3%
	Voc [V] /Tolerance	43.04±3%	43.29±3%	43.54±3%	43.80±3%
	Isc [Adc] /Tolerance	16.54±3%	16.60±3%	16.67±3%	16.73±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%

bifaciality coefficient	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-530HT-03	QN-455HT-03	QN-460HT-03	QN-465HT-03
STC condition	Pmp [W] /Tolerance	530±3%	455±3%	460±3%	465±3%
	Voc [V] /Tolerance	44.05±3%	38.67±3%	38.95±3%	39.21±3%
	Isc [Adc] /Tolerance	15.23±3%	14.89±3%	14.95±3%	15.01±3%
	Vmp [V]	36.81	32.09	32.33	32.56
	I _{max} [Adc]	14.4	14.18	14.23	14.28
BNPI condition	Pmp [W] /Tolerance	584±3%	502±3%	507±3%	513±3%
	Voc [V] /Tolerance	44.05±3%	38.67±3%	38.95±3%	39.21±3%
	Isc [Adc] /Tolerance	16.79±3%	16.42±3%	16.49±3%	16.55±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-470HT-03	QN-475HT-03	QN-480HT-03	QN-585HT-04
STC condition	Pmp [W] /Tolerance	470±3%	475±3%	480±3%	585±3%
	Voc [V] /Tolerance	39.49±3%	39.75±3%	40.01±3%	50.80±3%
	Isc [Adc] /Tolerance	15.07±3%	15.13±3%	15.18±3%	14.58±3%
	Vmp [V]	32.80	33.03	33.26	42.83
	I _{max} [Adc]	14.33	14.38	14.43	13.66
BNPI condition	Pmp [W] /Tolerance	518±3%	524±3%	529±3%	645±3%
	Voc [V] /Tolerance	39.49±3%	39.75±3%	40.01±3%	50.80±3%
	Isc [Adc] /Tolerance	16.61±3%	16.68±3%	16.74±3%	16.07±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-590HT-04	QN-595HT-04	QN-600HT-04	QN-605HT-04
STC condition	Pmp [W] /Tolerance	590±3%	595±3%	600±3%	605±3%
	Voc [V] /Tolerance	51.02±3%	51.26±3%	51.49±3%	51.71±3%
	Isc [Adc] /Tolerance	14.64±3%	14.69±3%	14.75±3%	14.81±3%
	Vmp [V]	43.03	43.24	43.45	43.65
	I _{max} [Adc]	13.71	13.76	13.81	13.86
BNPI condition	Pmp [W] /Tolerance	650±3%	656±3%	662±3%	667±3%
	Voc [V] /Tolerance	51.02±3%	51.26±3%	51.49±3%	51.71±3%
	Isc [Adc] /Tolerance	16.14±3%	16.20±3%	16.27±3%	16.33±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-610HT-04	QN-615HT-04	QN-535HT-04	QN-540 HT-04
STC condition	Pmp [W] /Tolerance	610±3%	615±3%	535±3%	540±3%
	Voc [V] /Tolerance	51.93±3%	52.15±3%	46.77±3%	47.02±3%
	Isc [Adc] /Tolerance	14.87±3%	14.93±3%	14.48±3%	14.54±3%
	Vmp [V]	43.85	44.05	39.22	39.44
	I _{max} [Adc]	13.91	13.96	13.64	13.69
BNPI condition	Pmp [W] /Tolerance	673±3%	678±3%	590±3%	595±3%
	Voc [V] /Tolerance	51.93±3%	52.15±3%	46.77±3%	47.02±3%
	Isc [Adc] /Tolerance	16.39±3%	16.46±3%	15.97±3%	16.03±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%

bifaciality coefficient	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-545HT-04	QN-550HT-04	QN-555HT-04	QN-560HT-04
STC condition	Pmp [W] /Tolerance	545±3%	550±3%	555±3%	560±3%
	Voc [V] /Tolerance	47.27±3%	47.51±3%	47.75±3%	48.00±3%
	Isc [Adc] /Tolerance	14.60±3%	14.65±3%	14.71±3%	14.77±3%
	Vmp [V]	39.67	39.88	40.10	40.32
	I _{max} [Adc]	13.74	13.79	13.84	13.89
BNPI condition	Pmp [W] /Tolerance	601±3%	606±3%	612±3%	618±3%
	Voc [V] /Tolerance	47.27±3%	47.51±3%	47.75±3%	48.00±3%
	Isc [Adc] /Tolerance	16.09±3%	16.16±3%	16.22±3%	16.28±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-440HT-04	QN-445HT-04	QN-450HT-04	QN-455HT-04
STC condition	Pmp [W] /Tolerance	440±3%	445±3%	450±3%	455±3%
	Voc [V] /Tolerance	38.83±3%	39.12±3%	39.41±3%	39.68±3%
	Isc [Adc] /Tolerance	14.34±3%	14.40±3%	14.46±3%	14.51±3%
	Vmp [V]	32.23	32.48	32.73	32.97
	I _{max} [Adc]	13.65	13.70	13.75	13.80
BNPI condition	Pmp [W] /Tolerance	485±3%	491±3%	496±3%	502±3%
	Voc [V] /Tolerance	38.83±3%	39.12±3%	39.41±3%	39.68±3%
	Isc [Adc] /Tolerance	15.81±3%	15.88±3%	15.94±3%	16.00±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕ_{Isc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-460HT-04	QN-565HT-05	QN-570HT-05	QN-575HT-05
STC condition	Pmp [W] /Tolerance	460±3%	565±3%	570±3%	575±3%
	Voc [V] /Tolerance	39.96±3%	50.59±3%	50.83±3%	51.07±3%
	Isc [Adc] /Tolerance	14.57±3%	14.14±3%	14.19±3%	14.25±3%
	Vmp [V]	33.21	42.64	42.86	43.07
	I _{max} [Adc]	13.85	13.25	13.30	13.35
BNPI condition	Pmp [W] /Tolerance	507±3%	623±3%	629±3%	634±3%
	Voc [V] /Tolerance	39.96±3%	50.59±3%	50.83±3%	51.07±3%
	Isc [Adc] /Tolerance	16.07±3%	15.59±3%	15.65±3%	15.71±3%
bifaciality coefficient	ϕ_{Pmax}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕ_{Voc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕ_{Isc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-580HT-05	QN-585HT-05	QN-590HT-05	QN-595HT-05
STC condition	Pmp [W] /Tolerance	580±3%	585±3%	590±3%	595±3%
	Voc [V] /Tolerance	51.30±3%	51.53±3%	51.77±3%	52.00±3%
	Isc [Adc] /Tolerance	14.31±3%	14.37±3%	14.43±3%	14.48±3%
	Vmp [V]	43.28	43.49	43.70	43.91
	I _{max} [Adc]	13.40	13.45	13.50	13.55
BNPI condition	Pmp [W] /Tolerance	639±3%	645±3%	650±3%	656±3%
	Voc [V] /Tolerance	51.30±3%	51.53±3%	51.77±3%	52.00±3%
	Isc [Adc] /Tolerance	15.78±3%	15.84±3%	15.91±3%	15.97±3%
	ϕ_{Pmax}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕ_{Voc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-600HT-05	QN-520HT-05	QN-525HT-05	QN-530HT-05
STC condition	Pmp [W] /Tolerance	600±3%	520±3%	525±3%	530±3%
	Voc [V] /Tolerance	52.23±3%	46.70±3%	46.95±3%	47.21±3%
	Isc [Adc] /Tolerance	14.54±3%	14.10±3%	14.15±3%	14.21±3%
	Vmp [V]	44.12	39.16	39.38	39.61
	I _{max} [Adc]	13.60	13.28	13.33	13.38
BNPI condition	Pmp [W] /Tolerance	662±3%	573±3%	579±3%	584±3%
	Voc [V] /Tolerance	52.23±3%	46.70±3%	46.95±3%	47.21±3%
	Isc [Adc] /Tolerance	16.03±3%	15.54±3%	15.61±3%	15.67±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-535HT-05	QN-540HT-05	QN-545HT-05	QN-550HT-05
STC condition	Pmp [W] /Tolerance	535±3%	540±3%	545±3%	550±3%
	Voc [V] /Tolerance	47.46±3%	47.71±3%	47.96±3%	48.20±3%
	Isc [Adc] /Tolerance	14.27±3%	14.33±3%	14.39±3%	14.44±3%
	Vmp [V]	39.84	40.06	40.28	40.50
	I _{max} [Adc]	13.43	13.48	13.53	13.58
BNPI condition	Pmp [W] /Tolerance	590±3%	595±3%	601±3%	606±3%
	Voc [V] /Tolerance	47.46±3%	47.71±3%	47.96±3%	48.20±3%
	Isc [Adc] /Tolerance	15.73±3%	15.80±3%	15.86±3%	15.93±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-470HT-05	QN-475HT-05	QN-480HT-05	QN-485HT-05
STC condition	Pmp [W] /Tolerance	470±3%	475±3%	480±3%	485±3%
	Voc [V] /Tolerance	42.50±3%	42.78±3%	43.05±3%	43.31±3%
	Isc [Adc] /Tolerance	14.00±3%	14.06±3%	14.11±3%	14.17±3%
	Vmp [V]	35.44	35.69	35.93	36.16
	I _{max} [Adc]	13.26	13.31	13.36	13.41
BNPI condition	Pmp [W] /Tolerance	518±3%	524±3%	529±3%	535±3%
	Voc [V] /Tolerance	42.50±3%	42.78±3%	43.05±3%	43.31±3%
	Isc [Adc] /Tolerance	15.43±3%	15.50±3%	15.56±3%	15.63±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-490HT-05	QN-495HT-05	QN-500HT-05	QN-425HT-05
STC condition	Pmp [W] /Tolerance	490±3%	495±3%	500±3%	425±3%
	Voc [V] /Tolerance	43.59±3%	43.86±3%	44.12±3%	38.54±3%
	Isc [Adc] /Tolerance	14.23±3%	14.29±3%	14.34±3%	13.96±3%
	Vmp [V]	36.40	36.64	36.87	31.98
	I _{max} [Adc]	13.46	13.51	13.56	13.29
BNPI condition	Pmp [W] /Tolerance	540±3%	546±3%	551±3%	469±3%
	Voc [V] /Tolerance	43.59±3%	43.86±3%	44.12±3%	38.54±3%
	Isc [Adc] /Tolerance	15.69±3%	15.75±3%	15.82±3%	15.39±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-430HT-05	QN-435HT-05	QN-440HT-05	QN-445HT-05
STC condition	Pmp [W] /Tolerance	430±3%	435±3%	440±3%	445±3%
	Voc [V] /Tolerance	38.83±3%	39.13±3%	39.42±3%	39.70±3%
	Isc [Adc] /Tolerance	14.01±3%	14.07±3%	14.13±3%	14.19±3%
	Vmp [V]	32.23	32.49	32.74	32.99
	I _{max} [Adc]	13.34	13.39	13.44	13.49
BNPI condition	Pmp [W] /Tolerance	474±3%	480±3%	485±3%	491±3%
	Voc [V] /Tolerance	38.83±3%	39.13±3%	39.42±3%	39.70±3%
	Isc [Adc] /Tolerance	15.45±3%	15.52±3%	15.58±3%	15.64±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-450HT-05	QN-600HT-06	QN-605HT-06	QN-610HT-06
STC condition	Pmp [W] /Tolerance	450±3%	600±3%	605±3%	610±3%
	Voc [V] /Tolerance	39.98±3%	54.71±3%	54.93±3%	55.16±3%
	Isc [Adc] /Tolerance	14.25±3%	13.88±3%	13.94±3%	14.00±3%
	Vmp [V]	33.23	46.37	46.57	46.78
	I _{max} [Adc]	13.54	12.94	12.99	13.04
BNPI condition	Pmp [W] /Tolerance	496±3%	662±3%	667±3%	673±3%
	Voc [V] /Tolerance	39.98±3%	54.71±3%	54.93±3%	55.16±3%
	Isc [Adc] /Tolerance	15.71±3%	15.31±3%	15.37±3%	15.43±3%
	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-615HT-06	QN-620HT-06	QN-625HT-06	QN-630HT-06
STC condition	Pmp [W] /Tolerance	615±3%	620±3%	625±3%	630±3%
	Voc [V] /Tolerance	55.38±3%	55.60±3%	55.82±3%	56.04±3%
	Isc [Adc] /Tolerance	14.06±3%	14.11±3%	14.17±3%	14.23±3%
	Vmp [V]	46.98	47.18	47.38	47.58
	I _{max} [Adc]	13.09	13.14	13.19	13.24
BNPI condition	Pmp [W] /Tolerance	678±3%	684±3%	689±3%	695±3%
	Voc [V] /Tolerance	55.38±3%	55.60±3%	55.82±3%	56.04±3%
	Isc [Adc] /Tolerance	15.50±3%	15.56±3%	15.63±3%	15.69±3%
bifaciality coefficient	ϕP_{max}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-635HT-06	QN-555HT-06	QN-560HT-06	QN-565HT-06
STC condition	Pmp [W] /Tolerance	635±3%	555±3%	560±3%	565±3%
	Voc [V] /Tolerance	56.26±3%	51.01±3%	51.26±3%	51.32±3%
	Isc [Adc] /Tolerance	14.29±3%	13.77±3%	13.83±3%	13.94±3%
	Vmp [V]	47.78	43.02	43.24	43.30
	I _{max} [Adc]	13.29	12.90	12.95	13.05
BNPI condition	Pmp [W] /Tolerance	700±3%	612±3%	617±3%	623±3%
	Voc [V] /Tolerance	56.26±3%	51.01±3%	51.26±3%	51.32±3%
	Isc [Adc] /Tolerance	15.75±3%	15.18±3%	15.25±3%	15.37±3%
	ϕP_{max}	17.54±3%	16.91±3%	16.98±3%	17.11±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-570HT-06	QN-575HT-06	QN-580HT-06	QN-585HT-06
STC condition	Pmp [W] /Tolerance	570±3%	575±3%	580±3%	585±3%
	Voc [V] /Tolerance	51.55±3%	51.80±3%	52.03±3%	52.26±3%
	Isc [Adc] /Tolerance	13.99±3%	14.05±3%	14.11±3%	14.17±3%
	Vmp [V]	43.51	43.73	43.94	44.15
	I _{max} [Adc]	13.10	13.15	13.20	13.25
BNPI condition	Pmp [W] /Tolerance	628±3%	634±3%	640±3%	645±3%
	Voc [V] /Tolerance	51.55±3%	51.80±3%	52.03±3%	52.26±3%
	Isc [Adc] /Tolerance	15.43±3%	15.49±3%	15.56±3%	15.62±3%
bifaciality coefficient	ϕP_{max}	17.19±3%	17.26±3%	17.33±3%	17.40±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-510HT-06	QN-515HT-06	QN-520HT-06	QN-525HT-06
STC condition	Pmp [W] /Tolerance	510±3%	515±3%	520±3%	525±3%
	Voc [V] /Tolerance	47.01±3%	47.28±3%	47.54±3%	47.80±3%
	Isc [Adc] /Tolerance	13.73±3%	13.79±3%	13.85±3%	13.90±3%
	Vmp [V]	39.44	39.68	39.91	40.14
	I _{max} [Adc]	12.93	12.98	13.03	13.08
BNPI condition	Pmp [W] /Tolerance	562±3%	568±3%	573±3%	579±3%
	Voc [V] /Tolerance	47.01±3%	47.28±3%	47.54±3%	47.80±3%
	Isc [Adc] /Tolerance	15.14±3%	15.20±3%	15.27±3%	15.33±3%
	ϕP_{max}	16.86±3%	16.93±3%	17.00±3%	17.07±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-530HT-06	QN-535HT-06	QN-465HT-06	QN-470HT-06
STC condition	Pmp [W] /Tolerance	530±3%	535±3%	465±3%	470±3%
	Voc [V] /Tolerance	48.06±3%	48.30±3%	43.09±3%	43.37±3%
	Isc [Adc] /Tolerance	13.96±3%	14.02±3%	13.66±3%	13.72±3%
	Vmp [V]	40.37	40.59	35.96	36.21
	I _{max} [Adc]	13.13	13.18	12.93	12.98
BNPI condition	Pmp [W] /Tolerance	584±3%	590±3%	513±3%	518±3%
	Voc [V] /Tolerance	48.06±3%	48.30±3%	43.09±3%	43.37±3%
	Isc [Adc] /Tolerance	15.39±3%	15.46±3%	15.06±3%	15.12±3%
bifaciality coefficient	ϕP_{max}	17.15±3%	17.22±3%	16.77±3%	16.85±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-475HT-06	QN-480HT-06	QN-485HT-06	QN-415HT-06
STC condition	Pmp [W] /Tolerance	475±3%	480±3%	485±3%	415±3%
	Voc [V] /Tolerance	43.64±3%	43.93±3%	44.20±3%	38.80±3%
	Isc [Adc] /Tolerance	13.78±3%	13.83±3%	13.89±3%	13.54±3%
	Vmp [V]	36.45	36.70	36.94	32.20
	I _{max} [Adc]	13.03	13.08	13.13	12.89
BNPI condition	Pmp [W] /Tolerance	524±3%	529±3%	535±3%	458±3%
	Voc [V] /Tolerance	43.64±3%	43.93±3%	44.20±3%	38.80±3%
	Isc [Adc] /Tolerance	15.19±3%	15.25±3%	15.32±3%	14.93±3%
	ϕP_{max}	16.92±3%	16.99±3%	17.06±3%	16.63±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-420HT-06	QN-425HT-06	QN-430HT-06	QN-435HT-06
STC condition	Pmp [W] /Tolerance	420±3%	425±3%	430±3%	435±3%
	Voc [V] /Tolerance	39.10±3%	39.40±3%	39.69±3%	39.98±3%
	Isc [Adc] /Tolerance	13.60±3%	13.66±3%	13.71±3%	13.77±3%
	Vmp [V]	32.46	32.72	32.98	33.23
	I _{max} [Adc]	12.94	12.99	13.04	13.09
BNPI condition	Pmp [W] /Tolerance	463±3%	469±3%	474±3%	480±3%
	Voc [V] /Tolerance	39.10±3%	39.40±3%	39.69±3%	39.98±3%
	Isc [Adc] /Tolerance	14.99±3%	15.06±3%	15.12±3%	15.19±3%
bifaciality coefficient	ϕP_{max}	16.70±3%	16.77±3%	16.84±3%	16.91±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%
	ϕI_{sc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-440HT-06	QN-370HT-06	QN-375HT-06	QN-380HT-06
STC condition	Pmp [W] /Tolerance	440±3%	370±3%	375±3%	380±3%
	Voc [V] /Tolerance	40.28±3%	34.69±3%	35.01±3%	35.33±3%
	Isc [Adc] /Tolerance	13.83±3%	13.50±3%	13.56±3%	13.62±3%
	Vmp [V]	33.49	28.64	28.91	29.19
	I _{max} [Adc]	13.14	12.92	12.97	13.02
BNPI condition	Pmp [W] /Tolerance	485±3%	408±3%	413±3%	419±3%
	Voc [V] /Tolerance	40.28±3%	34.69±3%	35.01±3%	35.33±3%
	Isc [Adc] /Tolerance	15.25±3%	14.89±3%	14.95±3%	15.01±3%
	ϕP_{max}	16.98±3%	16.58±3%	16.65±3%	16.72±3%
	ϕV_{oc}	0.98±5%	0.98±5%	0.98±5%	0.98±5%

bifaciality coefficient	ϕ_{Isc}	0.8±10%	0.8±10%	0.8±10%	0.8±10%
	Maximum system voltage [V]	1500	1500	1500	1500
	Maximum Over-Current Protection Rating [A]	30	30	30	30
	Module type	QN-385HT-06	QN-390HT-06	-	
STC condition	Pmp [W] /Tolerance	385±3%	390±3%	-	
	Voc [V] /Tolerance	35.64±3%	35.96±3%	-	
	Isc [Adc] /Tolerance	13.67±3%	13.73±3%	-	
	Vmp [V]	29.46	29.73	-	
	I _{max} [Adc]	13.07	13.12	-	
BNPI condition	Pmp [W] /Tolerance	425±3%	430±3%	-	
	Voc [V] /Tolerance	35.64±3%	35.96±3%	-	
	Isc [Adc] /Tolerance	15.08±3%	15.14±3%	-	
bifaciality coefficient	ϕ_{Pmax}	16.79±3%	16.86±3%	-	
	ϕ_{Voc}	0.98±5%	0.98±5%	-	
	ϕ_{Isc}	0.8±10%	0.8±10%	-	
	Maximum system voltage [V]	1500	1500	-	
	Maximum Over-Current Protection Rating [A]	30	30	-	
Note: Further qualification for higher and/or lower output power see annex 3					

Information for testing sample:

Sample #	Sample Group ID	Type/model	Sample S/N	Remark
Material combination 1:				
M1-10 (GDP240092-1)	A	QN-685HT-01	26231193220542	Control module
M1-13 (GDP240092-2)	B	QN-685HT-01	26231193220850	OE/BT/HS
M1-4 (GDP240092-3)	C1	QN-685HT-01	26231193220795	UV/DML/TC50/ HF10/RT

M1-5 (GDP240092-4)	C2	QN-685HT-01	26231193220834	UV/DML/TC50/ HF10
M1-8 (GDP240092-5)	D1	QN-685HT-01	26231193220849	TC200
M1-9 (GDP240092-6)	D2	QN-685HT-01	26231193220642	TC200
M1-6 (GDP240092-7)	E1	QN-685HT-01	26231193220821	DH1000/SML
M1-7 (GDP240092-8)	E2	QN-685HT-01	26231193220801	DH1000/HT
M1-18 (GDP240092-9)	F1	QN-685HT-01	26231193220446	PID
M1-19 (GDP240092-10)	F2	QN-685HT-01	26231193220547	PID
M1-20 (GDP240092-11)	F3	QN-685HT-01	26231193220839	PID
M1-21 (GDP240092-12)	F4	QN-685HT-01	26231193220820	PID
GDP240092-22	Low 1-1	QN-670HT-01	26231193220698	Lower end power class
GDP240092-23	Low 1-2	QN-670HT-01	26231193220813	Lower end power class
GDP240092-24	High 1-1	QN-710HT-01	26231193220835	Higher end power class
GDP240092-25	High 1-2	QN-710HT-01	26231193220695	Higher end power class
Material combination 2:				
M2-10 (GDP230270-1)	A1	QN-560HT-06	26221093600003	Control module
M2-4 (GDP230270-3)	C1	QN-560HT-06	26221093600004	UV/DML/TC50/ HF/RT
M1-5 (GDP230270-4)	C2	QN-560HT-06	26221093600005	UV/DML/TC50/ HF
M2-11 (GDP240090-1)	A2	QN-580HT-06	26231193223792	Control module
M2-13 (GDP240090-2)	B	QN-580HT-06	26231193223793	HS
M2-18 (GDP240090-3)	F1	QN-580HT-05	26231193223790	PID

M2-19 (GDP240090-4)	F2	QN-580HT-05	26231193223797	PID
M2-20 (GDP240090-5)	F3	QN-580HT-05	26231193223799	PID
M2-21 (GDP240090-6)	F4	QN-580HT-05	26231193223791	PID
Material combination 3:				
M3-10 (GDP240390-1)	A	QN-615HT-06	26231293246161	Control module
M3-13 (GDP240390-2)	B	QN-615HT-06	26231293246116	BT/HS
GDP240390-3	Low 3-1	QN-600HT-06	26231293246093	Lower end power class
GDP240390-4	Low 3-2	QN-600HT-06	26231293246299	Lower end power class
GDP240390-5	High 3-1	QN-635HT-06	26231293246346	Higher end power class
GDP240390-6	High 3-2	QN-635HT-06	26231293246107	Higher end power class
Material combination 4:				
M4-10 (GDP240200-1)	A	QN-595HT-02	26231193209190	Control module
M4-13 (GDP240200-2)	B	QN-595HT-02	26231193209305	HS
M4-4 (GDP240200-3)	C1	QN-595HT-02	26231193210899	UV/DML/TC50/ HF10
M4-5 (GDP240200-4)	C2	QN-595HT-02	26231193210911	UV/DML/TC50/ HF10
M4-8 (GDP240200-5)	D1	QN-595HT-02	26231193210905	TC200
M4-9 (GDP240200-6)	D2	QN-595HT-02	26231193210897	TC200
M4-6 (GDP240200-7)	E1	QN-595HT-02	26231193208944	DH1000/SML
M4-7 (GDP240200-8)	E2	QN-595HT-02	26231193209373	DH1000/HT
M4-18 (GDP240200-9)	F1	QN-595HT-02	26231193210907	PID
M4-19	F2	QN-595HT-02	26231193210378	PID

(GDP240200-10)				
M4-20 (GDP240200-11)	F3	QN-595HT-02	26231193210760	PID
M4-21 (GDP240200-12)	F4	QN-595HT-02	26231193210777	PID
GDP240200-13	Low 2-1	QN-585HT-02	26231193210916	Lower end power class
GDP240200-14	Low 2-2	QN-585HT-02	26231193210779	Lower end power class
GDP240200-15	High 2-1	QN-620HT-02	26231193210789	Higher end power class
GDP240200-16	High 2-2	QN-620HT-02	26231193210739	Higher end power class
Remark: N/A				

Attachments:

	attachment number / number of pages
Installation manual	QN3-TD-046 Modules Installation Manual, Ver: A2
Drawings mechanical	Refer to Annex 2 of 704062316712-00 part 2 of 2
Circuit diagram	Refer to Annex 2 of 704062316712-00 part 2 of 2
Photographs	Attachment 1 / 6 pages
Component datasheets / certificates	Refer to TÜV SÜD Application forms
Others:	N/A
Product Description Sheet (Manufacturers and type references)	Annex 1, _12_ pages
Test table for verifying other stabilization procedure	Annex 2, _N/A_ pages
Lower and higher output power modules	Annex 3, _11_ pages
List of test equipment used	Annex 4, _N/A_ pages

If additional information is necessary, please provide

N/A

Copy of marking plate:



Q-SUN ANHUI CO.,LTD

Read the installation and operating manual before installing, operating or service unit.

WARNING
Made in China

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CE, RoHS, and other certification logos

*Considering LID, the power range of the certification, tolerance (Pmax)±3%, (Voc)±3%, (Isc)±5%

PTYPE	STC	BNPI
Pmax:	685W*	755W*
Vmp:	39.92V	39.92V
Imp:	17.16A	18.92A
Voc:	47.55V*	47.55V*
Isc:	18.24A*	20.11A*

Product: Mono Solar Module
Type: QN-685HT-01

Power Selection 0~5W
Max. System Voltage 1500 VDC
Max. Series Fuse Rating 35A
PV module Classification Class II
Fire safety Class C
Isc(BSI) 22.39A*

STC Condition: 1000W/m², 25°C, AM1.5
BSI: front 1000W/m², rear 300W/m²

Cell Technology Mono
Min. design load -1600Pa/+3600Pa
PV module 98th percentile operating temp. 70°C
PV connector manufacture: JM THY
PV connector type: PV-JM608
PV connector: see manual for designated connectors
Field Wiring: Copper only 1X4mm² min. insulated for 90°C min
Bifacial coefficients
φPmax=0.8±10%, φVoc=0.98±5%, φIsc=0.8±10%
BNPI Condition: front 1000W/m², rear 135W/m², 25°C, AM1.5

Picture of the product:

Refer to Attachment 1 of TRF 704062316712-00

Summary of testing:

1. Full tests according to IEC 61215-1:2021, IEC 61215-1-1:2021, IEC 61215-2:2021 were conducted on representative model QN-685HT-01 with material combination 1 (samples M1-x).

Below model types were included:

132 cells (210x105mm, N type) modules:

QN-xxxHT-01, xxx = 670 to 710 in steps of 5

120 cells (210x105mm, N type) modules:

QN-xxxHT-01, xxx = 610 to 645 in steps of 5

All models in each family bin are identical in structure, except for different output power,

QN-670HT-01 & QN-710HT-01 were selected as the representative models for qualification of lower end & higher end power class.

Below material components & combinations were verified (refer to Annex 1: Product Description Sheet for details).

Superstrate	Dongli 2.0mm Heat strengthened AR-coated glass
Encapsulant	JCC-305T / JCC-105P-T
Solar Cell	CZJT-210M-18D1
Interconnector	Tianwei ϕ 0.26mm round wire ribbon, 0.3x4 & 0.35x6mm string connector
Flux	FD-309
Substrate	Dongli 2.0mm Heat strengthened glass with white glaze
Junction box	JM37xy
Potting material	FS-8206A
Frame	Frame 6005-T6 Anodized aluminum alloy, 35mm height
Adhesive	FS-996
Fixing tape	T5065
Label	AVERY PET

2. Based on TÜV SÜD certificate Z2 104991 0004 Rev. 04, updated the testing standards from 'IEC 61215-1:2016, IEC 61215-1-1:2016, IEC 61215-2:2016' to 'IEC 61215-1:2021, IEC 61215-1-1:2021, IEC 61215-2:2021' for modules with TOPCon cells 182M 247 16BB 10SEG NFJ-TBNU & 182R MBB NFH-TBNU,

3. Redefined the module model names as below:

144 cells (182x93.4 mm, N type) modules:

QN-xxxHT-05, xxx = 565 to 600 in steps of 5

132 cells (182x93.4 mm, N type) modules:

QN-xxxHT-05, xxx = 520 to 550 in steps of 5

120 cells (182x93.4 mm, N type) modules:

QN-xxxHT-05, xxx = 470 to 500 in steps of 5

108 cells (182x93.4 mm, N type) modules:

QN-xxxHT-05, xxx = 425 to 450 in steps of 5

144 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 555 to 585 in steps of 5

132 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 510 to 535 in steps of 5

120 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 465 to 485 in steps of 5

108 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 415 to 440 in steps of 5

96 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 370 to 390 in steps of 5

Following gap tests were conducted on representative models QN-580HT-05 & QN-560HT-06 with material combination 2 (samples M2-x) for above modifications 2~3:

Hot-spot endurance test (MQT 09)

UV preconditioning test (MQT 10)

Thermal cycling test, 50 cycles (MQT 11)

Humidity freeze test (MQT 12)

Cyclic (dynamic) mechanical load test (MQT 20)

Potential induced degradation test (MQT 21)

4. Included below similar model types:

156 cells (182x91, N type) modules:

QN-xxxHT-06, xxx = 600 to 635 in steps of 5

Following tests were conducted on representative model QN-615HT-06 with material combination 3 (samples M3-x) according to retest guideline 4.2.7, 4.2.8 of IEC TS 62915 Edition 2.0 for above modification 4:

Hot-spot endurance test (MQT 09)

Bypass diode thermal test (MQT 18)

QN-600HT-06 & QN-635HT-06 were selected as the representative models for qualification of lower end & higher end power class.

5. Added alternative TOPCon Cells JACMKTB-D, JACMLTB-D & JACMHTB-D with different cut sizes,

6. Included below model types:

132 cells (182x105mm, N type) modules:

QN-xxxHT-02, xxx = 585 to 620 in steps of 5

120 cells (182x105mm, N type) modules:

QN-xxxHT-02, xxx = 535 to 565 in steps of 5

108 cells (182x105mm, N type) modules:

QN-xxxHT-02, xxx = 480 to 505 in steps of 5

96 cells (182x105mm, N type) modules:

QN-xxxHT-02, xxx = 425 to 450 in steps of 5

144 cells (182x99.5mm, N type) modules:

QN-xxxHT-03, xxx = 605 to 640 in steps of 5

132 cells (182x99.5mm, N type) modules:

QN-xxxHT-03, xxx = 555 to 585 in steps of 5

120 cells (182x99.5mm, N type) modules:

QN-xxxHT-03, xxx = 505 to 530 in steps of 5

108 cells (182x99.5mm, N type) modules:

QN-xxxHT-03, xxx = 455 to 480 in steps of 5

144 cells (182x95.8mm, N type) modules:

QN-xxxHT-04, xxx = 585 to 615 in steps of 5

132 cells (182x95.8mm, N type) modules:

QN-xxxHT-04, xxx = 535 to 560 in steps of 5

108 cells (182x95.8mm, N type) modules:

QN-xxxHT-04, xxx = 440 to 460 in steps of 5

7. Added following alternative manufacturer for Cell interconnector & String connector: JingLan Advanced Material Co., Ltd.,

8. Added below material combination:

Cell JACMKTB-D, JACMLTB-D, JACMHTB-D + Encapsulant S102 / S101 + Substrate black glaze glass + Adhesive HT906Z + J-box JM07w,

Following tests were conducted on representative model QN-595HT-02 with material combination 4 (samples M4-x) according to retest guideline 4.2.3, 4.2.4, 4.2.8 of IEC TS 62915 Edition 2.0 for above modifications 5~8:

Hot-spot endurance test (MQT 09)

UV preconditioning test (MQT 10)

Thermal cycling test, 50 & 200 cycles (MQT 11)

Humidity freeze test (MQT 12)

Damp heat test (MQT 13)

Static mechanical load test (MQT 16)

Cyclic (dynamic) mechanical load test (MQT 20)

Potential-Induced Degradation (MQT 21)

QN-585HT-02 & QN-620HT-02 were selected as the representative models for qualification of lower end & higher end power class.

9. Added below alternative Electrical terminations:

a) J-box: PV-GZX306 and related Potting material, bypass diodes, Cables, Connectors,

b) J-box: 3Qxy and related Potting material, bypass diodes, Cables, Connectors,

c) J-box: OSTA-03 and related Potting material, bypass diodes, Cables, Connectors,

Verification tests were performed on component level in TÜV SÜD reports 704071614003-14, 704071902004-05 & 04071914601-06, so no test was considered to be necessary in this report.

10. Added below alternative manufacturers for Cell interconnector & String connector with same material:

a) Jiangsu Lanxin New Energy Technology CO., Ltd.

b) Jiangsu Zhongdao new material science and Technology Co., Ltd.

No test was considered to be necessary in this report.

☐ deviation(s) found

☒ no deviations found

Additional information on Non-standard test method(s)	
Sub clause:	N/A
Page:	N/A
Rational:	N/A
Possible test case verdicts:	
test case does not apply to the test object:	N/A (not applicable / not included in the order)
test object does meet the requirement:	P (Pass)
test object does not meet the requirement:	F (Fail)
General remarks: <i>"(see remark #)" refers to a remark appended to the report.</i> <i>"(see appended table)" refers to a table appended to the report.</i> <i>Throughout this report a comma is used as the decimal separator.</i> <i>The test results presented in this report relate only to the object tested.</i> <i>This report shall not be reproduced except in full without the written approval of the testing laboratory.</i>	

10. Modifications:

Modifications:

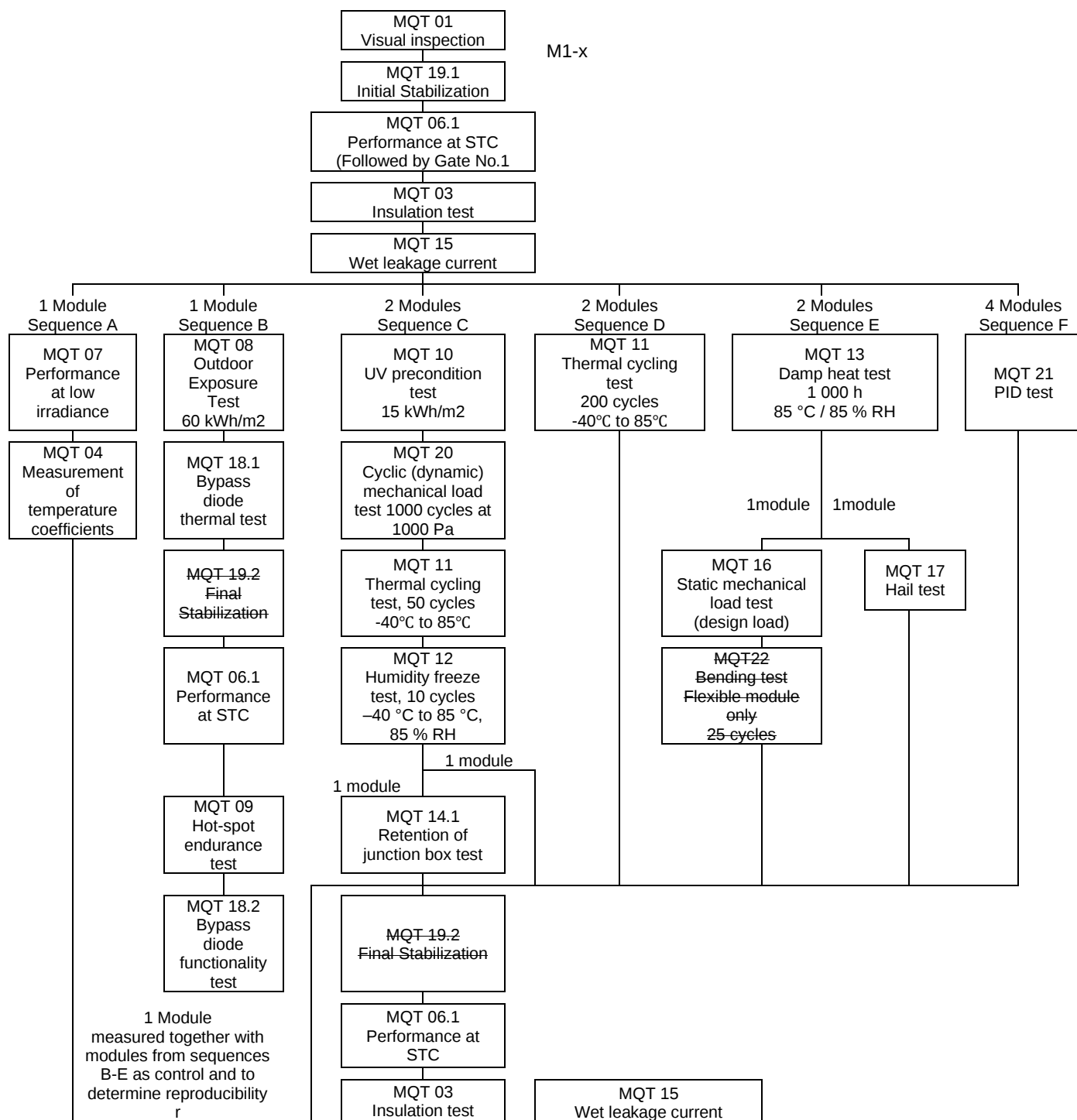
- ☒ Initial module design qualification
- ☐ Extension of module design qualification
- ☐ Original test report ref. No.:

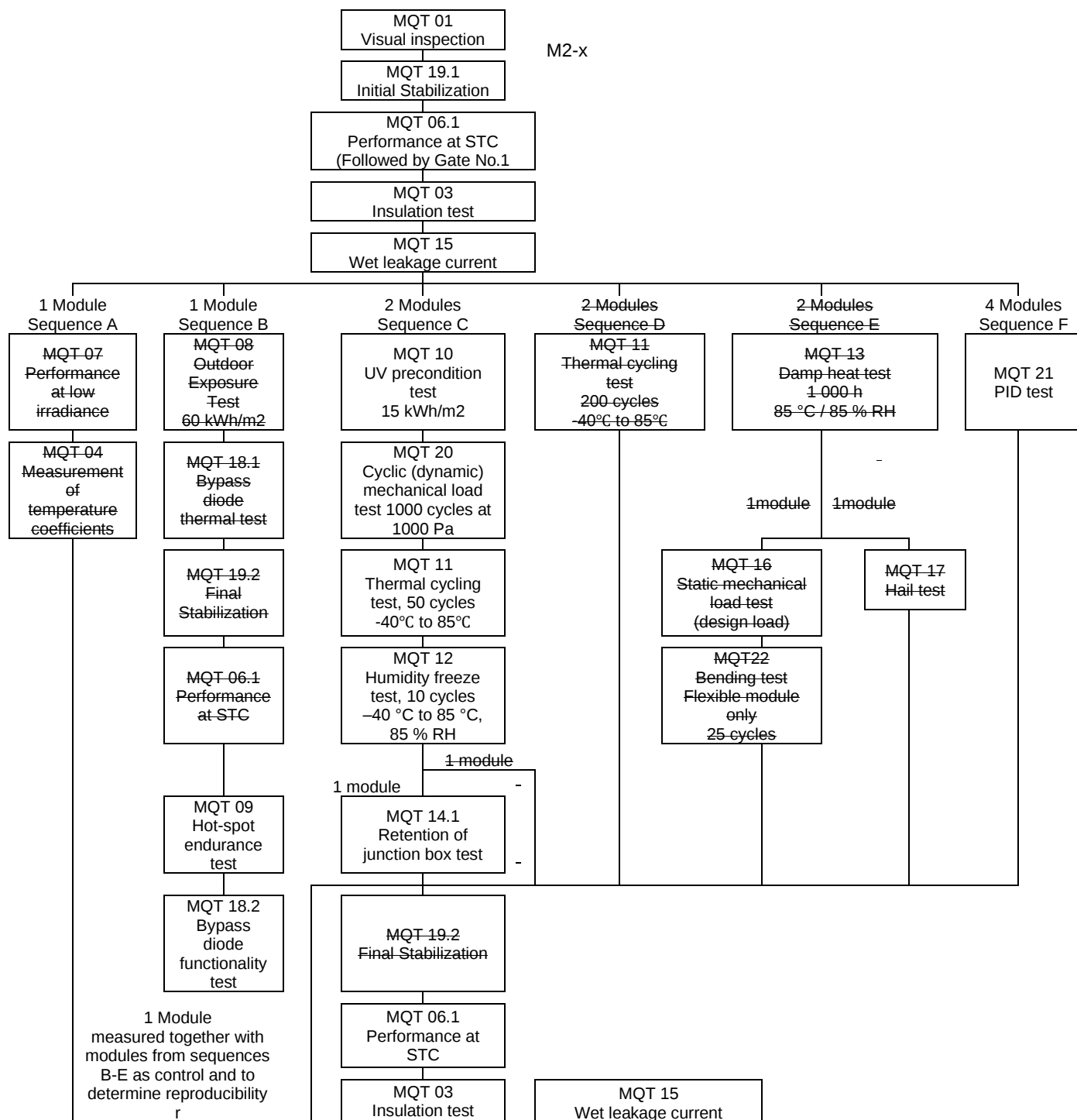
Model differences and modification:

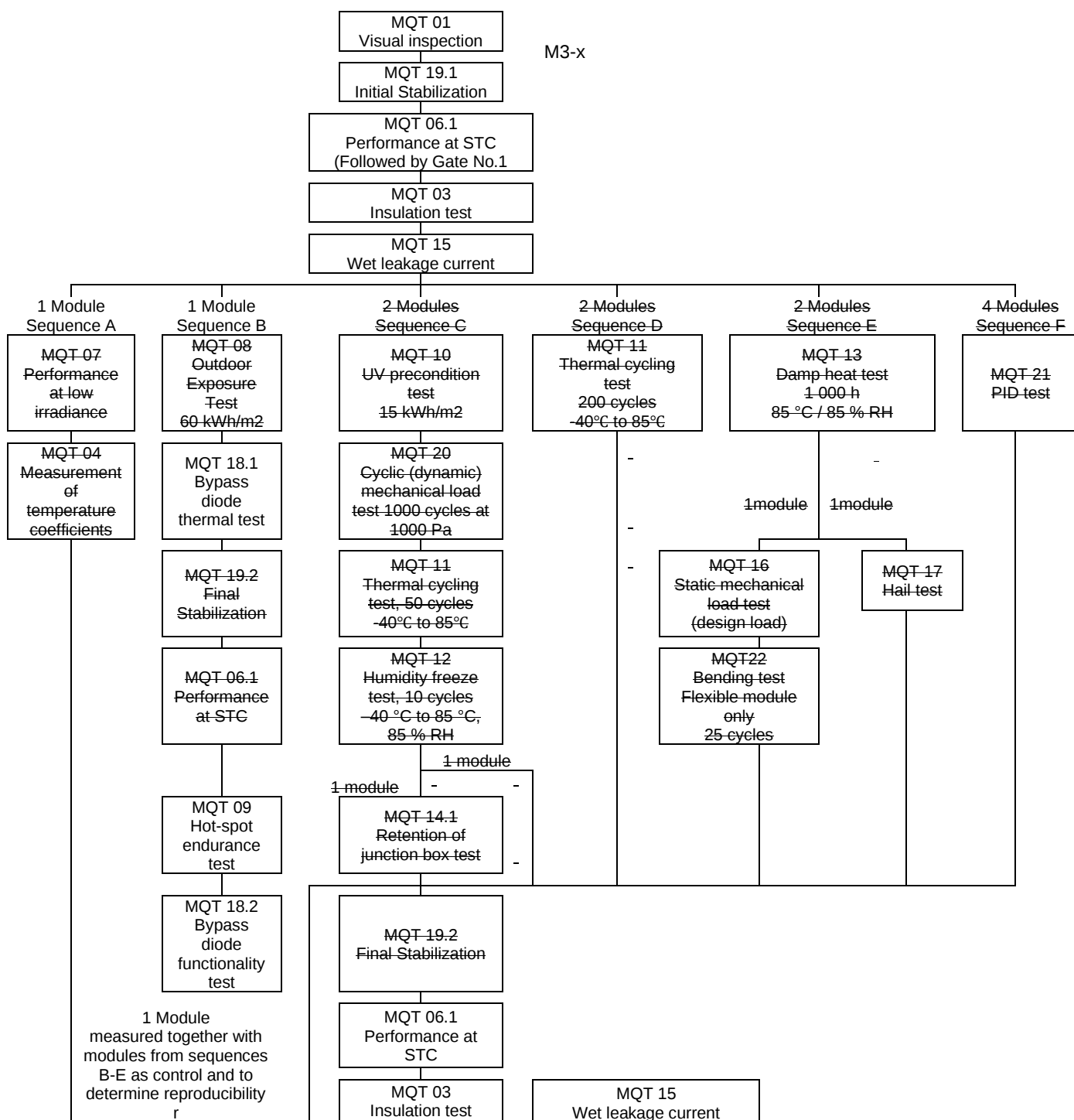
- | | |
|--|---|
| ☐ Test programs for crystalline silicon PV modules | ☐ Test programs for thin-film PV modules |
| ☐ 4.2.1 Modification to frontsheet | ☐ 4.3.1 Modification to frontsheet |
| ☐ 4.2.2 Modification to encapsulation system | ☐ 4.3.2 Modification to encapsulation system |
| ☐ 4.2.3 Modification to cell technology | ☐ 4.3.3 Modification to front contact (e. g. TCO) |
| ☐ 4.2.4 Modification to cell and string interconnect material or technique | ☐ 4.3.4 Modification to cell technology |
| ☐ 4.2.5 Modification to backsheet | ☐ 4.3.5 Modification to cell layout |
| ☐ 4.2.6 Modification to electrical termination | ☐ 4.3.6 Modification to back contact |
| ☐ 4.2.7 Modification to bypass diode | ☐ 4.3.7 Modification to edge deletion |
| ☐ 4.2.8 Modification to electrical circuitry | ☐ 4.3.8 Modification to interconnect material or technique |
| ☐ 4.2.9 Modification to edge sealing | ☐ 4.3.9 Modification to backsheet |
| ☐ 4.2.10 Modification to frame and/or mounting structure | ☐ 4.3.10 Modification to electrical termination |
| ☐ 4.2.11 Change in PV module size | ☐ 4.3.11 Modification to bypass diode |
| ☐ 4.2.12 Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process | ☐ 4.3.12 Modification to edge sealing |
| ☐ 4.2.13 Increase of over-current protection rating | ☐ 4.3.13 Modification to frame and/or mounting structure |
| ☐ 4.2.14 Increase of system voltage | ☐ 4.3.14 Change in PV module size |
| ☐ 4.2.15 Change in cell fixing tape | ☐ 4.3.15 Higher or lower output power (by 10 % or more) with the identical design and size |
| ☐ Others (material combinations) | ☐ 4.3.16 Increase of over-current protection rating |
| | ☐ 4.3.17 Increase of system voltage |

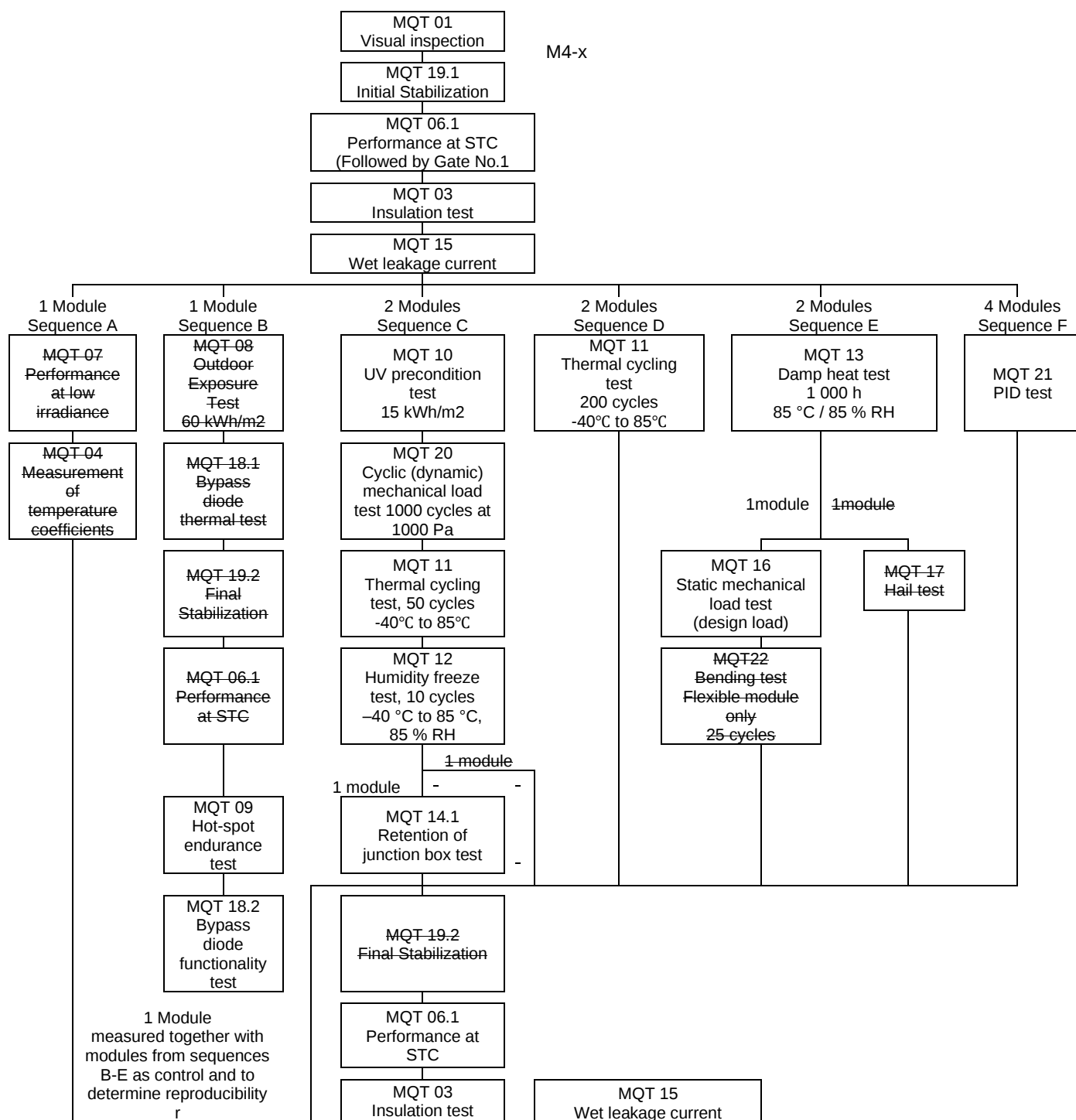
Note: The clause references modifications extracted from IEC 62915

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.
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IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict

5. Marking and Documentation			P
5.1	Name Plate		
	All electrical data shall be shown as relative to STC (1 000 W/m ² , 25 °C, AM1.5 according to IEC TS 61836), except for bifacial modules where two irradiance levels are required, 1 000 W/m ² and BNPI (higher irradiance at which nameplate verification is performed for bifacial modules, corresponding to 1 000 W/m ² on the module front and 135 W/m ² on the module rear, applied in any method allowed by IEC TS 60904-1-2).	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	QSUN solar (logo)	P
	b. Type or model number designation	Marked on label	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	1500V DC	P
	f. Class of protection against electrical shock	Class II	P
	g. Voltage at open-circuit or Voc including tolerances. For bifacial modules, open-circuit voltage shall be reported at two irradiance levels. The first required irradiance level is 1 000 W/m ² . The second required irradiance is BNPI	Marked on label	P
	h. Current at short-circuit or Isc including tolerances. For bifacial modules, short-circuit current shall be reported at two irradiance levels, defined in 5.1g	Marked on label	P
	i. Module maximum power or Pmax including tolerances. For bifacial modules, Pmax shall be reported at the two irradiance levels, defined in 5.1g	Marked on label	P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	j. For bifacial modules the following information including tolerances, shall be given on the nameplate: The values for the short-circuit current bifaciality coefficient ϕ_{sc} , the open-circuit voltage bifaciality coefficient ϕ_{Voc} , and the maximum power bifaciality coefficient ϕ_{Pmax} , measured at STC as defined in IEC TS 60904-1-2		P
	k. For flexible modules, the minimum radius of curvature		N/A
5.2	Documentation		P
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		—
	a. All information required under 5.1 e) to i)		P
	b. Overcurrent protection device type and rating are e.g. given in IEC 60269-6		P
	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. Performance at low irradiance (MQT 07) is specified		N/A
	International symbols used where applicable		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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		—
	h. The minimum cable diameters for modules intended for field wiring		P
	i. Any limitations on wiring methods and wire management that apply to the wiring compartment or box;		P
	j. The size, type, material and temperature rating of the conductors to be used		P
	k. Type of terminals for field wiring		N/A
	l. Specific PV connector model/types and manufacturer to which the module connectors are mated		P
	m. The bonding method(s) to be used (if applicable); all provided or specified hardware is identified in the documentation		P
	n. The type and ratings of bypass diode to be used (if applicable)		P
	o. limitations to the mounting situation (e.g., slope, orientation, mounting means, cooling)		P
	p. 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
	q. 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: <i>"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."</i>		P
5.2.3	Assembly instructions		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Provided with a product shipped in subassemblies, detailed and adequate to the degree required to facilitate complete and safe assembly of the product		P
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	t ₄	—
	manufacturer’s rated lower/upper production tolerance in %	-3	+3	+3	+3	
		m ₁	m ₂	m ₃		
	measurement uncertainty in % of laboratory	2.24	1.10	1.84		
	Laboratory reproducibility r	0.26				
	After stabilization, each individual module meets the requirements					P
	P _{max}		See Table 03.1, Table 03.3			P
	V _{oc}		See Table 03.1, Table 03.3			P
	I _{sc}		See Table 03.1, Table 03.3			P
	After stabilization the arithmetic average $\bar{P}$ max of all modules meet the requirements.		See Table 03.1, Table 03.3			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 at the beginning and the end of each sequence					P
	The wet leakage current test (MQT 15) requirements met at the beginning and at the end of each sequence					P

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Clause	Requirement + Test	Result - Remark	Verdict
	Specific requirements of the individual tests are met		P
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 02.1 - 02.6	P
4.6	Performance at STC &BNPI (MQT 06.1)	See Table 03.1 - 03.3	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	5 Modules	Samples A	P
4.7	Performance at low irradiance(MQT 07)	See Table 06.1 - 06.2	P
4.4	Measurement of temperature coefficients(MQT 04)	See Table 07	P

Sequence B	4 Modules	Sample B	P
4.8	Outdoor exposure test(MQT 08)	See Table 08	P
4.18.1	Bypass diode thermal test (MQT 18.1)		P
	Maximum allowed junction temperature	200	—
	Calculated junction temperature	See Table 09	—
	Final measurements.....	See Table 09	P
4.18.2	Bypass diode functionality test (MQT 18.2)	See Table 10	P
4.19.6	Final stabilization (MQT 19.2)	See Table 10.1 – 10.3	N/A
4.9	Hot spot endurance test (MQT 09)	See Table 11	P

Sequence C	6 Modules	Samples C1; C2	P
4.10	UV preconditioning test (MQT 10)	See Table 12.1 - 12.6	P
4.20	Cyclic (dynamic) mechanical load test (MQT 20)	See Table 13	P
4.11	Thermal cycling test 50 cycles (MQT 11).....	See Table 14	P
4.12	Humidity-freeze test (MQT 12).....	See Table 15	P

Sequence C1	3 Modules	Sample C1	P
4.14.2	Retention of junction box on mounting surface (MQT 14.1)	See Table 16	P
4.14.3	Test of cord anchorage (MQT 14.2)		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.14.3.1	The junction box, separate from the module, shall be tested to IEC 62790 "Test of cord anchorage" and shall meet the requirements therein	See list of attachments	P
Sequence D	4 Modules	Sample D1; D2	P
4.11	Thermal cycling test 200 cycles (MQT 11)	See Table 17	P
Sequence E	4 Modules	Samples E1; E2	P
4.13	Damp heat test (MQT 13)	See Table 18	P
4.19.6	Final stabilization (MQT 19.2)	See Table 23.3	P
Sequence E1	2 Modules	Sample E1	P
4.16	Static mechanical load test (MQT 16)	See Table 19	P
4.22	Bending test (MQT 22)	See Table 20	N/A
Sequence E2	2 Modules	Sample E2	P
4.17	Hail test (MQT 17)	See Table 21	P
Sequence F	12 Modules	Sample F1; F2; F3; F4	P
4.21	Potential induced degradation test (MQT 21)	See Table 22	P
4.19.6	Final stabilization (MQT 19.2)	See Table 23.4, 23.6, 23.7	P
	Final measurement	All modules for Sequence C, D, E, F; Control module for Sequence A	P
4.19.6	Final stabilization (MQT 19.2)	See Table 23.1 - 23.2	N/A
4.6	Performance at STC&BNPI(MQT 06.1)	See Table 23.5, 23.8	P
4.3	Insulation test(MQT 03)	See Table 23.9	P
4.15	Wet leakage current test(MQT 15)	See Table 23.10	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]..... :	2023-12-15 for M1-x, M4-x 2022-12-25 for M2-10, M2-4, M2-5 2023-12-05 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-05 for M3-x		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-10	No major visual defects found		P
M1-13	No major visual defects found		P
M1-4	No major visual defects found		P
M1-5	No major visual defects found		P
M1-8	No major visual defects found		P
M1-9	No major visual defects found		P
M1-6	No major visual defects found		P
M1-7	No major visual defects found		P
M1-18	No major visual defects found		P
M1-19	No major visual defects found		P
M1-20	No major visual defects found		P
M1-21	No major visual defects found		P
M2-10	No major visual defects found		P
M2-4	No major visual defects found		P
M2-5	No major visual defects found		P
M2-11	No major visual defects found		P
M2-13	No major visual defects found		P
M2-18	No major visual defects found		P
M2-19	No major visual defects found		P
M2-20	No major visual defects found		P
M2-21	No major visual defects found		P
M3-10	No major visual defects found		P
M3-13	No major visual defects found		P
M4-10	No major visual defects found		P
M4-13	No major visual defects found		P
M4-4	No major visual defects found		P
M4-5	No major visual defects found		P

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Clause	Requirement + Test	Result - Remark	Verdict
M4-8	No major visual defects found		P
M4-9	No major visual defects found		P
M4-6	No major visual defects found		P
M4-7	No major visual defects found		P
M4-11	No major visual defects found		P
M4-18	No major visual defects found		P
M4-19	No major visual defects found		P
M4-20	No major visual defects found		P
M4-21	No major visual defects found		P
Supplementary information: N/A			

TABLE 02: MQT 19.1 ini: Initial stabilization							P
TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization (Front side)							
Test Date [YYYY-MM-DD]..... :		2023-12-15 for M1-x, M4-x 2022-12-25 for M2-10, M2-4, M2-5 2023-12-05 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-05 for M3-x					—
Test method		☒ Simulator ☐ Natural sunlight					—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
M1-10	18.226	47.501	17.102	40.320	689.553	79.65	—
M1-13	17.975	47.540	17.079	40.400	689.992	80.75	—
M1-4	18.075	47.571	17.047	40.424	689.108	80.14	—
M1-5	17.983	47.467	17.118	40.228	688.623	80.67	—
M1-8	18.043	47.451	17.103	40.200	687.541	80.31	—
M1-9	17.960	47.450	17.118	40.270	689.342	80.89	—
M1-6	18.013	47.494	17.099	40.269	688.560	80.49	—
M1-7	18.273	47.556	17.086	40.346	689.352	79.33	—
M1-18	18.035	47.538	17.084	40.362	689.544	80.43	—
M1-19	17.998	47.498	17.108	40.306	689.555	80.66	—
M1-20	18.049	47.467	17.071	40.320	688.303	80.34	—
M1-21	18.027	47.466	17.087	40.270	688.093	80.42	—
M2-10	13.459	51.848	12.921	43.899	567.211	81.28	—

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Clause	Requirement + Test				Result - Remark		Verdict
M2-4	13.495	51.843	12.933	43.906	567.816	81.16	—
M2-5	13.471	51.826	12.930	43.897	567.559	81.29	—
M2-11	14.221	51.656	13.527	43.156	583.771	79.47	—
M2-13	14.233	51.628	13.518	43.202	584.005	79.48	—
M2-18	14.175	51.572	13.517	43.161	583.407	79.81	—
M2-19	14.287	51.633	13.616	43.052	586.196	79.46	—
M2-20	14.194	51.628	13.542	43.139	584.188	79.72	—
M2-21	14.187	51.617	13.551	43.169	584.983	79.88	—
M3-10	13.640	56.184	12.981	47.874	621.452	81.09	—
M3-13	13.636	55.987	13.003	47.733	620.672	81.30	—
M4-10	15.509	47.719	14.720	40.443	595.321	80.44	—
M4-13	15.671	47.759	14.785	40.441	597.920	79.89	—
M4-4	15.648	47.772	14.812	40.398	598.375	80.05	—
M4-5	15.738	47.858	14.809	40.683	602.475	79.99	—
M4-8	15.739	47.810	14.814	40.407	598.589	79.55	—
M4-9	15.655	47.794	14.824	40.332	597.882	79.91	—
M4-6	15.687	47.756	14.837	40.367	598.925	79.95	—
M4-7	15.502	47.830	14.783	40.456	598.061	80.66	—
M4-18	15.696	47.664	14.829	40.370	598.647	80.02	—
M4-19	15.496	47.676	14.816	40.319	597.366	80.86	—
M4-20	15.748	47.534	14.870	40.314	599.469	80.08	—
M4-21	15.653	47.564	14.825	40.307	597.551	80.26	—
Supplementary information: N/A							
TABLE 02.2: MQT 06.1 ini: Performance at STC before initial stabilization (Back side)							P
Test Date [YYYY-MM-DD]..... :				2023-12-15 for M1-x, M4-x 2022-12-25 for M2-10, M2-4, M2-5 2023-12-05 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-05 for M3-x			—
Test method..... :				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
M1-10	14.594	47.135	13.078	41.099	537.493	78.14	—
M1-13	14.617	47.193	13.139	41.108	540.118	78.30	—

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Clause	Requirement + Test				Result - Remark		Verdict
M1-4	14.703	47.196	13.083	41.140	538.235	77.56	—
M1-5	14.539	47.102	13.124	40.919	537.021	78.42	—
M1-8	14.884	47.066	13.020	41.014	534.002	76.23	—
M1-9	15.084	47.028	13.072	40.963	535.468	75.49	—
M1-6	14.889	47.083	13.140	40.935	537.886	76.73	—
M1-7	14.911	47.147	13.119	41.025	538.207	76.56	—
M1-18	15.013	47.119	13.029	41.187	536.625	75.86	—
M1-19	15.087	47.161	13.133	41.052	539.136	75.77	—
M1-20	14.825	47.188	13.073	41.096	537.248	76.80	—
M1-21	15.028	47.092	13.182	40.848	538.458	76.09	—
M2-10	10.476	51.429	9.903	44.572	441.388	81.93	—
M2-4	10.396	51.441	9.968	44.306	441.655	82.59	—
M2-5	10.429	51.391	9.873	44.647	440.795	82.24	—
M2-11	11.313	51.052	10.198	45.411	463.101	80.18	—
M2-13	11.383	51.057	10.235	45.397	464.638	79.95	—
M2-18	11.338	51.168	10.205	45.341	462.705	79.76	—
M2-19	11.322	51.045	10.172	45.414	461.951	79.93	—
M2-20	11.389	51.083	10.179	45.521	463.358	79.64	—
M2-21	11.392	51.048	10.207	45.428	463.684	79.73	—
M3-10	10.637	55.769	9.658	48.549	468.886	79.04	—
M3-13	10.511	55.456	9.593	48.422	464.512	79.69	—
M4-10	12.540	47.283	11.014	41.077	452.422	76.30	—
M4-13	11.981	47.317	10.862	41.396	449.643	79.32	—
M4-4	12.378	47.374	10.911	41.324	450.886	76.89	—
M4-5	12.495	47.419	10.937	41.452	453.361	76.52	—
M4-8	12.012	47.454	11.009	41.099	452.459	79.38	—
M4-9	12.222	47.361	10.670	41.237	439.999	76.01	—
M4-6	11.987	47.397	10.751	41.497	446.134	78.52	—
M4-7	12.460	47.430	10.766	41.507	446.864	75.61	—
M4-18	11.979	47.262	10.775	41.455	446.678	78.90	—
M4-19	12.510	47.333	10.794	41.467	447.595	75.59	—

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Clause	Requirement + Test				Result - Remark		Verdict
M4-20	12.029	47.161	10.999	41.068	451.707	79.62	—
M4-21	12.218	47.171	10.705	41.273	441.827	76.66	—
Supplementary information: N/A							
TABLE 02.3: MQT 06.1 ini: Performance at BNPI (front side irradiance 1000 W/m², back side irradiance 135 W/m², 25 °C, AM 1.5) before initial stabilization							P
Test Date [YYYY-MM-DD]..... :			2023-12-15 for M1-x, M4-x 2022-12-25 for M2-10, M2-4, M2-5 2023-12-05 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-05 for M3-x				—
Test method			☒ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
M1-10	20.103	47.677	18.920	40.313	762.722	79.58	—
M1-13	19.873	47.735	18.899	40.400	763.520	80.49	—
M1-4	19.977	47.717	18.864	40.401	762.124	79.95	—
M1-5	19.874	47.625	18.934	40.234	761.791	80.49	—
M1-8	19.909	47.680	18.873	40.304	760.657	80.13	—
M1-9	19.811	47.620	18.902	40.263	761.051	80.67	—
M1-6	19.884	47.702	18.863	40.348	761.084	80.24	—
M1-7	20.165	47.729	18.886	40.308	761.257	79.10	—
M1-18	19.894	47.710	18.883	40.317	761.306	80.21	—
M1-19	19.853	47.683	18.897	40.306	761.662	80.46	—
M1-20	19.927	47.728	18.849	40.383	761.179	80.03	—
M1-21	19.917	47.670	18.863	40.358	761.273	80.18	—
M2-10	14.887	52.020	14.320	43.883	628.386	81.14	—
M2-4	14.922	52.020	14.226	44.248	629.457	81.09	—
M2-5	14.907	52.019	14.357	43.850	629.552	81.19	—
M2-11	15.628	51.504	14.881	43.156	642.204	79.79	—
M2-13	15.572	51.519	14.902	43.213	643.960	80.27	—
M2-18	15.571	51.521	14.879	43.148	641.999	80.03	—
M2-19	15.534	51.511	14.914	43.123	643.136	80.37	—
M2-20	15.721	51.489	14.896	43.167	643.016	79.44	—
M2-21	15.672	51.509	14.911	43.172	643.738	79.74	—

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IEC 61215-2							
Clause	Requirement + Test				Result - Remark		Verdict
M3-10	15.033	56.377	14.282	47.879	683.808	80.68	—
M3-13	15.014	56.143	14.296	47.727	682.305	80.94	—
M4-10	17.083	47.887	16.219	40.400	655.248	80.10	—
M4-13	17.254	47.902	16.299	40.397	658.431	79.66	—
M4-4	17.213	47.924	16.291	40.352	657.374	79.69	—
M4-5	17.304	47.997	16.310	40.599	662.170	79.73	—
M4-8	17.355	47.959	16.362	40.349	660.190	79.32	—
M4-9	17.264	47.953	16.347	40.293	658.670	79.56	—
M4-6	17.302	47.988	16.345	40.443	661.041	79.62	—
M4-7	17.084	47.988	16.316	40.395	659.085	80.39	—
M4-18	17.304	47.854	16.378	40.342	660.721	79.79	—
M4-19	17.089	47.816	16.341	40.276	658.150	80.54	—
M4-20	17.350	47.706	16.380	40.308	660.245	79.77	—
M4-21	17.255	47.678	16.338	40.276	658.029	79.99	—
Supplementary information: N/A							
TABLE 02.4: 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 #	M1-10	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	689.553	—	—
1	5	800~1000	50 ± 10	MPPT	687.523	—	—
2	5	800~1000	50 ± 10	MPPT	685.412	0.602	Yes
Initial (R)	—	—	—	—	537.493	—	—
1	5	800~1000	50 ± 10	MPPT	534.591	—	—
2	5	800~1000	50 ± 10	MPPT	534.087	0.636	Yes
Sample #	M1-13	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	689.992	—	—

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Clause	Requirement + Test				Result - Remark		Verdict
1	5	800~1000	50 ± 10	MPPT	687.516	—	—
2	5	800~1000	50 ± 10	MPPT	685.518	0.651	Yes
Initial (R)	—	—	—	—	540.118	—	—
1	5	800~1000	50 ± 10	MPPT	538.004	—	—
2	5	800~1000	50 ± 10	MPPT	535.960	0.773	Yes
Sample #	M1-4	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	689.108	—	—
1	5	800~1000	50 ± 10	MPPT	686.984	—	—
2	5	800~1000	50 ± 10	MPPT	685.660	0.502	Yes
Initial (R)	—	—	—	—	538.235	—	—
1	5	800~1000	50 ± 10	MPPT	536.516	—	—
2	5	800~1000	50 ± 10	MPPT	534.940	0.614	Yes
Sample #	M1-5	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	688.623	—	—
1	5	800~1000	50 ± 10	MPPT	686.451	—	—
2	5	800~1000	50 ± 10	MPPT	685.222	0.495	Yes
Initial (R)	—	—	—	—	537.021	—	—
1	5	800~1000	50 ± 10	MPPT	535.149	—	—
2	5	800~1000	50 ± 10	MPPT	534.734	0.427	Yes
Sample #	M1-8	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	687.541	—	—
1	5	800~1000	50 ± 10	MPPT	686.359	—	—
2	5	800~1000	50 ± 10	MPPT	684.281	0.475	Yes
Initial (R)	—	—	—	—	534.002	—	—
1	5	800~1000	50 ± 10	MPPT	531.714	—	—
2	5	800~1000	50 ± 10	MPPT	528.874	0.965	Yes

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IEC 61215-2							
Clause	Requirement + Test				Result - Remark		Verdict
Sample #	M1-9	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	689.342	—	—
1	5	800~1000	50 ± 10	MPPT	687.814	—	—
2	5	800~1000	50 ± 10	MPPT	686.080	0.474	Yes
Initial (R)	—	—	—	—	535.468	—	—
1	5	800~1000	50 ± 10	MPPT	532.601	—	—
2	5	800~1000	50 ± 10	MPPT	530.760	0.883	Yes
Sample #	M1-6	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	688.560	—	—
1	5	800~1000	50 ± 10	MPPT	686.527	—	—
2	5	800~1000	50 ± 10	MPPT	684.173	0.639	Yes
Initial (R)	—	—	—	—	537.886	—	—
1	5	800~1000	50 ± 10	MPPT	536.662	—	—
2	5	800~1000	50 ± 10	MPPT	533.863	0.750	Yes
Sample #	M1-7	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	689.352	—	—
1	5	800~1000	50 ± 10	MPPT	686.922	—	—
2	5	800~1000	50 ± 10	MPPT	684.112	0.763	Yes
Initial (R)	—	—	—	—	538.207	—	—
1	5	800~1000	50 ± 10	MPPT	537.145	—	—
2	5	800~1000	50 ± 10	MPPT	535.791	0.450	Yes
Sample #	M1-18	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	689.544	—	—
1	5	800~1000	50 ± 10	MPPT	687.503	—	—
2	5	800~1000	50 ± 10	MPPT	684.584	0.722	Yes

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Clause	Requirement + Test				Result - Remark		Verdict
Initial (R)	—	—	—	—	536.625	—	—
1	5	800~1000	50 ± 10	MPPT	534.669	—	—
2	5	800~1000	50 ± 10	MPPT	532.163	0.835	Yes
Sample #	M1-19	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	689.555	—	—
1	5	800~1000	50 ± 10	MPPT	687.861	—	—
2	5	800~1000	50 ± 10	MPPT	685.255	0.625	Yes
Initial (R)	—	—	—	—	539.136	—	—
1	5	800~1000	50 ± 10	MPPT	536.948	—	—
2	5	800~1000	50 ± 10	MPPT	536.019	0.580	Yes
Sample #	M1-20	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	688.303	—	—
1	5	800~1000	50 ± 10	MPPT	686.693	—	—
2	5	800~1000	50 ± 10	MPPT	685.089	0.468	Yes
Initial (R)	—	—	—	—	537.248	—	—
1	5	800~1000	50 ± 10	MPPT	534.375	—	—
2	5	800~1000	50 ± 10	MPPT	531.975	0.986	Yes
Sample #	M1-21	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	688.093	—	—
1	5	800~1000	50 ± 10	MPPT	686.468	—	—
2	5	800~1000	50 ± 10	MPPT	684.886	0.467	Yes
Initial (R)	—	—	—	—	538.458	—	—
1	5	800~1000	50 ± 10	MPPT	536.008	—	—
2	5	800~1000	50 ± 10	MPPT	533.804	0.868	Yes
Sample #	M2-10	Test Date (YYYY-MM-DD) start/end			2022-12-25 / 2022-12-27		
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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Clause	Requirement + Test				Result - Remark		Verdict
Initial (F)	—	—	—	—	567.211	—	—
1	5	800~1000	50 ± 10	MPPT	565.396	—	—
2	5	800~1000	50 ± 10	MPPT	564.468	0.485	Yes
Initial (R)	—	—	—	—	441.388	—	—
1	5	800~1000	50 ± 10	MPPT	439.911	—	—
2	5	800~1000	50 ± 10	MPPT	439.244	0.487	Yes
Sample #	M2-4	Test Date (YYYY-MM-DD) start/end			2022-12-25 / 2022-12-27		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	567.816	—	—
1	5	800~1000	50 ± 10	MPPT	566.006	—	—
2	5	800~1000	50 ± 10	MPPT	565.319	0.441	Yes
Initial (R)	—	—	—	—	441.655	—	—
1	5	800~1000	50 ± 10	MPPT	440.585	—	—
2	5	800~1000	50 ± 10	MPPT	439.884	0.402	Yes
Sample #	M2-5	Test Date (YYYY-MM-DD) start/end			2022-12-25 / 2022-12-27		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	567.559	—	—
1	5	800~1000	50 ± 10	MPPT	565.813	—	—
2	5	800~1000	50 ± 10	MPPT	565.147	0.426	Yes
Initial (R)	—	—	—	—	440.795	—	—
1	5	800~1000	50 ± 10	MPPT	439.315	—	—
2	5	800~1000	50 ± 10	MPPT	438.433	0.537	Yes
Sample #	M2-11	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	583.771	—	—
1	5	800~1000	50 ± 10	MPPT	582.047	—	—
2	5	800~1000	50 ± 10	MPPT	580.689	0.529	Yes
Initial (R)	—	—	—	—	463.101	—	—
1	5	800~1000	50 ± 10	MPPT	462.193	—	—
2	5	800~1000	50 ± 10	MPPT	461.565	0.332	Yes

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Clause	Requirement + Test				Result - Remark		Verdict
Sample #	M2-13	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
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 (F)	—	—	—	—	584.005	—	—
1	5	800~1000	50 ± 10	MPPT	583.062	—	—
2	5	800~1000	50 ± 10	MPPT	581.478	0.434	Yes
Initial (R)	—	—	—	—	464.638	—	—
1	5	800~1000	50 ± 10	MPPT	462.284	—	—
2	5	800~1000	50 ± 10	MPPT	461.372	0.706	Yes
Sample #	M2-18	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
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 (F)	—	—	—	—	583.407	—	—
1	5	800~1000	50 ± 10	MPPT	582.417	—	—
2	5	800~1000	50 ± 10	MPPT	580.898	0.431	Yes
Initial (R)	—	—	—	—	462.705	—	—
1	5	800~1000	50 ± 10	MPPT	460.843	—	—
2	5	800~1000	50 ± 10	MPPT	458.669	0.876	Yes
Sample #	M2-19	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
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 (F)	—	—	—	—	586.196	—	—
1	5	800~1000	50 ± 10	MPPT	584.416	—	—
2	5	800~1000	50 ± 10	MPPT	581.466	0.810	Yes
Initial (R)	—	—	—	—	461.951	—	—
1	5	800~1000	50 ± 10	MPPT	459.887	—	—
2	5	800~1000	50 ± 10	MPPT	457.867	0.888	Yes
Sample #	M2-20	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
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 (F)	—	—	—	—	584.188	—	—
1	5	800~1000	50 ± 10	MPPT	582.091	—	—
2	5	800~1000	50 ± 10	MPPT	580.832	0.576	Yes

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Clause	Requirement + Test				Result - Remark		Verdict
Initial (R)	—	—	—	—	463.358	—	—
1	5	800~1000	50 ± 10	MPPT	462.841	—	—
2	5	800~1000	50 ± 10	MPPT	460.104	0.704	Yes
Sample #	M2-21	Test Date (YYYY-MM-DD) start/end			2023-12-05 / 2023-12-07		
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 (F)	—	—	—	—	584.983	—	—
1	5	800~1000	50 ± 10	MPPT	582.382	—	—
2	5	800~1000	50 ± 10	MPPT	581.161	0.656	Yes
Initial (R)	—	—	—	—	463.684	—	—
1	5	800~1000	50 ± 10	MPPT	461.296	—	—
2	5	800~1000	50 ± 10	MPPT	460.212	0.752	Yes
Sample #	M3-10	Test Date (YYYY-MM-DD) start/end			2024-03-05 / 2024-03-07		
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 (F)	—	—	—	—	621.452	—	—
1	5	800~1000	50 ± 10	MPPT	618.617	—	—
2	5	800~1000	50 ± 10	MPPT	617.158	0.694	Yes
Initial (R)	—	—	—	—	468.886	—	—
1	5	800~1000	50 ± 10	MPPT	467.397	—	—
2	5	800~1000	50 ± 10	MPPT	465.542	0.716	Yes
Sample #	M3-13	Test Date (YYYY-MM-DD) start/end			2024-03-05 / 2024-03-07		
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 (F)	—	—	—	—	620.672	—	—
1	5	800~1000	50 ± 10	MPPT	618.540	—	—
2	5	800~1000	50 ± 10	MPPT	617.743	0.473	Yes
Initial (R)	—	—	—	—	464.512	—	—
1	5	800~1000	50 ± 10	MPPT	464.443	—	—
2	5	800~1000	50 ± 10	MPPT	463.944	0.122	Yes
Sample #	M4-10	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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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Clause	Requirement + Test				Result - Remark		Verdict
Initial (F)	—	—	—	—	595.321	—	—
1	5	800~1000	50 ± 10	MPPT	593.804	—	—
2	5	800~1000	50 ± 10	MPPT	592.185	0.528	Yes
Initial (R)	—	—	—	—	452.422	—	—
1	5	800~1000	50 ± 10	MPPT	451.600	—	—
2	5	800~1000	50 ± 10	MPPT	449.003	0.758	Yes
Sample #	M4-13	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	597.920	—	—
1	5	800~1000	50 ± 10	MPPT	595.238	—	—
2	5	800~1000	50 ± 10	MPPT	593.483	0.745	Yes
Initial (R)	—	—	—	—	449.643	—	—
1	5	800~1000	50 ± 10	MPPT	446.953	—	—
2	5	800~1000	50 ± 10	MPPT	445.563	0.912	Yes
Sample #	M4-4	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	598.375	—	—
1	5	800~1000	50 ± 10	MPPT	596.730	—	—
2	5	800~1000	50 ± 10	MPPT	595.807	0.430	Yes
Initial (R)	—	—	—	—	450.886	—	—
1	5	800~1000	50 ± 10	MPPT	449.559	—	—
2	5	800~1000	50 ± 10	MPPT	448.471	0.537	Yes
Sample #	M4-5	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	(P _{max} - P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	602.475	—	—
1	5	800~1000	50 ± 10	MPPT	601.360	—	—
2	5	800~1000	50 ± 10	MPPT	599.586	0.481	Yes
Initial (R)	—	—	—	—	453.361	—	—
1	5	800~1000	50 ± 10	MPPT	453.057	—	—
2	5	800~1000	50 ± 10	MPPT	452.021	0.296	Yes

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Clause	Requirement + Test				Result - Remark		Verdict
Sample #	M4-8	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	598.589	—	—
1	5	800~1000	50 ± 10	MPPT	597.376	—	—
2	5	800~1000	50 ± 10	MPPT	595.295	0.552	Yes
Initial (R)	—	—	—	—	452.459	—	—
1	5	800~1000	50 ± 10	MPPT	450.478	—	—
2	5	800~1000	50 ± 10	MPPT	449.518	0.652	Yes
Sample #	M4-9	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	597.882	—	—
1	5	800~1000	50 ± 10	MPPT	595.177	—	—
2	5	800~1000	50 ± 10	MPPT	593.272	0.774	Yes
Initial (R)	—	—	—	—	439.999	—	—
1	5	800~1000	50 ± 10	MPPT	437.681	—	—
2	5	800~1000	50 ± 10	MPPT	436.313	0.842	Yes
Sample #	M4-6	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	598.925	—	—
1	5	800~1000	50 ± 10	MPPT	598.055	—	—
2	5	800~1000	50 ± 10	MPPT	595.961	0.496	Yes
Initial (R)	—	—	—	—	446.134	—	—
1	5	800~1000	50 ± 10	MPPT	445.825	—	—
2	5	800~1000	50 ± 10	MPPT	444.988	0.257	Yes
Sample #	M4-7	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	598.061	—	—
1	5	800~1000	50 ± 10	MPPT	596.721	—	—
2	5	800~1000	50 ± 10	MPPT	595.398	0.446	Yes

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Clause	Requirement + Test				Result - Remark		Verdict
Initial (R)	—	—	—	—	446.864	—	—
1	5	800~1000	50 ± 10	MPPT	444.407	—	—
2	5	800~1000	50 ± 10	MPPT	443.809	0.686	Yes
Sample #	M4-18	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	598.647	—	—
1	5	800~1000	50 ± 10	MPPT	596.109	—	—
2	5	800~1000	50 ± 10	MPPT	594.607	0.677	Yes
Initial (R)	—	—	—	—	446.678	—	—
1	5	800~1000	50 ± 10	MPPT	444.621	—	—
2	5	800~1000	50 ± 10	MPPT	444.094	0.581	Yes
Sample #	M4-19	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	597.366	—	—
1	5	800~1000	50 ± 10	MPPT	595.559	—	—
2	5	800~1000	50 ± 10	MPPT	594.381	0.501	Yes
Initial (R)	—	—	—	—	447.595	—	—
1	5	800~1000	50 ± 10	MPPT	447.185	—	—
2	5	800~1000	50 ± 10	MPPT	444.683	0.652	Yes
Sample #	M4-20	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	599.469	—	—
1	5	800~1000	50 ± 10	MPPT	597.761	—	—
2	5	800~1000	50 ± 10	MPPT	596.706	0.462	Yes
Initial (R)	—	—	—	—	451.707	—	—
1	5	800~1000	50 ± 10	MPPT	451.116	—	—
2	5	800~1000	50 ± 10	MPPT	450.083	0.360	Yes
Sample #	M4-21	Test Date (YYYY-MM-DD) start/end			2023-12-15 / 2023-12-17		
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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Clause	Requirement + Test				Result - Remark		Verdict
Initial (F)	—	—	—	—	597.551	—	—
1	5	800~1000	50 ± 10	MPPT	595.179	—	—
2	5	800~1000	50 ± 10	MPPT	593.573	0.668	Yes
Initial (R)	—	—	—	—	441.827	—	—
1	5	800~1000	50 ± 10	MPPT	439.766	—	—
2	5	800~1000	50 ± 10	MPPT	439.290	0.576	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 03.1: MQT 06.1 ini: Performance at STC after initial stabilization (Front side)										P
Test Date [YYYY-MM-DD]					2023-12-17 for M1-x, M4-x 2022-12-27 for M2-10, M2-4, M2-5 2023-12-07 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-07 for M3-x					—
Pmax(lab) lower limit (W)					See table below: Pmax [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					672.571 for M1-x 549.839 for M2-10, M2-4, M2-5 569.476 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 603.841 for M3-x 584.204 for M4-x					—
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.		
M1-10	18.230	18.506	47.479	48.536	17.093	40.099	685.412	652.394	79.19	P
M1-13	17.978	18.506	47.517	48.536	17.026	40.263	685.518	652.394	80.25	P

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Clause	Requirement + Test						Result - Remark			Verdict
M1-4	18.067	18.506	47.550	48.536	17.038	40.243	685.660	652.394	79.81	P
M1-5	17.985	18.506	47.442	48.536	17.119	40.027	685.222	652.394	80.31	P
M1-8	18.040	18.506	47.424	48.536	17.125	39.958	684.281	652.394	79.98	P
M1-9	17.962	18.506	47.422	48.536	17.140	40.028	686.080	652.394	80.55	P
M1-6	18.014	18.506	47.474	48.536	17.057	40.111	684.173	652.394	80.00	P
M1-7	18.273	18.506	47.525	48.536	17.044	40.138	684.112	652.394	78.78	P
M1-18	18.041	18.506	47.511	48.536	17.032	40.194	684.584	652.394	79.87	P
M1-19	17.990	18.506	47.473	48.536	17.107	40.057	685.255	652.394	80.24	P
M1-20	18.051	18.506	47.447	48.536	17.102	40.059	685.089	652.394	79.99	P
M1-21	18.026	18.506	47.445	48.536	17.126	39.991	684.886	652.394	80.08	P
Average	—						685.023	672.571	—	P
M2-10	13.460	14.032	51.598	52.323	12.928	43.664	564.468	533.344	81.28	P
M2-4	13.495	14.032	51.617	52.323	12.931	43.717	565.319	533.344	81.16	P
M2-5	13.473	14.032	51.601	52.323	12.969	43.576	565.147	533.344	81.29	P
Average	—						564.978	549.839	—	P
M2-11	14.223	14.519	51.621	52.364	13.528	42.925	580.689	552.392	79.09	P
M2-13	14.236	14.519	51.603	52.364	13.547	42.923	581.478	552.392	79.15	P
M2-18	14.171	14.519	51.545	52.364	13.542	42.896	580.898	552.392	79.53	P
M2-19	14.293	14.519	51.611	52.364	13.566	42.862	581.466	552.392	78.82	P
M2-20	14.190	14.519	51.604	52.364	13.543	42.888	580.832	552.392	79.32	P
M2-21	14.192	14.519	51.593	52.364	13.527	42.963	581.161	552.392	79.37	P
Average	—						581.087	569.476	—	P
M3-10	13.632	14.255	56.159	56.579	12.947	47.668	617.158	585.726	80.62	P
M3-13	13.632	14.255	55.960	56.579	13.001	47.515	617.743	585.726	80.98	P
Average	—						617.451	603.841	—	P
M4-10	15.507	16.183	47.692	48.179	14.724	40.219	592.185	566.678	80.07	P
M4-13	15.664	16.183	47.741	48.179	14.727	40.299	593.483	566.678	79.36	P
M4-4	15.641	16.183	47.748	48.179	14.851	40.119	595.807	566.678	79.78	P
M4-5	15.740	16.183	47.829	48.179	14.835	40.417	599.586	566.678	79.64	P

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Clause	Requirement + Test						Result - Remark			Verdict
M4-8	15.727	16.183	47.781	48.179	14.836	40.125	595.295	566.678	79.22	P
M4-9	15.663	16.183	47.772	48.179	14.765	40.181	593.272	566.678	79.29	P
M4-6	15.682	16.183	47.729	48.179	14.843	40.151	595.961	566.678	79.62	P
M4-7	15.500	16.183	47.799	48.179	14.812	40.197	595.398	566.678	80.36	P
M4-18	15.694	16.183	47.630	48.179	14.810	40.149	594.607	566.678	79.55	P
M4-19	15.493	16.183	47.656	48.179	14.821	40.104	594.381	566.678	80.50	P
M4-20	15.753	16.183	47.509	48.179	14.902	40.042	596.706	566.678	79.73	P
M4-21	15.649	16.183	47.534	48.179	14.785	40.147	593.573	566.678	79.80	P
Average	—						595.021	584.204	—	P
Supplementary information: The limit values are calculated considering manufacturer's tolerances t of rated nameplate values and laboratory measurement uncertainties m .										

TABLE 03.2: MQT 06.1 ini: Performance at STC after initial stabilization (Back side)										P
Test Date [YYYY-MM-DD].....:					2023-12-17 for M1-x, M4-x 2022-12-27 for M2-10, M2-4, M2-5 2023-12-07 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-07 for M3-x					—
Test method.....:					☒ Simulator ☐ Natural sunlight					—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Φ_{Isc}	Φ_{Voc}	Φ_{Pmax}	Result
M1-10	14.590	47.112	13.059	40.898	534.087	77.70	0.80	0.99	0.78	P
M1-13	14.608	47.170	13.084	40.963	535.960	77.78	0.81	0.99	0.78	P
M1-4	14.709	47.176	13.054	40.979	534.940	77.09	0.81	0.99	0.78	P
M1-5	14.540	47.082	13.141	40.692	534.734	78.11	0.81	0.99	0.78	P
M1-8	14.888	47.037	12.948	40.846	528.874	75.52	0.83	0.99	0.77	P
M1-9	15.082	47.002	13.020	40.765	530.760	74.87	0.84	0.99	0.77	P
M1-6	14.887	47.059	13.099	40.756	533.863	76.20	0.83	0.99	0.78	P
M1-7	14.915	47.116	13.136	40.788	535.791	76.24	0.82	0.99	0.78	P
M1-18	15.017	47.094	12.972	41.024	532.163	75.25	0.83	0.99	0.78	P
M1-19	15.085	47.130	13.139	40.796	536.019	75.39	0.84	0.99	0.78	P
M1-20	14.823	47.158	13.001	40.918	531.975	76.10	0.82	0.99	0.78	P

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Clause	Requirement + Test						Result - Remark			Verdict
M1-21	15.024	47.066	13.123	40.677	533.804	75.49	0.83	0.99	0.78	P
M2-10	10.476	51.186	9.901	44.362	439.244	81.91	0.78	0.99	0.78	P
M2-4	10.402	51.214	9.972	44.114	439.884	82.57	0.77	0.99	0.78	P
M2-5	10.432	51.172	9.871	44.414	438.433	82.13	0.77	0.99	0.78	P
M2-11	11.306	51.025	10.227	45.132	461.565	80.01	0.79	0.99	0.79	P
M2-13	11.379	51.027	10.206	45.206	461.372	79.46	0.80	0.99	0.79	P
M2-18	11.336	51.140	10.148	45.198	458.669	79.12	0.80	0.99	0.79	P
M2-19	11.324	51.014	10.128	45.208	457.867	79.26	0.79	0.99	0.79	P
M2-20	11.391	51.055	10.153	45.317	460.104	79.11	0.80	0.99	0.79	P
M2-21	11.386	51.027	10.172	45.243	460.212	79.21	0.80	0.99	0.79	P
M3-10	10.637	55.745	9.624	48.373	465.542	78.51	0.78	0.99	0.75	P
M3-13	10.513	55.435	9.628	48.187	463.944	79.61	0.77	0.99	0.75	P
M4-10	12.542	47.259	10.977	40.904	449.003	75.75	0.81	0.99	0.76	P
M4-13	11.984	47.293	10.817	41.191	445.563	78.62	0.77	0.99	0.75	P
M4-4	12.372	47.344	10.925	41.050	448.471	76.56	0.79	0.99	0.75	P
M4-5	12.491	47.390	10.965	41.224	452.021	76.36	0.79	0.99	0.75	P
M4-8	12.010	47.432	10.999	40.869	449.518	78.91	0.76	0.99	0.76	P
M4-9	12.227	47.331	10.619	41.088	436.313	75.39	0.78	0.99	0.74	P
M4-6	11.979	47.365	10.791	41.237	444.988	78.43	0.76	0.99	0.75	P
M4-7	12.453	47.407	10.740	41.323	443.809	75.18	0.80	0.99	0.75	P
M4-18	11.983	47.235	10.768	41.242	444.094	78.46	0.76	0.99	0.75	P
M4-19	12.507	47.309	10.787	41.224	444.683	75.15	0.81	0.99	0.75	P
M4-20	12.024	47.137	11.022	40.835	450.083	79.41	0.76	0.99	0.75	P
M4-21	12.210	47.148	10.699	41.059	439.290	76.31	0.78	0.99	0.74	P
Supplementary information: N/A										

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Clause	Requirement + Test					Result - Remark				Verdict
TABLE 03.3: MQT 06.1 ini: Performance at BNPI (front side irradiance 1000 W/m², backside irradiance 135 W/m², 25 °C, AM 1.5) after initial stabilization										P
Test Date [YYYY-MM-DD]		2023-12-17 for M1-x, M4-x 2022-12-27 for M2-10, M2-4, M2-5 2023-12-07 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-07 for M3-x								—
Pmax(lab) lower limit (W)		See table below: Pmax [W] – Min calc.								—
$\bar{P}_{max}(Lab)$ lower limit (W)		741.301 for M1-x 605.805 for M2-10, M2-4, M2-5 627.406 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 665.698 for M3-x 644.097 for M4-x								—
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.		
M1-10	20.101	20.404	47.652	48.536	18.927	40.096	758.897	719.062	79.23	P
M1-13	19.877	20.404	47.709	48.536	18.938	40.181	760.948	719.062	80.24	P
M1-4	19.973	20.404	47.692	48.536	18.829	40.226	757.415	719.062	79.51	P
M1-5	19.868	20.404	47.592	48.536	18.879	40.059	756.274	719.062	79.98	P
M1-8	19.906	20.404	47.652	48.536	18.917	40.050	757.626	719.062	79.87	P
M1-9	19.808	20.404	47.597	48.536	18.829	40.096	754.968	719.062	80.08	P
M1-6	19.879	20.404	47.677	48.536	18.774	40.237	755.409	719.062	79.70	P
M1-7	20.156	20.404	47.700	48.536	18.918	40.036	757.401	719.062	78.78	P
M1-18	19.886	20.404	47.686	48.536	18.909	40.061	757.513	719.062	79.88	P
M1-19	19.854	20.404	47.660	48.536	18.831	40.112	755.349	719.062	79.83	P
M1-20	19.927	20.404	47.704	48.536	18.793	40.229	756.024	719.062	79.53	P
M1-21	19.916	20.404	47.642	48.536	18.786	40.215	755.479	719.062	79.62	P
Average	—						756.942	741.301	—	P
M2-10	14.887	15.473	51.802	52.323	14.319	43.694	625.673	587.631	81.13	P

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Clause	Requirement + Test						Result - Remark			Verdict
M2-4	14.921	15.473	51.782	52.323	14.323	43.704	625.974	587.631	81.02	P
M2-5	14.904	15.473	51.783	52.323	14.332	43.701	626.332	587.631	81.15	P
Average	—						625.993	605.805	—	P
M2-11	15.626	16.010	51.477	52.364	14.890	42.927	639.183	608.583	79.46	P
M2-13	15.571	16.010	51.491	52.364	14.863	42.992	638.990	608.583	79.70	P
M2-18	15.566	16.010	51.493	52.364	14.872	42.905	638.083	608.583	79.61	P
M2-19	15.525	16.010	51.489	52.364	14.901	42.916	639.491	608.583	80.00	P
M2-20	15.719	16.010	51.464	52.364	14.895	42.938	639.562	608.583	79.06	P
M2-21	15.678	16.010	51.482	52.364	14.903	42.950	640.084	608.583	79.30	P
Average	—						639.232	627.406	—	P
M3-10	15.032	15.716	56.352	56.579	14.245	47.676	679.145	645.727	80.17	P
M3-13	15.015	15.716	56.114	56.579	14.216	47.577	676.355	645.727	80.27	P
Average	—						677.750	665.698	—	P
M4-10	17.077	17.847	47.866	48.179	16.188	40.221	651.098	624.774	79.65	P
M4-13	17.248	17.847	47.874	48.179	16.309	40.187	655.410	624.774	79.37	P
M4-4	17.215	17.847	47.896	48.179	16.282	40.121	653.250	624.774	79.23	P
M4-5	17.299	17.847	47.973	48.179	16.271	40.438	657.967	624.774	79.28	P
M4-8	17.355	17.847	47.927	48.179	16.369	40.092	656.266	624.774	78.90	P
M4-9	17.264	17.847	47.927	48.179	16.335	40.075	654.625	624.774	79.12	P
M4-6	17.302	17.847	47.965	48.179	16.314	40.234	656.377	624.774	79.09	P
M4-7	17.084	17.847	47.964	48.179	16.291	40.210	655.061	624.774	79.94	P
M4-18	17.300	17.847	47.832	48.179	16.392	40.128	657.778	624.774	79.49	P
M4-19	17.083	17.847	47.794	48.179	16.282	40.105	652.990	624.774	79.98	P
M4-20	17.347	17.847	47.676	48.179	16.409	40.069	657.492	624.774	79.50	P
M4-21	17.254	17.847	47.651	48.179	16.350	40.034	654.556	624.774	79.61	P
Average	—						655.239	644.097	—	P
Supplementary information: The limit values are calculated considering manufacturer's tolerances <i>t</i> of rated nameplate values and laboratory measurement uncertainties <i>m</i> .										

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Clause	Requirement + Test		Result - Remark	Verdict
TABLE 04: MQT 03 ini: Initial Insulation test				P
Test Date [YYYY-MM-DD].....:	2023-12-17 for M1-x, M4-x 2022-12-27 for M2-10, M2-4, M2-5 2024-01-15 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-07 for M3-x			—
Test Voltage applied [V]	8000/1500			—
Size of module [m²]	3.11 for M1-x 2.58 for M2-10, M2-4, M2-5 2.70 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21, M4-x 2.80 for M3-x			—
Required Resistance [MΩ].....:	12.88 for M1-x 15.48 for M2-10, M2-4, M2-5 14.80 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21, M4-x 14.31 for M3-x			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
M1-10	>10000	No Dielectric breakdown	x	P
M1-13	>10000	No Dielectric breakdown	x	P
M1-4	>10000	No Dielectric breakdown	x	P
M1-5	>10000	No Dielectric breakdown	x	P
M1-8	>10000	No Dielectric breakdown	x	P
M1-9	>10000	No Dielectric breakdown	x	P
M1-6	>10000	No Dielectric breakdown	x	P
M1-7	>10000	No Dielectric breakdown	x	P
M1-18	>10000	No Dielectric breakdown	x	P
M1-19	>10000	No Dielectric breakdown	x	P
M1-20	>10000	No Dielectric breakdown	x	P
M1-21	>10000	No Dielectric breakdown	x	P
M2-10	>2000	No Dielectric breakdown	x	P
M2-4	>2000	No Dielectric breakdown	x	P
M2-5	>2000	No Dielectric breakdown	x	P
M2-11	>2000	No Dielectric breakdown	x	P
M2-13	>2000	No Dielectric breakdown	x	P
M2-18	>2000	No Dielectric breakdown	x	P
M2-19	>2000	No Dielectric breakdown	x	P

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Clause	Requirement + Test		Result - Remark	Verdict
M2-20	>2000	No Dielectric breakdown	x	P
M2-21	>2000	No Dielectric breakdown	x	P
M3-10	>10000	No Dielectric breakdown	x	P
M3-13	>10000	No Dielectric breakdown	x	P
M4-10	>10000	No Dielectric breakdown	x	P
M4-13	>10000	No Dielectric breakdown	x	P
M4-4	>10000	No Dielectric breakdown	x	P
M4-5	>10000	No Dielectric breakdown	x	P
M4-8	>10000	No Dielectric breakdown	x	P
M4-9	>10000	No Dielectric breakdown	x	P
M4-6	>10000	No Dielectric breakdown	x	P
M4-7	>10000	No Dielectric breakdown	x	P
M4-18	>10000	No Dielectric breakdown	x	P
M4-19	>10000	No Dielectric breakdown	x	P
M4-20	>10000	No Dielectric breakdown	x	P
M4-21	>10000	No Dielectric breakdown	x	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.				

TABLE 05: MQT 15 ini: Initial Wet leakage current test		P
Test Date [YYYY-MM-DD]	2023-12-17 for M1-x, M4-x 2022-12-27 for M2-10, M2-4, M2-5 2024-01-15 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2024-03-07 for M3-x	—
Test Voltage applied [V]	1500	—
Solution temperature [°C]	22.2 for M1-x, M4-x 24.0 for M2-10, M2-4, M2-5 21.8 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 23.1 for M3-x	—
Solution resistivity [Ω cm]	2795 for M1-x, M4-x 2813 for M2-10, M2-4, M2-5 2848 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21 2893 for M3-x	—

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Clause	Requirement + Test	Result - Remark	Verdict
Size of module [m ²]		3.11 for M1-x 2.58 for M2-10, M2-4, M2-5 2.70 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21, M4-x 2.80 for M3-x	—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
M1-10	12.88	>10000	P
M1-13	12.88	>10000	P
M1-4	12.88	>10000	P
M1-5	12.88	>10000	P
M1-8	12.88	>10000	P
M1-9	12.88	>10000	P
M1-6	12.88	>10000	P
M1-7	12.88	>10000	P
M1-18	12.88	>10000	P
M1-19	12.88	>10000	P
M1-20	12.88	>10000	P
M1-21	12.88	>10000	P
M2-10	15.48	744.4	P
M2-4	15.48	725.0	P
M2-5	15.48	703.0	P
M2-11	14.80	5219	P
M2-13	14.80	5577	P
M2-18	14.80	5729	P
M2-19	14.80	5143	P
M2-20	14.80	4904	P
M2-21	14.80	5683	P
M3-10	14.31	>10000	P
M3-13	14.31	>10000	P
M4-10	14.80	>10000	P
M4-13	14.80	>10000	P
M4-4	14.80	>10000	P
M4-5	14.80	>10000	P
M4-8	14.80	>10000	P
M4-9	14.80	>10000	P

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Clause	Requirement + Test	Result - Remark	Verdict
M4-6	14.80	>10000	P
M4-7	14.80	>10000	P
M4-18	14.80	>10000	P
M4-19	14.80	>10000	P
M4-20	14.80	>10000	P
M4-21	14.80	>10000	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 06.1: MQT 07 - Performance at low irradiance (Front side)							P
Test Date [YYYY-MM-DD]				2024-02-25 for M1-10			—
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 [%]	
M1-10	3.546	43.266	3.378	37.239	125.793	81.99	
Supplementary information: N/A							

TABLE 06.2: MQT 07 - Performance at low irradiance (Back side)									P
Test Date [YYYY-MM-DD] :					2024-02-25 for M1-10				—
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 [%]	ϕIsc	ϕVoc	ϕPmax
M1-10	2.903	43.150	2.616	37.132	97.137	77.55	0.82	1.00	0.77
Supplementary information: N/A									

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Clause	Requirement + Test		Result - Remark	Verdict
TABLE 07: MQT 04 - Measurement of temperature coefficients				P
Test Date [YYYY-MM-DD]		2024-02-25 for M1-10		—
Ambient air temperature [°C] high/low		55/25		—
Irradiance [W/m²] high/low		1000		—
Module temperature [°C] high/low.....		55/25		—
Sample #	α [%/°C]	β [%/°C]	δ [%/°C]	—
M1-10	0.0312	-0.3126	-0.2967	—
Supplementary information: N/A				

TABLE 08: MQT 08 - Outdoor exposure test		P
Test Date [YYYY-MM-DD] start/end	2023-12-15 / 2024-01-05	—
Sample #	M1-13	—
Total irradiation dosage [kWh/m²]	60	—
Angle of tilt the test module	37°	—
Electrical load:	☒ Restive load ☐ MPPT	—
Supplementary information: N/A		

Table 08.1: MQT 01: Visual inspection after outdoor exposure test		P
Test Date [YYYY-MM-DD]: 2024-01-05		—
Sample #	Nature and position of initial findings – comments or attach photos	—
M1-13	No major visual defects found	P
Supplementary information: N/A		

Table 08.2: MQT 15: Wet leakage current test after outdoor exposure test				P
Test Date [YYYY-MM-DD]		2023-01-05		—
Test Voltage applied [V]		1500		—
Solution temperature [°C]		22.1		—
Size of module [m²]		3.11		—
Solution resistivity [Ω cm].....		2786		—
Sample #	Measured [MΩ]		Limit [MΩ]	Result
M1-13	>10000		12.88	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.				

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Clause	Requirement + Test			Result - Remark		Verdict
Table 08.3: MQT 02 - Maximum power determination after outdoor exposure 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 [%]
—	—	—	—	—	—	—
Supplementary information:						

Table 08.4: MQT 03 - Insulation test after outdoor exposure test - Optional					N/A
Test Date [YYYY-MM-DD]			—		—
Test Voltage applied [V]			—		—
Size of module [m²]			—		—
Required Resistance [MΩ].....			—		—
Sample #	Measured	Required (MΩ)	Dielectric breakdown		Result
	(MΩ)	(MΩ)	Yes (description)	No	
—	—	—	—	—	—
Supplementary information: Size of module [m²]					

TABLE 09: MQT 18: Bypass diode thermal test					P
Test Date [YYYY-MM-DD] start/end	2024-01-16 / 2024-01-16				—
Sample #	M1-13				—
Module temperature [°C].....	75 ± 5				—
Number of diodes in junction box	3				—
Diode manufacturer	Hangzhou Silan Microelectronics Co., Ltd.				—
Diode type designation	MK5050				—
Max. permissible junction temperature Tj _{max} [°C] (according to diode datasheet)	200				—
Detailed description of sample preparation procedure	Standard production module				—
Step 1, Determination of VD versus TJ characteristic					—
	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	110 ± 2 °C
Ambient temperature of the junction box ... :	30.4 30.6 30.8	50.3 50.5 50.6	70.2 70.3 70.4	90.1 90.1 90.2	—
Pulsed current.....	22.36	22.36	22.36	22.36	—

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Clause	Requirement + Test		Result - Remark		Verdict
Voltage drop [V]	0.45	0.43	0.41	0.39	—
	0.45	0.43	0.41	0.39	
	0.45	0.43	0.41	0.39	
V _D versus T _J characteristic	$T_J = -995.0 \cdot V_D + 478.150$ $T_J = -991.50 \cdot V_D + 476.805$ $T_J = -990.0 \cdot V_D + 476.30$				—
Max. permissible junction temperature T _{Jmax} [°C] (according to diode datasheet)	200				—
Step 2, Bypass diode thermal test					—
	Diode 1	Diode 2	Diode 3	Result	
Current flow applied [A]	22.36	22.36	22.36	—	
Max. diode surface temperature allowed T _{Jmax} [°C] :	N/A	N/A	N/A	—	
Voltage drop [V] after 1h	0.35	0.35	0.35	—	
Calculated max. junction temperature T _{Jcalc} [°C]	129.9	129.8	129.8	—	
T _{Jcalc} < T _{Jmax} (test passed)? yes/no	yes	yes	yes	P	
Current flow (1.25 * I _{sc}) [A]	27.95	27.95	27.95	—	
Bypass diode remain(s) functional (yes/no)	yes	yes	yes	P	
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/m² on the front side and 300 W/m² on the back side).					
Extrapolate I _{sc} -BSI, these quantities are combined as follows: $I_{sc-BSI}=I_{sc-BNPI}+(I_{sc-BNPI}-I_{sc})(G_{BSI}-G_{BNPI})/(G_{BNPI}-1000)$, $G_{BSI}=1000+300\phi$, $G_{BNPI}=1000+135\phi$, $\phi=\text{Min}(\phi_{Isc}, \phi_{Pmax})$					
Test Date [YYYY-MM-DD] start/end	2024-03-15 / 2024-03-15				—
Sample #	M3-13				—
Module temperature [°C].....	75 ± 5				—
Number of diodes in junction box	3				—
Diode manufacturer	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd				—
Diode type designation	THY4050				—
Max. permissible junction temperature T _{Jmax} [°C] (according to diode datasheet)	200				—
Detailed description of sample preparation procedure	Standard production module				—
Step 1, Determination of V _D versus T _J characteristic					—
	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	110 ± 2 °C

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Clause	Requirement + Test		Result - Remark		Verdict
Ambient temperature of the junction box ... :	30.4 30.6 30.8	50.3 50.5 50.6	70.2 70.3 70.4	90.1 90.1 90.2	—
Pulsed current.....:	16.78	16.78	16.78	16.78	—
Voltage drop [V]:	0.44 0.44 0.44	0.42 0.42 0.42	0.40 0.40 0.40	0.38 0.38 0.38	—
V _D versus T _J characteristic:	T _J = -995.0* V _D + 468.20 T _J = -991.50* V _D + 466.89 T _J = -990.0* V _D + 466.40				—
Max. permissible junction temperature T _{Jmax} [°C] (according to diode datasheet) :	200				—
Step 2, Bypass diode thermal test					—
	Diode 1	Diode 2	Diode 3	Result	
Current flow applied [A]:	16.78	16.78	16.78	—	
Max. diode surface temperature allowed T _{Jmax} [°C] :	N/A	N/A	N/A	—	
Voltage drop [V] after 1h:	0.33	0.33	0.33	—	
Calculated max. junction temperature T _{Jcalc} [°C]:	139.9	139.7	139.7	—	
T _{Jcalc} < T _{Jmax} (test passed)? yes/no:	yes	yes	yes	P	
Current flow (1.25 * I _{sc}) [A]:	20.98	20.98	20.98	—	
Bypass diode remain(s) functional (yes/no):	yes	yes	yes	P	
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 I _{sc} -BSI, these quantities are combined as follows: I _{sc-BSI} =I _{sc-BNPI} +(I _{sc-BNPI} -I _{sc})(G _{BSI} -G _{BNPI})/(G _{BNPI} -1000), G _{BSI} =1000+300φ, G _{BNPI} =1000+135φ, φ=Min(φ _{Isc} , φ _{Pmax})					

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Clause	Requirement + Test		Result - Remark	Verdict
TABLE 09.1: MQT 01 - Visual inspection after bypass diode thermal test				P
Test Date [YYYY-MM-DD]..... :		2024-01-16 for M1-13 2024-03-15 for M3-13	—	
Sample #	Nature and position of initial findings – comments or attach photos			—
M1-13	No major visual defects found			P
M3-13	No major visual defects found			P
Supplementary information: N/A				

TABLE 09.2: MQT 15 - Wet leakage current test after bypass diode thermal test			P
Test Date [YYYY-MM-DD]		2024-01-16 for M1-13 2024-03-15 for M3-13	—
Test Voltage applied [V]		1500	—
Solution temperature [°C]		22.2 for M1-13 21.5 for M3-13	—
Size of module [m ²]		3.11 for M1-13 2.80 for M3-13	—
Solution resistivity [Ω cm]		2794 for M1-13 2824 for M3-13	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-13	>10000	12.88	P
M3-13	>10000	14.31	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 09.3: MQT 02 – Max. power determination after bypass diode thermal test - Optional							N/A
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:							

TABLE 09.4: MQT 03 - Insulation test after bypass diode thermal test - Optional			N/A
Test Date [YYYY-MM-DD]			—
Test Voltage applied [V]			—
Size of module [m ²]			—

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Clause		Requirement + Test		Result - Remark	Verdict
Required Resistance [MΩ].....:					—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
					—
Supplementary information:					

TABLE 10: MQT 18.2 - Bypass diode functionality test after bypass diode thermal test					P
Test Date [YYYY-MM-DD]		2024-01-16 for M1-13 2024-03-15 for M3-13			—
☐ Method A					—
Ambient temperature [°C]					—
Current flow applied [A]					—
Sample #	VFM	VFM _{rated}	VFM = (N × VFM _{rated}) ± 10 %		Result
			☐ Yes ☐ No		—
Supplementary information:					
☒ Method B					—
	IV curve after shading				Result
Diode 1	Turn on				P
Diode 2	Turn on				P
Diode 3	Turn on				P
Supplementary information: N/A					

TABLE 10.1: MQT 19.1 Fin: Final stabilization							N/A
TABLE 10.2: 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:							

TABLE 10.3: 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 #	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:							
☐ 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 11: MQT 09 - Hot-spot endurance test		P
Test Date [YYYY-MM-DD] start/end	2024-02-04 / 2024-02-04	—
Sample #	M1-13	—
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	—
Type of light source	☒ Pulse Simulator ☒ Steady state Simulator ☐ Natural sunlight	—
Module temperature at thermal equilibrium [°C] :	51.3 / 53.6 / 52.6 / 51.6 / 50.3 / 52.1 / 54.0	—

TABLE 11.1: MQT 09 - Hot-spot endurance test for WBT						P
Selected hot-spot cells.....	LOW	LOW	LOW	HIGH	Permanen t	—
	/	/	/	/	/	
Shading rate [%].....	10	10	15	10	10 10 10	—

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Clause	Requirement + Test				Result - Remark	Verdict
Max. measured cell temperature in each cell [°C] :	161.3	155.7	165.1	143.6	151.2 153.2 154.1	—
Test duration of each shading [h]	1	1	1	1	1	—
Irradiance during shading [W/m²]	1251	1251	1251	1251	1251	—
Supplementary information: For Bifacial modules, determination of the cell shading percent and the prolonged exposure are performed at the elevated irradiance BSI. If double-side illumination is used to produce BSI, both the back and the front of the cell are shaded in the same way. During cell selection, any cell that is permanently shaded by a module feature (such as the junction box) is added to the list of selected cells						

Test Date [YYYY-MM-DD] start/end	2023-12-12 / 2023-12-12	—
Sample #	M2-13	—
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	—
Type of light source	☒ Pulse Simulator ☒ Steady state Simulator ☐ Natural sunlight	—
Module temperature at thermal equilibrium [°C] .:	52.3 / 51.8 / 52.7 / 55.2 / 50.8 / 51.4 / 51.9	—

TABLE 11.1: MQT 09 - Hot-spot endurance test for WBT						P
Selected hot-spot cells	LOW	LOW	LOW	HIGH	Permanen t	—
	/	/	/	/	/	
Shading rate [%].....	10	10	15	10	10 5 10	—
Max. measured cell temperature in each cell [°C] :	160.6	154.5	162.1	141.6	157.4 149.3 151.2	—
Test duration of each shading [h]	1	1	1	1	1	—
Irradiance during shading [W/m²]	1238	1238	1238	1238	1238	—

IEC 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict
Supplementary information: For Bifacial modules, determination of the cell shading percent and the prolonged exposure are performed at the elevated irradiance BSI. If double-side illumination is used to produce BSI, both the back and the front of the cell are shaded in the same way. During cell selection, any cell that is permanently shaded by a module feature (such as the junction box) is added to the list of selected cells			

Test Date [YYYY-MM-DD] start/end	2024-03-26 / 2024-03-26	—
Sample #	M3-13	—
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	—
Type of light source	☒ Pulse Simulator ☒ Steady state Simulator ☐ Natural sunlight	—
Module temperature at thermal equilibrium [°C] :	51.5 / 53.3 / 55.2 / 52.8 / 51.7 / 54.4 / 56.2	—

TABLE 11.1: MQT 09 - Hot-spot endurance test for WBT						P
Selected hot-spot cells	LOW	LOW	LOW	HIGH	Permanen t	—
	/	/	/	/	/	
Shading rate [%].....	15	10	10	5	10 10 10	—
Max. measured cell temperature in each cell [°C] :	167.3	162.1	165.4	143.5	151.6 153.8 155.3	—
Test duration of each shading [h]	1	1	1	1	1	—
Irradiance during shading [W/m²]	1240	1240	1240	1240	1240	—
Supplementary information: For Bifacial modules, determination of the cell shading percent and the prolonged exposure are performed at the elevated irradiance BSI. If double-side illumination is used to produce BSI, both the back and the front of the cell are shaded in the same way. During cell selection, any cell that is permanently shaded by a module feature (such as the junction box) is added to the list of selected cells						

Test Date [YYYY-MM-DD] start/end	2024-02-06 / 2024-02-06	—
Sample #	M4-13	—
Procedure of technology	☒ wafer-based technologies (WBT) MQT 09.1 ☐ monolithically integrated (MLI) thin film technologies MQT 09.2	—

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Clause	Requirement + Test	Result - Remark	Verdict
Cell interconnection circuit	☐ S ☒ SP ☐ PS		—
Type of light source	☒ Pulse Simulator ☒ Steady state Simulator ☐ Natural sunlight		—
Module temperature at thermal equilibrium [°C] :	52.1 / 54.2 / 51.1 / 51.8 / 50.7 / 52.6 / 54.5		—

TABLE 11.1: MQT 09 - Hot-spot endurance test for WBT						P
Selected hot-spot cells	LOW	LOW	LOW	HIGH	Permanen t	—
	/	/	/	/	/	
Shading rate [%].....	10	10	15	10	10 10 10	—
Max. measured cell temperature in each cell [°C] :	162.7	157.1	171.3	147.4	150.2 152.8 153.9	—
Test duration of each shading [h]	1	1	1	1	1	—
Irradiance during shading [W/m²]	1248	1248	1248	1248	1248	—
Supplementary information: For Bifacial modules, determination of the cell shading percent and the prolonged exposure are performed at the elevated irradiance BSI. If double-side illumination is used to produce BSI, both the back and the front of the cell are shaded in the same way. During cell selection, any cell that is permanently shaded by a module feature (such as the junction box) is added to the list of selected cells						

TABLE 11.2: 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:		

TABLE 11.3: MQT 01 - Visual inspection after hot-spot endurance test		P
Test Date [YYYY-MM-DD]	2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13	—
Sample #	Nature and position of initial findings – comments or attach photos	—

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Clause	Requirement + Test	Result - Remark	Verdict
M1-13	No major visual defects found		P
M2-13	No major visual defects found		P
M3-13	No major visual defects found		P
M4-13	No major visual defects found		P
Supplementary information: N/A			

TABLE 11.4: MQT 02 - Maximum power determination after hot-spot endurance test							P
Test Date [YYYY-MM-DD]		2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13					—
Module temperature [°C]		25					—
Irradiance [W/m ²]		1000					—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
M1-13	17.985	47.506	16.981	39.984	678.968	79.47	P
M2-13	14.226	51.619	13.521	42.719	577.604	78.66	P
M3-13	13.640	55.933	12.991	47.147	612.487	80.28	P
M4-13	15.669	47.756	14.694	40.186	590.493	78.91	P
Supplementary information: N/A							

TABLE 11.5: MQT 02 - Maximum power determination after hot-spot endurance test (at BNPI)							P
Test Date [YYYY-MM-DD]		2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13					—
Module temperature [°C]		25					—
Irradiance [W/m ²]		BNPI					—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	—
M1-13	19.886	47.707	18.958	39.839	755.268	79.61	P
M2-13	15.566	51.477	14.859	42.754	635.282	79.28	P
M3-13	15.013	56.126	14.221	47.183	670.989	79.63	P
M4-13	17.248	47.893	16.334	40.022	653.719	79.14	P
Supplementary information: N/A							

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Clause	Requirement + Test		Result - Remark		Verdict
TABLE 11.6: MQT 03 - Insulation test after hot-spot endurance test					P
Test Date [YYYY-MM-DD]		2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13			—
Test Voltage applied [V]		8000/1500			—
Size of module [m²]		3.11 for M1-13 2.70 for M2-13, M4-13 2.80 for M3-13			—
Required Resistance [MΩ].....		12.88 for M1-13 14.80 for M2-13, M4-13 14.31 for M3-13			—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
M1-13	>10000	12.88	No Dielectric breakdown	x	P
M2-13	8416	14.80	No Dielectric breakdown	x	P
M3-13	>10000	14.31	No Dielectric breakdown	x	P
M4-13	>10000	14.80	No Dielectric breakdown	x	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.					

TABLE 11.7: MQT 15 - Wet leakage current test after hot-spot endurance test					P
Test Date [YYYY-MM-DD]	2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13				—
Test Voltage applied [V]	1500				—
Solution temperature [°C]	21.5 for M1-13 21.9 for M2-13 23.1 for M3-13 21.8 for M4-13				—
Size of module [m ²]	3.11 for M1-13 2.70 for M2-13, M4-13 2.80 for M3-13				—
Solution resistivity [Ω cm]	2896 for M1-13 2866 for M2-13 2702 for M3-13 2782 for M4-13				—

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Clause	Requirement + Test	Result - Remark	Verdict
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-13	>10000	12.88	P
M2-13	5582	14.80	P
M3-13	>10000	14.31	P
M4-13	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 11.8: MQT 18.2 - Bypass diode functionality test after Hot-spot endurance test					P
Test Date [YYYY-MM-DD]		2024-02-05 for M1-13 2023-12-13 for M2-13 2024-03-26 for M3-13 2024-02-07 for M4-13			—
☐ Method A					—
Ambient temperature [°C]					—
Current flow applied [A]					—
Sample #	VFM	VFMrated	VFM = (N × VFMrated) ± 10 %		Result
			☐ Yes ☐ No		—
Supplementary information:					
☒ Method B					—
	IV curve after shading				Result
Diode 1	Turn on				P
Diode 2	Turn on				P
Diode 3	Turn on				P
Supplementary information: N/A					

TABLE 12.1: MQT 10 - UV preconditioning test (Front side)		P
Test Date (YYYY-MM-DD) start/end	2023-12-28 / 2024-01-02 for M1-x, M4-x 2023-01-01 / 2023-01-06 for M2-x	—
Module temperature [°C]	60 ± 5	—
UV irradiance (280-400nm) [W/m²]	132.74 for M1-x, M4-x 129.31 for M2-x	—
UV dose (280-320nm) [kWh/ m²]	1.11 for M1-x, M2-x, M4-x	—
Module operation condition	☒ Short circuited ☐ Open circuited	—
Supplementary information: UV preconditioning test was performed on front side of the module.		

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Clause	Requirement + Test	Result - Remark	Verdict
TABLE 12.2: MQT 10 - UV preconditioning test (Back side)			P
Test Date (YYYY-MM-DD) start/end	2024-01-02 / 2024-01-07 for M1-x, M4-x 2023-01-06 / 2023-01-11 for M2-x		—
Module temperature [°C]	60 ± 5		—
UV irradiance (280-400nm) [W/m²]	127.12 for M1-x, M4-x 132.74 for M2-x		—
UV dose (280-320nm) [kWh/ m²]	1.09 for M1-x, M4-x 1.15 for M2-x		—
Module operation condition	☒ Short circuited ☐ Open circuited		—
Supplementary information: For bifacial modules repeat the procedure of UV irradiation on the rear-side of the modules.			

TABLE 12.3: MQT 01 - Visual inspection after UV preconditioning test			P
Test Date [YYYY-MM-DD]	2024-01-07 for M1-x, M4-x 2023-01-11 for M2-x		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-4	No major visual defects found		P
M1-5	No major visual defects found		P
M2-4	No major visual defects found		P
M2-5	No major visual defects found		P
M4-4	No major visual defects found		P
M4-5	No major visual defects found		P
Supplementary information: N/A			

TABLE 12.4: MQT 15 - Wet leakage current test after UV preconditioning test			P
Test Date [YYYY-MM-DD]	2024-01-07 for M1-x, M4-x 2023-01-11 for M2-x		—
Test Voltage applied [V]	1500		—
Solution temperature [°C]	21.5 for M1-x, M4-x 21.9 for M2-x		—
Solution resistivity [Ω cm]	2794 for M1-x, M4-x 2757 for M2-x		—
Sample #	Measured [MΩ]	Required Resistance [MΩ]	Result
M1-4	>10000	12.88	P
M1-5	>10000	12.88	P
M2-4	415.2	15.48	P

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Clause	Requirement + Test	Result - Remark	Verdict
M2-5	491.0	15.48	P
M4-4	>10000	14.80	P
M4-5	>10000	14.80	P
Supplementary information: Size of module [m ²] 3.11 for M1-x, 2.58 for M2-x, 2.70 for M4-x, the maximum measuring limit of the equipment is 10000 MΩ.			

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Clause	Requirement + Test				Result - Remark		Verdict
TABLE 12.5: MQT 02 – Max. power determination after UV preconditioning 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
							—
							—
Supplementary information:							

TABLE 12.6: MQT 03 - Insulation test after UV preconditioning test - Optional					N/A
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:					

TABLE 13: MQT 20 - Cyclic (dynamic) mechanical Load test							P
Test Date [MM/DD/YYYY]				2024-01-15 for M1-x 2023-01-12 for M2-x 2024-01-17 for M4-x			—
Sample #				M1-4, M1-5 M2-4, M2-5 M4-4, M4-5			—
Temperature of tested module(°C)				24.0 for M1-x, M2-x, M4-x			—
Maximum pressure (Pa)				1000			—
Pressure tolerance(Pa)				±1000			—
Monitoring current (A)				0.05			—
Rate per minute(cycles)				5			—
Number of cycles				1000			—
Pressure provider (Air pressure or vacuum)				Air pressure			—
Cell and alive part broken/ not				not			P

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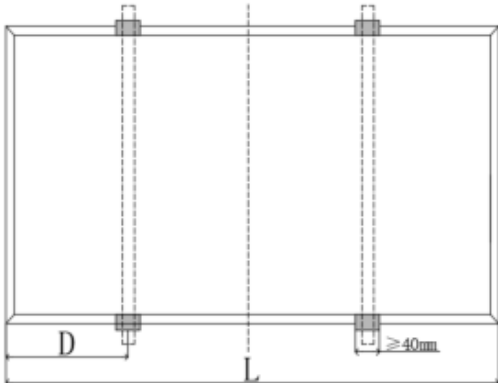
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Clause	Requirement + Test	Result - Remark	Verdict
	Current continuous (continuous/ disconnection occurred)	continuous	P
Supplementary information:			
 D=1/4L			

TABLE 13.1: MQT 01 - Visual inspection after Cyclic (dynamic) mechanical Load test		P
Test Date [YYYY-MM-DD].....:	2024-01-15 for M1-x 2023-01-12 for M2-x 2024-01-17 for M4-x	—
Sample #	Nature and position of initial findings – comments or attach photos	—
M1-4	No major visual defects found	P
M1-5	No major visual defects found	P
M2-4	No major visual defects found	P
M2-5	No major visual defects found	P
M4-4	No major visual defects found	P
M4-5	No major visual defects found	P
Supplementary information: N/A		

TABLE 13.2: MQT 15 - Wet leakage current test after Cyclic (dynamic) mechanical Load test		P
Test Date [YYYY-MM-DD]..... :	2024-01-15 for M1-x 2023-01-12 for M2-x 2024-01-17 for M4-x	—
Test Voltage applied [V]	1500	—
Solution temperature [°C]	21.6 for M1-x 21.1 for M2-x 21.9 for M4-x	—

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Clause	Requirement + Test	Result - Remark	Verdict
Solution resistivity [Ω cm]		2689 for M1-x 2744 for M2-x 2926 for M4-x	—
Size of module [m^2]		3.11 for M1-x 2.58 for M2-x 2.70 for M4-x	—
Sample #	Measured [$M\Omega$]	Required Resistance [$M\Omega$]	Result
M1-4	>10000	12.88	P
M1-5	>10000	12.88	P
M2-4	587.4	15.48	P
M2-5	535.4	15.48	P
M4-4	>10000	14.80	P
M4-5	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 $M\Omega$.			

TABLE 14: MQT 11 - Thermal cycling 50 test			p	
Test Date [YYYY-MM-DD] start/end:		2024-01-25 / 2024-02-04 for M1-x, M4-x 2023-01-14 / 2023-01-24 for M2-x	—	
Total cycles (50).....:		50	—	
Weight attached (N)		5	—	
Applied current (A)		During the heat up cycle from -40 °C to 80 °C	20.96 / 20.99 for M1-x 16.0 / 16.0 for M2-x 18.13 / 18.15 for M4-x	—
		Other stages	0.05	—
Sample #	Open circuits (yes/no)			—
M1-4	No			P
M1-5	No			P
M2-4	No			P
M2-5	No			P
M4-4	No			P
M4-5	No			P
Supplementary information: N/A				

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Clause	Requirement + Test		Result - Remark	Verdict
TABLE 14.1: MQT 01 - Visual inspection after thermal cycling 50 test				P
Test Date [YYYY-MM-DD]		2024-02-04 for M1-x, M4-x 2023-01-24 for M2-x		—
Sample #	Nature and position of initial findings – comments or attach photos			—
M1-4	No major visual defects found			P
M1-5	No major visual defects found			P
M2-4	No major visual defects found			P
M2-5	No major visual defects found			P
M4-4	No major visual defects found			P
M4-5	No major visual defects found			P
Supplementary information: N/A				

TABLE 14.2: MQT 15 - Wet leakage current test after thermal cycling 50 test			P
Test Date [YYYY-MM-DD]		2024-02-04 for M1-x, M4-x 2023-01-24 for M2-x	—
Test Voltage applied [V]		1500	—
Solution temperature [°C]		21.8 for M1-x, M4-x 24.0 for M2-x	—
Solution resistivity [Ω cm]		2914 for M1-x, M4-x 2992 for M2-x	—
Size of module [m²]		3.11 for M1-x 2.58 for M2-x 2.70 for M4-x	—
Sample #	Measured [MΩ]	Required Resistance [MΩ]	Result
M1-4	>10000	12.88	P
M1-5	>10000	12.88	P
M2-4	594.0	15.48	P
M2-5	594.6	15.48	P
M4-4	>10000	14.80	P
M4-5	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 14.3: MQT 03 – Max. power determination after thermal cycling 50 test - Optional			N/A
Test Date [YYYY-MM-DD]			—
Module temperature [°C]			—

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Clause	Requirement + Test			Result - Remark		Verdict
Irradiance [W/m²):						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]
						—
						—
Supplementary information:						

TABLE 14.4: MQT 03 - Insulation test after thermal cycling 50 test - Optional					N/A
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: Size of module [m²]					

TABLE 15: MQT 12 - Humidity freeze 10 test		P
Test Date [YYYY-MM-DD] start/end	2024-02-08 / 2024-02-18 for M1-x, M4-x 2023-01-25 / 2023-02-04 for M2-x	—
Total cycles (10)	10	—
Applied current (A)	0.1	—
Sample #	Open circuits (yes/no)	—
M1-4	No	P
M1-5	No	P
M2-4	No	P
M2-5	No	P
M4-4	No	P
M4-5	No	P
Supplementary information: N/A		

TABLE 15.1: MQT 01 - Visual inspection after humidity freeze 10 test					P
Test Date [YYYY-MM-DD]		2024-02-18 for M1-x, M4-x 2023-02-04 for M2-x			—

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Clause	Requirement + Test	Result - Remark	Verdict
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-4	No major visual defects found		P
M1-5	No major visual defects found		P
M2-4	No major visual defects found		P
M2-5	No major visual defects found		P
M4-4	No major visual defects found		P
M4-5	No major visual defects found		P
Supplementary information: N/A			

TABLE 15.2: MQT 15 - Wet leakage current test after humidity freeze 10 test			P
Test Date [YYYY-MM-DD].....:	2024-02-18 for M1-x, M4-x 2023-02-04 for M2-x	—	
Test Voltage applied [V]	1500	—	
Solution temperature [°C].....:	21.7 for M1-x, M4-x 22.7 for M2-x	—	
Size of module [m²]	3.11 for M1-x 2.58 for M2-x 2.70 for M4-x	—	
Solution resistivity [Ω cm]	2874 for M1-x, M4-x 2935 for M2-x	—	
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-4	>10000	12.88	P
M1-5	>10000	12.88	P
M2-4	596.8	15.48	P
M2-5	501.2	15.48	P
M4-4	>10000	14.80	P
M4-5	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 15.3: MQT 02 - Maximum power determination after humidity freeze 10 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 [%]
						—

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

TABLE 15.4: MQT 03 Insulation test after humidity freeze 10 test) -Optional					N/A
Test Date [YYYY-MM-DD]					—
Test Voltage applied [V]					—
Size of module [m ²]					—
Required Resistance [MΩ].....					—
Sample #	Measured	Required	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
					—
					—
Supplementary information: Size of module [m ²]					

TABLE 16: MQT 14.1 Retention of junction box on mounting surface		P
Test Date [YYYY-MM-DD] start/end: 2024-02-18 for M1-4, M4-4 2023-02-04 for M2-4		—
Sample #	M1-4, M2-4, M4-4	—
Supplementary information: the force used in the retention of junction box on mounting surface was increased from 40 N to 156 N.		

TABLE 16.1: MQT 01 - Visual inspection after retention of junction box on mounting surface		P
Test Date [YYYY-MM-DD] :		2024-02-18 for M1-4, M4-4 2023-02-04 for M2-4
Sample #	Nature and position of initial findings – comments or attach photos	—
M1-4	No major visual defects found	P
M2-4	No major visual defects found	P
M4-4	No major visual defects found	P
Supplementary information: N/A		

TABLE 16.2: MQT 15 - Wet leakage current test after retention of junction box on mounting surface				P
Test Date [YYYY-MM-DD]		2024-02-18 for M1-4, M4-4 2023-02-04 for M2-4		—
Test Voltage applied [V]		1500		—

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Clause	Requirement + Test	Result - Remark	Verdict
Solution temperature [°C].....:	22.1 for M1-4, M4-4 22.3 for M2-4		—
Size of module [m²]	3.11 for M1-4 2.58 for M2-4 2.70 for M4-4		—
Solution resistivity [Ω cm]..... :	2837 for M1-4, M4-4 2974 for M2-4		—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-4	>10000	12.88	P
M2-4	487.5	15.48	P
M4-4	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 17: MQT 11 - Thermal cycling 200 test				P
Test Date [YYYY-MM-DD] start/end		2024-01-15 / 2024-02-18		—
Total cycles (200).....		200		—
Weight attached (N)		5		—
Applied current (A)		During the heat up cycle from –40 °C to 80 °C	20.92 / 20.97 for M1-x 18.14 / 18.05 for M2-x	—
		Other stages	0.05	—
Sample #	Open circuits (yes/no)			—
M1-8	No			P
M1-9	No			P
M4-8	No			P
M4-9	No			P
Supplementary information: N/A				

TABLE 17.1: MQT 01 - Visual inspection after thermal cycling 200 test			P
Test Date [YYYY-MM-DD].....:	2024-02-18		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-8	No major visual defects found		P
M1-9	No major visual defects found		P
M4-8	No major visual defects found		P
M4-9	No major visual defects found		P

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

TABLE 17.2: MQT 15 - Wet leakage current test after thermal cycling 200 test			P
Test Date [YYYY-MM-DD]	2024-02-18		—
Test Voltage applied [V]	1500		—
Solution temperature [°C]	22.1		—
Size of module [m²]	3.11 for M1-x 2.70 for M4-x		—
Solution resistivity [Ω cm]	2935		—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-8	>10000	12.88	P
M1-9	>10000	12.88	P
M4-8	>10000	14.80	P
M4-9	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

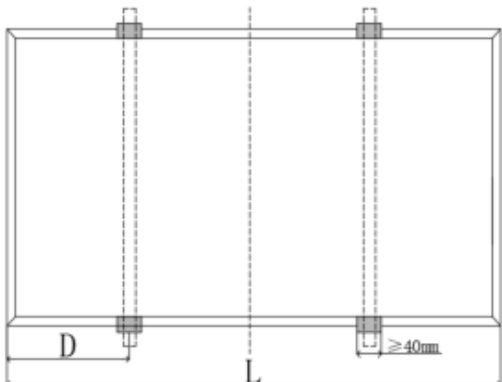
TABLE 18: MQT 13 - Damp heat 1000 test			P
Test Date [YYYY-MM-DD] start/end	2024-01-16 / 2024-02-27		—
Total hours (1000h)	1000		—
Sample #			—
M1-6	No		P
M1-7	No		P
M4-6	No		P
M4-7	No		P
Supplementary information: N/A			

TABLE 18.1: MQT 01 - Visual inspection after damp heat 1000 test			P
Test Date [YYYY-MM-DD]	2024-02-27		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-6	No major visual defects found		P
M1-7	No major visual defects found		P
M4-6	No major visual defects found		P
M4-7	No major visual defects found		P
Supplementary information: N/A			

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Clause	Requirement + Test	Result - Remark	Verdict
TABLE 18.2: MQT 15 - Wet leakage current test after damp heat 1000 test			P
Test Date [YYYY-MM-DD]	2024-02-27		—
Test Voltage applied [V]	1500		—
Solution temperature [°C]	22.1		—
Size of module [m²]	3.11 for M1-x 2.70 for M4-x		—
Solution resistivity [Ω cm]	2884		—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-6	>10000	12.88	P
M1-7	>10000	12.88	P
M4-6	>10000	14.80	P
M4-7	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 18.3: 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
							—
							—
Supplementary information:							

TABLE 18.4: 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: Size of module [m²]					

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Clause	Requirement + Test	Result - Remark	Verdict
TABLE 19: MQT 16 Static mechanical load test			P
Sample # :	M1-6		—
Design load(front side/ back side)..... :	3600 / 1600		—
Safety factors	1.5		—
Test Date [YYYY-MM-DD]	2024-03-05		—
Mounting method	Installed by 4 clamps on long side frame		—
Load applied to..... :	front side	back side	—
Mechanical load [Pa]..... :	5400	2400	—
First cycle time (start/end)..... :	9:13 / 10:13	10:18 / 11:18	—
Intermittent open-circuit (yes/no)	No	No	P
Second cycle time (start/end)	11:23 / 12:23	12:28 / 13:28	—
Intermittent open-circuit (yes/no)	No	No	P
Third cycle time (start/end)	13:38 / 14:38	15:48 / 16:48	—
Intermittent open-circuit (yes/no)	No	No	P
Supplementary information:			
 D=1/4L			

Sample # :	M4-6		—
Design load(front side/ back side)..... :	3600 / 1600		—
Safety factors	1.5		—
Test Date [YYYY-MM-DD]	2024-03-08		—
Mounting method	Installed by 4 clamps on long side frame		—
Load applied to..... :	front side	back side	—
Mechanical load [Pa]..... :	5400	2400	—
First cycle time (start/end)..... :	9:18 / 10:18	10:25 / 11:25	—
Intermittent open-circuit (yes/no)	No	No	P

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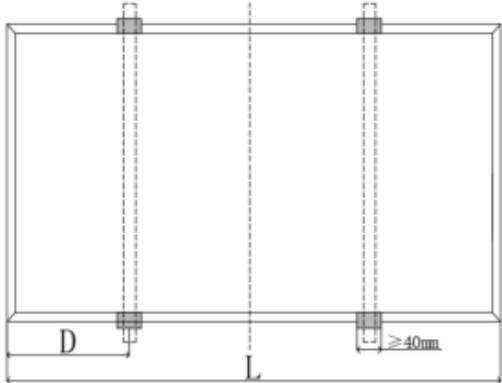
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Clause	Requirement + Test	Result - Remark	Verdict
Second cycle time (start/end)	11:33 / 12:33	12:41 / 13:41	—
Intermittent open-circuit (yes/no)	No	No	P
Third cycle time (start/end)	13:52 / 14:52	15:12 / 16:12	—
Intermittent open-circuit (yes/no)	No	No	P
Supplementary information:			
 D=1/4L			

TABLE 19.1: MQT 01 - Visual inspection after static mechanical load test			P
Test Date [YYYY-MM-DD]	2024-03-05 for M1-6 2024-03-08 for M4-6		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-6	No major visual defects found		P
M4-6	No major visual defects found		P
Supplementary information: N/A			

TABLE 19.2: MQT 15 - Wet leakage current test after static mechanical load test				P
Test Date [YYYY-MM-DD]	2024-03-05 for M1-6 2024-03-08 for M4-6			—
Test Voltage applied [V]	1500			—
Solution temperature [°C]	21.9			—
Size of module [m²]	3.11 for M1-6 2.70 for M4-6			—
Solution resistivity [Ω cm]	2791			—
Sample #	Measured [MΩ]	Limit [MΩ]		Result
M1-6	>10000	12.88		P
M4-6	>10000	14.80		P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.				

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Clause	Requirement + Test	Result - Remark	Verdict

TABLE 20: MQT 22 Bending test			N/A
Test Date [YYYY-MM-DD]			—
Sample # :			—
Specified radius of curvature			—
Bending radius			—
Total cycles.....			—
Intermittent open-circuit (yes/no)			—
Supplementary information: may need to be performed with each mounting situation			

TABLE 20.1: MQT 01 - Visual inspection after bending test			N/A
Test Date [YYYY-MM-DD]			—
Sample #	Nature and position of initial findings – comments or attach photos		—
			—
Supplementary information:			

TABLE 20.2: MQT 15 - Wet leakage current test after bending test				N/A
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:				

TABLE 21: MQT 17 - Hail impact test							P
Test Date [YYYY-MM-DD]	2024-03-08						—
Sample #	M1-7						—
Ice ball size [mm]	1	2	3	4	5	6	—
	24.6	25.1	25.1	24.8	24.8	25.1	
	7	8	9	10	11	/	
	24.5	24.7	24.8	24.5	24.5	/	
Ice ball weight [g]	1	2	3	4	5	6	—
	7.35	7.47	7.50	7.42	7.43	7.33	

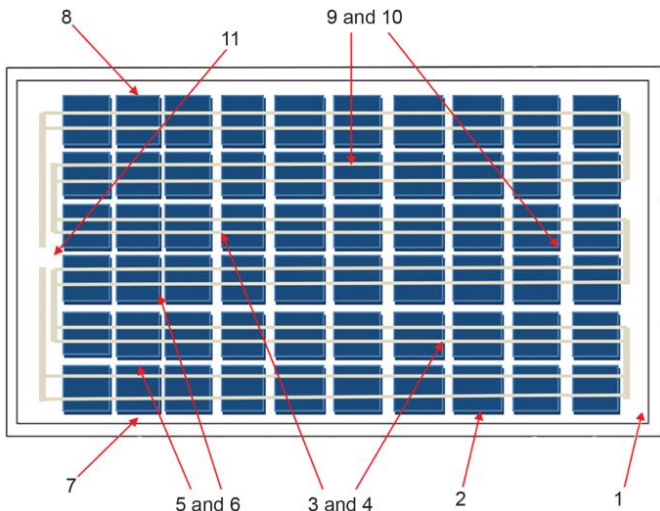
IEC 61215-2							
Clause	Requirement + Test					Result - Remark	Verdict
Ice ball velocity [m/s]	7	8	9	10	11	/	—
	7.37	7.32	7.48	7.46	7.41	/	
	1	2	3	4	5	6	
	22.73	22.37	22.44	23.09	22.44	23.06	
Number of impact locations	7	8	9	10	11	/	—
	22.64	22.56	22.94	22.70	22.85	/	
Supplementary information: (impact location descriptions)							—
							

TABLE 21.1: MQT 01 - Visual inspection after hail impact test		P
Test Date [YYYY-MM-DD]	2024-03-08	—
Sample #	Nature and position of initial findings – comments or attach photos	—
M1-7	No major visual defects found	P
Supplementary information: N/A		

TABLE 21.2: MQT 15 - Wet leakage current test after hail impact test			P
Test Date [YYYY-MM-DD]..... :		2024-03-08	—
Test Voltage applied [V]..... :		1500	—
Solution temperature [°C]..... :		22.1	—
Solution resistivity [Ω cm] :		2687	—
Size of module [m²] :		3.11	—
Sample #	Measured [MΩ]	Required Resistance [MΩ]	Result
M1-7	>10000	12.88	P

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Clause	Requirement + Test	Result - Remark	Verdict
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

TABLE 22: MQT 15 -Potential induced degradation test			P
Test Date [YYYY-MM-DD] start/end	2024-01-16 / 2024-01-21 for M1-x, M4-x 2023-12-11 / 2023-12-15 for M2-x		—
Chamber air temperature (°C)	85		—
Chamber relative humidity (% RH)	85		—
Test duration hours (h)	96		—
Sample #	Applied voltage stress (V) and polarities		—
M1-18	-1500		—
M1-19	-1500		—
M1-20	+1500		—
M1-21	+1500		—
M2-18	-1500		—
M2-19	-1500		—
M2-20	+1500		—
M2-21	+1500		—
M4-18	-1500		—
M4-19	-1500		—
M4-20	+1500		—
M4-21	+1500		—
Supplementary information: N/A			

TABLE 22.1: MQT 01 - Visual inspection after potential induced degradation test			P
Test Date [YYYY-MM-DD]	2024-01-21 for M1-x, M4-x 2023-12-15 for M2-x		—
Sample #	Nature and position of initial findings – comments or attach photos		—
M1-18	No major visual defects found		P
M1-19	No major visual defects found		P
M1-20	No major visual defects found		P
M1-21	No major visual defects found		P
M2-18	No major visual defects found		P
M2-19	No major visual defects found		P
M2-20	No major visual defects found		P

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Clause	Requirement + Test	Result - Remark	Verdict
M2-21	No major visual defects found		P
M4-18	No major visual defects found		P
M4-19	No major visual defects found		P
M4-20	No major visual defects found		P
M4-21	No major visual defects found		P
Supplementary information: N/A			

TABLE 22.2: MQT 15 - Wet leakage current test after potential induced degradation test			P
Test Date [YYYY-MM-DD]	2024-01-21 for M1-x, M4-x 2023-12-15 for M2-x		—
Test Voltage applied [V]	1500		—
Solution temperature [°C]	22.1 for M1-x, M4-x 22.8 for M2-x		—
Solution resistivity [Ω cm]	2875 for M1-x, M4-x 2658 for M2-x		—
Size of module [m ²]	3.11 for M1-x 2.70 for M2-x, M4-x		—
Sample #	Measured [$M\Omega$]	Required Resistance [$M\Omega$]	Result
M1-18	>10000	12.88	P
M1-19	>10000	12.88	P
M1-20	>10000	12.88	P
M1-21	>10000	12.88	P
M2-18	5623	14.80	P
M2-19	4839	14.80	P
M2-20	5281	14.80	P
M2-21	5392	14.80	P
M4-18	>10000	14.80	P
M4-19	>10000	14.80	P
M4-20	>10000	14.80	P
M4-21	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 $M\Omega$.			

TABLE 23: MQT 19.2 Fin: Final stabilization			N/A
TABLE 23.1: MQT 06.1: Performance at STC before final stabilization			
Test Date [YYYY-MM-DD]			—

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Clause	Requirement + Test				Result - Remark		Verdict
Test method			☐ Simulator		☐ Natural sunlight		—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
							—
							—
							—
							—
							—
							—
							—
Supplementary information:							

TABLE 23.2: MQT 19.1 Final Stabilization procedure							N/A
☐ IEC 61215-1-2 ☐ IEC 61215-1-3 ☐ IEC 61215-1-4							
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							
3							
4						—	—
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							
3							
4						—	—

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Clause	Requirement + Test	Result - Remark	Verdict
Supplementary information:			
☐ Other stabilization procedures			
Sample #	Test Date (YYYY-MM-DD) start/end		
Supplementary information: see Annex 3 for verification of this alternative stabilization procedure			

TABLE 23.3: MQT 19.2 Fin: Final stabilization									P
☒ IEC 61215-1-1									—
☐ Method 1									N/A
Stress-specific stabilization – BO LID (MQT 19.3)									
Test Date [YYYY-MM-DD]									—
Applied current (A)									—
Module temperature [°C]									—
Total hours (48h)									—
Performance at STC after final stabilization— for monofacial modules									
Test Date [YYYY-MM-DD]									—
Test method					☐ Solar simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result
									—
									—
Performance at BNPI after final stabilization — for bifacial modules									—
Test Date [YYYY-MM-DD]									—
Test method					☐ Solar simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result
Supplementary information:									

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Clause	Requirement + Test						Result - Remark		Verdict	
☒ Method 2									—	
Performance at STC before final stabilization— for monofacial modules									—	
Test Date [YYYY-MM-DD]										—
Test method				☐ Solar simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result	
									—	
									—	
Performance at BNPI before final stabilization — for bifacial modules									—	
Test Date [YYYY-MM-DD]				2024-03-26						—
Test method				☒ Solar simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result	
M1-6	19.895	47.620	18.750	39.346	737.738	77.87	755.409	-2.34	P	
M1-7	20.161	47.689	18.886	39.371	743.561	77.34	757.401	-1.83	P	
M4-6	17.297	47.957	16.335	39.336	642.554	77.46	656.377	-2.11	P	
M4-7	17.087	47.956	16.217	39.601	642.209	78.37	655.061	-1.96	P	
Supplementary information: This module was not stabilized, and therefore the amount of degradation observed may be larger than what would have been obtained if the module had been stabilized, due to destabilization artifacts.										
If Power Degradation≥5%, then perform stress-specific stabilization MQT 19.3 in method 1										
Stress-specific stabilization – BO LID (MQT 19.3)									N/A	
Test Date [YYYY-MM-DD]										—
Applied current (A)										—
Module temperature [°C].....										—
Total hours (48h)										—
Performance at STC after final stabilization — for monofacial modules										
Test Date [YYYY-MM-DD]										—
Test method				☐ Solar simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result	
									—	

IEC 61215-2										
Clause	Requirement + Test						Result - Remark		Verdict	
									—	
Performance at BNPI after final stabilization — for bifacial modules										
Test Date [YYYY-MM-DD]										—
Test method				☐ Solar simulator		☐ Natural sunlight			—	
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation	Result	
									—	
									—	
Supplementary information:										
TABLE 23.4: MQT 19.2 Fin: Final stabilization									P	
☐ Method 3									N/A	
Test Date (YYYY-MM-DD) start/end										—
Test duration (h)										—
Module temperature [°C]										—
UV irradiance (280-400nm) [W/m²]										—
UV dose (280-320nm) [kWh/ m²]										—
UV dose (280-400nm) [kWh/ m²]										—
Side exposed				☐ Front side		☐ Rear side				—
Module operation condition				☐ Short circuited		☐ Open circuited				—
Supplementary information: For bifacial modules, the irradiance shall be applied to the rear side, whereas for monofacial modules, the irradiance shall be applied to the front side.										
Performance at STC after final stabilization— for monofacial modules										
Test Date [YYYY-MM-DD]										—
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	
									—	
									—	
									—	
									—	
Performance at BNPI after final stabilization — for bifacial modules									N/A	
Test Date [YYYY-MM-DD]										—

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Clause	Requirement + Test						Result - Remark	Verdict	
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
									—
									—
									—
									—
Supplementary information:									
☒ Method 4									N/A
Performance at STC before final stabilization— for monofacial modules									—
Test Date [YYYY-MM-DD] :									
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
									—
									—
									—
									—
Performance at BNPI before final stabilization — for bifacial modules									P
Test Date [YYYY-MM-DD] : 2024-01-21 for M1-x, M4-x 2023-12-15 for M2-x									
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
M1-18	19.883	47.689	18.933	39.580	749.368	79.03	749.368	-1.08	P
M1-19	19.855	47.633	18.810	39.695	746.663	78.95	746.663	-1.15	P
M1-20	19.933	47.687	18.806	40.011	752.447	79.16	752.447	-0.47	P
M1-21	19.911	47.652	18.756	40.017	750.559	79.11	750.559	-0.65	P
M2-18	15.626	51.473	14.890	42.926	639.168	79.47	638.083	-1.55	P
M2-19	15.563	51.481	14.872	42.242	628.223	78.41	639.491	-1.29	P
M2-20	15.525	51.481	14.953	42.217	631.271	78.98	639.562	-1.02	P

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Clause	Requirement + Test						Result - Remark		Verdict	
M2-21	15.722	51.428	14.887	42.522	633.025	78.29	640.084	-0.99	P	
M4-18	17.303	47.826	16.430	39.680	651.942	78.78	657.778	-0.89	P	
M4-19	17.088	47.799	16.255	39.665	644.755	78.94	652.990	-1.26	P	
M4-20	17.342	47.683	16.436	39.815	654.399	79.14	657.492	-0.47	P	
M4-21	17.256	47.664	16.331	39.840	650.627	79.10	654.556	-0.60	P	
Supplementary information: This module was not stabilized, and therefore the amount of degradation observed may be larger than what would have been obtained if the module had been stabilized, due to polarization artifacts										
If Power Degradation $\geq$ 5%, then perform method 3 final stabilization										
Method 3									N/A	
Test Date [YYYY-MM-DD]										—
Test duration (h)										—
Module temperature [°C]										—
UV irradiance (280-400nm) [W/m ²]										—
UV dose (280-320nm) [kWh/ m ²]										—
UV dose (280-400nm) [kWh/ m ²]										—
Side exposed				☐ Front side		☐ Rear side				—
Module operation condition				☐ Short circuited		☐ Open circuited				—
Performance at STC after final stabilization — for monofacial modules									N/A	
Test Date [YYYY-MM-DD]										—
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	
									—	
									—	
									—	
									—	
Performance at BNPI after final stabilization — for bifacial modules									N/A	
Test Date [YYYY-MM-DD]										—
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	

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

TABLE 23.5: MQT 06.1: Final Performance at STC									N/A
Test Date [YYYY-MM-DD]..... :									—
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
									—
									—
									—
									—
Supplementary information: Pmax [W] (Lab_GateNo.1) is calculated by considering the reproducibility <i>r</i> of control module.									

For bifacial modules								P
TABLE 23.6: MQT 06.1 ini: Performance at STC after final stabilization (Front side)								P
Test Date [YYYY-MM-DD]..... :					Different dates			—
Test method..... :					☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result	
M1-10	18.228	47.486	17.092	40.098	685.355	79.18	P	
M1-13	17.987	47.507	16.992	39.803	676.333	79.15	P	
M1-4	18.063	47.531	16.958	39.173	664.296	77.37	P	
M1-5	17.998	47.402	17.032	39.042	664.963	77.94	P	
M1-8	18.038	47.438	17.092	39.328	672.194	78.56	P	
M1-9	17.965	47.400	17.075	39.409	672.909	79.02	P	
M1-6	18.008	47.407	16.988	39.271	667.136	78.15	P	
M1-7	18.276	47.515	17.023	39.493	672.289	77.42	P	
M1-18	18.046	47.504	17.002	39.794	676.578	78.92	P	
M1-19	17.986	47.456	17.091	39.648	677.624	79.39	P	

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Clause		Requirement + Test					Result - Remark			Verdict
M1-20	18.055	47.459	17.094	39.832	680.888	79.46				P
M1-21	18.027	47.424	17.090	39.787	679.960	79.54				P
M2-10	13.463	51.605	12.923	43.661	564.231	81.21				P
M2-4	13.497	51.543	12.751	43.347	552.718	79.45				P
M2-5	13.465	51.540	12.975	43.100	559.223	80.58				P
M2-11	14.215	51.628	13.526	42.921	580.549	79.11				P
M2-13	14.226	51.619	13.521	42.719	577.604	78.66				P
M2-18	14.215	51.628	13.526	42.921	580.549	79.11				P
M2-19	14.171	51.526	13.529	42.253	571.641	78.29				P
M2-20	14.300	51.600	13.495	42.313	571.014	77.39				P
M2-21	14.184	51.575	13.531	42.469	574.648	78.55				P
M3-10	13.623	56.151	12.951	47.669	617.361	80.71				P
M3-13	13.637	55.924	13.010	46.969	611.067	80.13				P
M4-10	15.504	47.684	14.719	40.218	591.969	80.07				P
M4-13	15.663	47.737	14.720	39.996	588.741	78.74				P
M4-4	15.632	47.711	14.931	39.198	585.265	78.47				P
M4-5	15.731	47.728	14.820	39.576	586.516	78.12				P
M4-8	15.734	47.788	14.762	39.539	583.675	77.63				P
M4-9	15.662	47.741	14.727	39.582	582.924	77.96				P
M4-6	15.688	47.712	14.761	39.389	581.421	77.68				P
M4-7	15.496	47.793	14.830	39.511	585.948	79.12				P
M4-18	15.697	47.616	14.771	39.746	587.088	78.55				P
M4-19	15.490	47.636	14.741	39.780	586.397	79.47				P
M4-20	15.750	47.524	14.887	39.817	592.756	79.19				P
M4-21	15.648	47.531	14.800	39.932	590.994	79.46				P
Supplementary information: N/A										
TABLE 23.7: MQT 06.1 ini: Performance at STC after final stabilization (Back side)										P
Test Date [YYYY-MM-DD]..... :			Different dates							—
Test method..... :			☒ Simulator ☐ Natural sunlight							—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	ϕIsc	ϕVoc	ϕPmax	Result
M1-10	14.589	47.117	13.063	40.891	534.159	77.71	0.80	0.99	0.78	P
M1-13	14.593	47.166	13.055	40.536	529.197	76.89	0.81	0.99	0.78	P

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Clause	Requirement + Test						Result - Remark			Verdict
M1-4	14.707	47.056	12.996	39.873	518.190	74.88	0.81	0.99	0.78	P
M1-5	14.532	47.015	12.944	39.815	515.365	75.43	0.81	0.99	0.78	P
M1-8	14.896	47.007	12.887	40.225	518.380	74.03	0.83	0.99	0.77	P
M1-9	15.089	47.028	13.022	40.092	522.078	73.57	0.84	0.99	0.78	P
M1-6	14.887	47.030	13.125	39.834	522.821	74.67	0.83	0.99	0.78	P
M1-7	14.922	47.092	13.131	40.166	527.420	75.06	0.82	0.99	0.78	P
M1-18	15.026	47.087	12.914	40.662	525.109	74.22	0.83	0.99	0.78	P
M1-19	15.089	47.088	13.127	40.333	529.451	74.52	0.84	0.99	0.78	P
M1-20	14.821	47.168	13.029	40.674	529.942	75.81	0.82	0.99	0.78	P
M1-21	15.024	47.053	13.141	40.438	531.396	75.17	0.83	0.99	0.78	P
M2-10	10.467	51.183	9.906	44.356	439.391	82.02	0.78	0.99	0.78	P
M2-4	10.399	51.151	9.913	43.603	432.237	81.26	0.77	0.99	0.78	P
M2-5	10.424	51.110	9.743	44.072	429.393	80.60	0.77	0.99	0.77	P
M2-11	11.299	51.017	10.225	45.121	461.362	80.04	0.79	0.99	0.79	P
M2-13	11.379	51.031	10.176	45.029	458.215	78.91	0.80	0.99	0.79	P
M2-18	11.332	51.149	10.153	44.495	451.758	77.94	0.79	0.99	0.79	P
M2-19	11.333	51.032	10.038	44.625	447.946	77.45	0.80	0.99	0.79	P
M2-20	11.387	51.042	10.128	44.883	454.575	78.21	0.79	0.99	0.78	P
M2-21	11.386	50.980	10.159	44.839	455.519	78.48	0.80	0.99	0.79	P
M3-10	10.642	55.746	9.621	48.364	465.310	78.43	0.78	0.99	0.75	P
M3-13	10.505	55.380	9.639	47.618	458.990	78.90	0.77	0.99	0.75	P
M4-10	12.363	47.244	10.885	40.196	437.533	74.91	0.81	0.99	0.76	P
M4-13	12.477	47.321	10.862	40.480	439.694	74.47	0.77	0.99	0.75	P
M4-4	12.008	47.407	10.934	40.232	439.897	77.27	0.79	0.99	0.75	P
M4-5	12.229	47.268	10.627	40.457	429.937	74.38	0.79	0.99	0.75	P
M4-8	11.960	47.354	10.858	40.339	438.001	77.34	0.76	0.99	0.75	P
M4-9	12.453	47.402	10.717	40.696	436.139	73.88	0.78	0.99	0.74	P
M4-6	11.987	47.209	10.786	40.764	439.681	77.70	0.76	0.99	0.75	P
M4-7	12.509	47.319	10.736	40.833	438.383	74.06	0.80	0.99	0.74	P

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Clause	Requirement + Test						Result - Remark			Verdict
M4-18	12.023	47.111	11.032	40.616	448.076	79.11	0.76	0.99	0.75	P
M4-19	12.214	47.131	10.704	40.841	437.162	75.94	0.81	0.99	0.75	P
M4-20	12.539	47.254	10.978	40.893	448.923	75.77	0.76	0.99	0.76	P
M4-21	11.991	47.300	10.767	40.905	440.424	77.65	0.78	0.99	0.74	P
Supplementary information: N/A										

TABLE 23.8: MQT 06.1: Final Performance at BNPI									P
Test Date [YYYY-MM-DD]..... :					Different dates				—
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
M1-10	20.101	47.651	18.920	40.101	758.711	79.21	756.924	0.24	P
M1-13	19.882	47.691	18.979	39.655	752.612	79.37	758.970	-0.84	P
M1-4	19.970	47.690	18.730	39.199	734.197	77.09	755.446	-2.81	P
M1-5	19.838	47.567	18.866	39.009	735.944	77.99	754.308	-2.43	P
M1-8	19.905	47.640	18.890	39.411	744.474	78.51	755.656	-1.48	P
M1-9	19.817	47.629	18.876	39.401	743.733	78.80	753.005	-1.23	P
M1-6	19.895	47.620	18.750	39.346	737.738	77.87	753.445	-2.08	P
M1-7	20.161	47.689	18.886	39.371	743.561	77.34	755.432	-1.57	P
M1-18	19.883	47.689	18.933	39.580	749.368	79.03	755.543	-0.82	P
M1-19	19.855	47.633	18.810	39.695	746.663	78.95	753.385	-0.89	P
M1-20	19.933	47.687	18.806	40.011	752.447	79.16	754.058	-0.21	P
M1-21	19.911	47.652	18.756	40.017	750.559	79.11	753.515	-0.39	P
M2-10	14.890	51.796	14.316	43.688	625.437	81.09	624.046	0.22	P
M2-4	14.913	51.700	14.262	43.142	615.291	79.80	624.346	-1.45	P
M2-5	14.905	51.729	14.230	43.363	617.055	80.03	624.704	-1.22	P
M2-11	15.626	51.473	14.890	42.926	639.168	79.47	637.521	0.26	P
M2-13	15.566	51.477	14.859	42.754	635.282	79.28	637.329	-0.32	P
M2-18	15.626	51.473	14.890	42.926	639.168	79.47	637.521	0.26	P
M2-19	15.563	51.481	14.872	42.242	628.223	78.41	636.424	-1.29	P

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Clause	Requirement + Test						Result - Remark		Verdict
M2-20	15.525	51.481	14.953	42.217	631.271	78.98	637.828	-1.03	P
M2-21	15.722	51.428	14.887	42.522	633.025	78.29	637.899	-0.76	P
M3-10	15.027	56.347	14.246	47.679	679.235	80.22	677.379	0.27	P
M3-13	15.020	56.098	14.192	47.058	667.847	79.26	674.596	-1.00	P
M4-10	17.081	47.860	16.188	40.210	650.919	79.62	649.405	0.23	P
M4-13	17.242	47.912	16.305	39.891	650.423	78.73	653.706	-0.50	P
M4-4	17.216	47.868	16.280	39.291	639.657	77.62	651.552	-1.83	P
M4-5	17.305	47.899	16.248	39.581	643.112	77.59	656.256	-2.00	P
M4-8	17.342	47.915	16.330	39.467	644.496	77.56	654.560	-1.54	P
M4-9	17.281	47.943	16.292	39.443	642.605	77.56	652.923	-1.58	P
M4-6	17.297	47.957	16.335	39.336	642.554	77.46	654.670	-1.85	P
M4-7	17.087	47.956	16.217	39.601	642.209	78.37	653.358	-1.71	P
M4-18	17.303	47.826	16.430	39.680	651.942	78.78	656.068	-0.63	P
M4-19	17.088	47.799	16.255	39.665	644.755	78.94	651.292	-1.00	P
M4-20	17.342	47.683	16.436	39.815	654.399	79.14	655.783	-0.21	P
M4-21	17.256	47.664	16.331	39.840	650.627	79.10	652.854	-0.34	P
Supplementary information: Pmax [W] (Lab_GateNo.1) is calculated by considering the reproducibility <i>r</i> of control module.									

TABLE 23.9: MQT 03 fin: Final Insulation test					P
Test Date [YYYY-MM-DD]		Different dates			—
Test Voltage applied [V]		8000/1500			—
Size of module [m²]		3.11 for M1-x 2.58 for M2-10, M2-4, M2-5 2.70 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21, M4-x 2.80 for M3-x			—
Sample #	Required	Measured	Dielectric breakdown		Result
	MΩ	MΩ	Yes (description)	No	
M1-10	12.88	>10000	No Dielectric breakdown	x	P
M1-13	12.88	>10000	No Dielectric breakdown	x	P
M1-4	12.88	>10000	No Dielectric breakdown	x	P
M1-5	12.88	>10000	No Dielectric breakdown	x	P

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Clause	Requirement + Test		Result - Remark		Verdict
M1-8	12.88	>10000	No Dielectric breakdown	x	P
M1-9	12.88	>10000	No Dielectric breakdown	x	P
M1-6	12.88	>10000	No Dielectric breakdown	x	P
M1-7	12.88	>10000	No Dielectric breakdown	x	P
M1-18	12.88	>10000	No Dielectric breakdown	x	P
M1-19	12.88	>10000	No Dielectric breakdown	x	P
M1-20	12.88	>10000	No Dielectric breakdown	x	P
M1-21	12.88	>10000	No Dielectric breakdown	x	P
M2-10	15.48	>2000	No Dielectric breakdown	x	P
M2-4	15.48	>2000	No Dielectric breakdown	x	P
M2-5	15.48	>2000	No Dielectric breakdown	x	P
M2-11	14.80	>2000	No Dielectric breakdown	x	P
M2-13	14.80	>2000	No Dielectric breakdown	x	P
M2-18	14.80	>2000	No Dielectric breakdown	x	P
M2-19	14.80	>2000	No Dielectric breakdown	x	P
M2-20	14.80	>2000	No Dielectric breakdown	x	P
M2-21	14.80	>2000	No Dielectric breakdown	x	P
M3-10	14.31	>10000	No Dielectric breakdown	x	P
M3-13	14.31	>10000	No Dielectric breakdown	x	P
M4-10	14.80	>10000	No Dielectric breakdown	x	P
M4-13	14.80	>10000	No Dielectric breakdown	x	P
M4-4	14.80	>10000	No Dielectric breakdown	x	P
M4-5	14.80	>10000	No Dielectric breakdown	x	P
M4-8	14.80	>10000	No Dielectric breakdown	x	P
M4-9	14.80	>10000	No Dielectric breakdown	x	P
M4-6	14.80	>10000	No Dielectric breakdown	x	P
M4-7	14.80	>10000	No Dielectric breakdown	x	P
M4-18	14.80	>10000	No Dielectric breakdown	x	P
M4-19	14.80	>10000	No Dielectric breakdown	x	P
M4-20	14.80	>10000	No Dielectric breakdown	x	P
M4-21	14.80	>10000	No Dielectric breakdown	x	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.					

TABLE 23.10: MQT 15 fin: Final Wet leakage current test	P
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Clause	Requirement + Test	Result - Remark	Verdict
Test Date [YYYY-MM-DD]		Different date	—
Test Voltage applied [V]		1500	—
Solution temperature [°C]		22 ± 2	—
Size of module [m²]		3.11 for M1-x 2.58 for M2-10, M2-4, M2-5 2.70 for M2-11, M2-13, M2-18, M2-19, M2-20, M2-21, M4-x 2.80 for M3-x	—
Solution resistivity [Ω cm]		<3500	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
M1-10	>10000	12.88	P
M1-13	>10000	12.88	P
M1-4	>10000	12.88	P
M1-5	>10000	12.88	P
M1-8	>10000	12.88	P
M1-9	>10000	12.88	P
M1-6	>10000	12.88	P
M1-7	>10000	12.88	P
M1-18	>10000	12.88	P
M1-19	>10000	12.88	P
M1-20	>10000	12.88	P
M1-21	>10000	12.88	P
M2-10	516.2	15.48	P
M2-4	596.8	15.48	P
M2-5	501.2	15.48	P
M2-11	5375	14.80	P
M2-13	5582	14.80	P
M2-18	5623	14.80	P
M2-19	4839	14.80	P
M2-20	5281	14.80	P
M2-21	5392	14.80	P
M3-10	>10000	14.31	P
M3-13	>10000	14.31	P
M4-10	>10000	14.80	P
M4-13	>10000	14.80	P

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Clause	Requirement + Test	Result - Remark	Verdict
M4-4	>10000	14.80	P
M4-5	>10000	14.80	P
M4-8	>10000	14.80	P
M4-9	>10000	14.80	P
M4-6	>10000	14.80	P
M4-7	>10000	14.80	P
M4-18	>10000	14.80	P
M4-19	>10000	14.80	P
M4-20	>10000	14.80	P
M4-21	>10000	14.80	P
Supplementary information: the maximum measuring limit of the equipment is 10000 MΩ.			

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

A1.1	MODULE TYPE/S
	QN-685HT-01, QN-670HT-01, QN-710HT-01

A1.2	MODULE DESIGN
	Module dimensions (L x W x H) [mm]: 2384 x 1303 x 35
	Weights.....: 38.0 ±3% Kg (approx.)
	Front/Rear cover bonding classification: ☐ rigid/flexible ☒ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL
	Cell type reference: CHUZHOU JIETAI NEW ENERGY TECHNOLOGY CO., LTD Cell type: CZJT-210M-18D1, N type mono crystalline silicon, 18 busbars
	Cell dimensions L x W x T (± %) [mm]: 210 ±0.5 x 105 ±0.5 x 0.13 ±0.013
	Cell thickness [μm]: 130 ± 13
	Cell area [cm ²]: 220.48

A1.4	IDENTIFICATION OF MATERIALS
	Front cover.....: Nantong Dongli New Energy Technology Co., Ltd. Type: Heat strengthened AR-coated glass, patterned solar glass, Thickness: 2.0 mm
	Rear cover: Nantong Dongli New Energy Technology Co., Ltd. Type: Heat strengthened glass with white glaze, patterned solar glass, Thickness: 2.0 mm
	Encapsulation material front side: Kunshan Tianyang New Materials Co., Ltd. Type: JCC-305T, material: EVA/POE/EVA, Thickness: 0.6±0.1 mm
	Encapsulation material back side: Kunshan Tianyang New Materials Co., Ltd. Type: JCC-105P-T, material: EVA, Thickness: 0.6±0.1 mm

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	Frame parts	Frame (Jiangsu) PV Materials Manufacturing Co., Ltd Anodized aluminum alloy, 6005-T6, silver colour, assembled by key corners
	Mounting parts.....	N/A
	Adhesive for frame	Jiangxi Fenfa Technology Co Ltd Type: FS-996, Rated HB at min. 3.0 mm thick, RTI=105, HWI=2, HAI=0 UL certified, No. E518743
	Edge sealing	N/A
	Internal wiring	N/A
	Cell connector.....	Tianwei Technology Dongtai Co., Ltd Cross section: $\Phi 0.26$ mm, round wire ribbon, Material: Base Cu ($\geq 99.95\%$), coating: Sn(60 ± 3)%Pb(40 ± 3)%, coating thickness $0.018 (-0.005, +0.01)$ mm at each side.
	String connector	Tianwei Technology Dongtai Co., Ltd Cross section: 0.3×4 & 0.35×6 mm, Material: Base Cu ($\geq 99.97\%$), coating Sn63%Pb37%, coating thickness 0.025 ± 0.0025 mm at each side.
	Soldering material.....	Sn(60 ± 3)%Pb(40 ± 3)%
	Fluxing agent	Anhui Costar Technology Co., Ltd. Type: FD-309, no clean halogen free liquid flux.
	Junction box.....	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: JM37xy (x=A, y=C), DC 1500 V, 30A, IP 68(1m, 1h), -40 °C to 85 °C, TÜV SÜD certified, No. B 097074 0006 Rev. 01
	Cable	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: H1Z2Z2-K $1 \times 4 \text{ mm}^2$, 1500V DC, -40 °C to 90 °C, TÜV Rheinland certified, No. R 50334928
	Connector	Stäubli Electrical Connectors AG Type: PV-KST4-EVO2A/xy, PV-KBT4-EVO2A/xy, 1500VDC, 45A (4 mm^2), IP68(1m, 1h), -40°C to 85°C TÜV Rheinland certified, No. R 60127169
	Bypass diode	Hangzhou Silan Microelectronics Co., Ltd. Type: MK5050, Max. peak reverse voltage 50 V, Max. average forward current 50 A, Max. junction temperature 200 °C.

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	Potting material.....:	Jiangxi Fenfa Technology Co Ltd Type: FS-8206A, white colour, Rated V-1 at min. 6.0 mm thick, RTI=105, HWI=1, HAI=0 UL certified, No. E518743
	Adhesive for junction box	Jiangxi Fenfa Technology Co Ltd Type: FS-996, Rated HB at min. 3.0 mm thick, RTI=105, HWI=2, HAI=0 UL certified, No. E518743
	Additional material (e. g. fixing tape, insulation tape).....:	1) Fixing tape: Suzhou temosun PV Material Co., Ltd. Type: T5065 2) Marking label: Suzhou ZhengAo Packing Material Limited Company Type: AVERY PET

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....:	0.45 mm
	Between cell and accessible surfaces.....:	10.5 mm
	Between any current carrying part and accessible surfaces	10.5 mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells	132
	Serial-parallel connection of cells	SPS
	Cells per bypass diode	44
	No. of bypass diodes	3

Remark: for tested sample group M1-x

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Annex 1-2: Product Description Sheet (Manufacturers and type references)

A1.1	MODULE TYPE/S
	QN-560HT-06, QN-580HT-05

A1.2	MODULE DESIGN
	Module dimensions (L x W x H) [mm]: 2278 x 1134 x 30 for QN-560HT-06 2384 x 1134 x 30 for QN-580HT-05
	Weights.....: 27.2 ±3% Kg (approx.) 32.5 ±3% Kg (approx.)
	Front/Rear cover bonding classification: ☐ rigid/flexible ☒ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL
	Cell type reference: Jinko Solar Co., Ltd. Cell type: 182M 247 16BB 10SEG NFJ-TBNU, N type mono crystalline silicon, 16 busbars Cell type: 182R MBB NFH-TBNU, N type mono crystalline silicon, 16 busbars
	Cell dimensions L x W x T (± %) [mm]: 182 ±0.5 x 91 ±0.5 x 0.16 ±0.016 182 ±0.5 x 93.4 ±0.5 x 0.16 ±0.016
	Cell thickness [µm]: 160 ± 16
	Cell area [cm²]: 165.6 167.0

A1.4	IDENTIFICATION OF MATERIALS
	Front cover.....: Flat Solar Glass Group Co., Ltd. Type: AR Coated Heat strengthened glass, patterned solar glass, Thickness: 1.6 mm for QN-560HT-06 Thickness: 2.0 mm for QN-580HT-05
	Rear cover: Flat Solar Glass Group Co., Ltd. Type: Heat strengthened glass with white glaze, patterned solar glass, Thickness: 1.6 mm for QN-560HT-06 Thickness: 2.0 mm for QN-580HT-05
	Encapsulation material front side: Jiangsu Lushan New Materials Co., Ltd. Type: S102, material: EVA/POE/EVA thickness: 0.6±0.1mm

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	Encapsulation material back side	Jiangsu Lushan New Materials Co., Ltd. Type: S101, material: EVA/POE/EVA thickness: 0.6±0.1mm
	Frame parts	Jiangsu Chengqing New Energy Co., Ltd. Anodized aluminum alloy, 6005-T6, black colour, assembled by key corners
	Mounting parts	N/A
	Adhesive for frame	Guangzhou Jintas Chemical Co., Ltd. Type: 179, Rated HB at min. 1.5 mm thick, RTI=105 UL certified, No. E521359
	Edge sealing	N/A
	Internal wiring	N/A
	Cell connector	Suzhou Boneed Photovoltaic Technology Co., Ltd. Cross section: ϕ 0.26 (-0.01, +0.02) mm, round wire ribbon, Material: Base Cu ($\geq 99.95\%$), coating: Sn(60±3)%Pb(40±3)%, coating thickness 0.018 (-0.005, +0.01) mm at each side.
	String connector	Suzhou Boneed Photovoltaic Technology Co., Ltd. Cross section: 0.3±0.015 × 4±0.05 & 0.35±0.015 × 6±0.05 mm, Material: Base Cu ($\geq 99.95\%$), coating Sn60%Pb40%, coating thickness 0.023(-0.005, + 0.01)mm at each side.
	Soldering material.....	Sn(60±3)%Pb(40±3)%
	Fluxing agent	Shenzhen Vital New Material Company Limited Type: WTO-PV107, no clean halogen free liquid flux.
	Junction box.....	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: JM07w, Rated DC 1500 V, 25A, IP 68 (1m, 1h), -40 °C to 85 °C, TÜV SÜD certified, No. B 097074 0004 Rev. 02
	Cable	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: 62930 IEC 131 1×4mm ² , 1500V DC, -40 °C to 90 °C, TÜV Rheinland certified, No. R 50507377

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	Connector	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: HQC4, Rated DC 1500V, 30A, IP68 (1m, 1h), -40°C to 85°C TÜV SÜD certified, No. B 097074 0005 Rev. 01
	Bypass diode	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: THY4050, Schottky, Max. peak reverse voltage 50 V, Max. average forward current 40 A, Max. junction temperature 200 °C.
	Potting material.....	Guangzhou Jointas Chemical Co., Ltd. Type: 162, Rated V-0 at min. 3.0 mm thick, RTI=105 UL certified, No. E521359
	Adhesive for junction box	Guangzhou Jointas Chemical Co., Ltd. Type: 179, Rated HB at min. 1.5 mm thick, RTI=105 UL certified, No. E521359
	Additional material (e. g. fixing tape, insulation tape).....	1) Fixing tape: Suzhou temosun PV Material Co., Ltd. Type: T5065, TEMOSUN Adhesive tapes, transparency, 0.06±0.02mm thick. 2) Marking label: Suzhou ZhengAo Packing Material Limited Company Type: AVERY PET

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....	1.6 mm 2.0 mm
	Between cell and accessible surfaces.....	10.5 mm
	Between any current carrying part and accessible surfaces	10.5 mm

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

Remark: for tested sample group M2-x

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Annex 1-3: Product Description Sheet (Manufacturers and type references)

A1.1	MODULE TYPE/S
	QN-615HT-06, QN-600HT-06, QN-635HT-06

A1.2	MODULE DESIGN
	Module dimensions (L x W x H) [mm]: 2465 x 1134 x 30
	Weights.....: 33.7 ±3% Kg (approx.)
	Front/Rear cover bonding classification: ☐ rigid/flexible ☒ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL
	Cell type reference: Jinko Solar Co., Ltd. Cell type: 182M 247 16BB 10SEG NFJ-TBNU, N type mono crystalline silicon, 16 busbars
	Cell dimensions L x W x T (± %) [mm]: 182 ±0.5 x 91 ±0.5 x 0.16 ±0.016
	Cell thickness [µm]: 160 ± 16
	Cell area [cm²]: 165.6

A1.4	IDENTIFICATION OF MATERIALS
	Front cover.....: Flat Solar Glass Group Co., Ltd. Type: AR Coated Heat strengthened glass, patterned solar glass, Thickness: 2.0 mm
	Rear cover: Flat Solar Glass Group Co., Ltd. Type: Heat strengthened glass with white glaze, patterned solar glass, Thickness: 2.0 mm
	Encapsulation material front side: Jiangsu Lushan New Materials Co., Ltd. Type: S102, material: EVA/POE/EVA thickness: 0.6±0.1mm
	Encapsulation material back side: Jiangsu Lushan New Materials Co., Ltd. Type: S101, material: EVA/POE/EVA thickness: 0.6±0.1mm
	Frame parts: Jiangsu Chengqing New Energy Co., Ltd. Anodized aluminum alloy, 6005-T6, silvery colour, assembled by key corners
	Mounting parts.....: N/A

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	Adhesive for frame	Shanghai Huitian New Material Co., Ltd. Type: HT906Z, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Edge sealing	N/A
	Internal wiring	N/A
	Cell connector	Suzhou Boneed Photovoltaic Technology Co., Ltd. Cross section: ϕ 0.26 (-0.01, +0.02) mm, round wire ribbon, Material: Base Cu ($\geq 99.95\%$), coating: Sn(60 $\pm$ 3)%Pb(40 $\pm$ 3)%, coating thickness 0.018 (-0.005, +0.01) mm at each side.
	String connector	Suzhou Boneed Photovoltaic Technology Co., Ltd. Cross section: 0.3 $\pm$ 0.015 $\times$ 4 $\pm$ 0.05 & 0.35 $\pm$ 0.015 $\times$ 6 $\pm$ 0.05 mm, Material: Base Cu ($\geq 99.95\%$), coating Sn60%Pb40%, coating thickness 0.023(-0.005, + 0.01)mm at each side.
	Soldering material.....	Sn(60 $\pm$ 3)%Pb(40 $\pm$ 3)%
	Fluxing agent	Shenzhen Vital New Material Company Limited Type: WTO-PV107, no clean halogen free liquid flux.
	Junction box.....	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: JM07w, Rated DC 1500 V, 25A, IP 68 (1m, 1h), -40 °C to 85 °C, TÜV SÜD certified, No. B 097074 0004 Rev. 02
	Cable	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: 62930 IEC 131 1 $\times$ 4mm ² , 1500V DC, -40 °C to 90 °C, TÜV Rheinland certified, No. R 50507377
	Connector	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: HQC4, Rated DC 1500V, 30A, IP68 (1m, 1h), -40°C to 85°C TÜV SÜD certified, No. B 097074 0005 Rev. 01
	Bypass diode	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: THY4050, Schottky, Max. peak reverse voltage 50 V, Max. average forward current 40 A, Max. junction temperature 200 °C.

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	Potting material.....:	Shanghai Huitian New Material Co., Ltd. Type: 5299W-S, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Adhesive for junction box	Shanghai Huitian New Material Co., Ltd. Type: HT906Z, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Additional material (e. g. fixing tape, insulation tape).....:	1) Fixing tape: Suzhou temosun PV Material Co., Ltd. Type: T5065, TEMOSUN Adhesive tapes, transparency, 0.06±0.02mm thick. 2) Marking label: Suzhou ZhengAo Packing Material Limited Company Type: AVERY PET

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....:	0.7 mm
	Between cell and accessible surfaces.....:	10.5 mm
	Between any current carrying part and accessible surfaces	10.5 mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells	156
	Serial-parallel connection of cells	SPS
	Cells per bypass diode	52
	No. of bypass diodes	3

Remark: for tested sample group M3-x

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Annex 1-4: Product Description Sheet (Manufacturers and type references)

A1.1	MODULE TYPE/S
	QN-595HT-02, QN-585HT-02, QN-620HT-02

A1.2	MODULE DESIGN
	Module dimensions (L x W x H) [mm]: 2382 x 1134 x 30
	Weights.....: 32.5 ±3% Kg (approx.)
	Front/Rear cover bonding classification: ☐ rigid/flexible ☒ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL
	Cell type reference: JA Solar Technology Co., Ltd. Cell type: JACMKTB-D, N type mono crystalline silicon, 16 busbars
	Cell dimensions L x W x T (± %) [mm]: 182 ±1.5 x 105 ±1.5 x 0.13 ±0.013
	Cell thickness [μm]: 130 ± 13
	Cell area [cm ²]: 191.1681

A1.4	IDENTIFICATION OF MATERIALS
	Front cover.....: China National Building Materials (HEFEI) New Energy Resources Co., LTD. Type: Heat strengthened AR-coated glass, patterned solar glass, Thickness: 2.0 mm
	Rear cover: China National Building Materials (HEFEI) New Energy Resources Co., LTD. Type: Heat strengthened glass with black glaze, patterned solar glass, Thickness: 2.0 mm
	Encapsulation material front side: Jiangsu Lushan New Materials Co., Ltd. Type: S102, material: EVA/POE/EVA thickness: 0.6±0.1mm
	Encapsulation material back side: Jiangsu Lushan New Materials Co., Ltd. Type: S101, material: EVA/POE/EVA thickness: 0.6±0.1mm

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	Frame parts	Frame (Jiangsu) PV Materials Manufacturing Co., Ltd Anodized aluminum alloy, 6005-T6, black colour, assembled by key corners
	Mounting parts.....	N/A
	Adhesive for frame	Shanghai Huitian New Material Co., Ltd. Type: HT906Z, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Edge sealing	N/A
	Internal wiring	N/A
	Cell connector.....	JingLan Advanced Material Co., Ltd. Cross section: ϕ 0.26 (-0.01, +0.02) mm, round wire ribbon, Material: Base Cu ($\geq 99.95\%$), coating: Sn(60 $\pm$ 3)%Pb(40 $\pm$ 3)%, coating thickness 0.018 (-0.005, +0.01) mm at each side.
	String connector	JingLan Advanced Material Co., Ltd. Cross section: 0.3 $\pm$ 0.015 $\times$ 4 $\pm$ 0.05 & 0.35 $\pm$ 0.015 $\times$ 6 $\pm$ 0.05 mm, Material: Base Cu ($\geq 99.95\%$), coating Sn60%Pb40%, coating thickness 0.023(-0.005, + 0.01)mm at each side.
	Soldering material.....	Sn(60 $\pm$ 3)%Pb(40 $\pm$ 3)%
	Fluxing agent	Shenzhen Vital New Material Company Limited Type: WTO-PV107, no clean halogen free liquid flux.
	Junction box.....	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: JM07w, Rated DC 1500 V, 25A, IP 68 (1m, 1h), -40 °C to 85 °C, TÜV SÜD certified, No. B 097074 0004 Rev. 02
	Cable	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: 62930 IEC 131 1 $\times$ 4mm ² , 1500V DC, -40 °C to 90 °C, TÜV Rheinland certified, No. R 50507377
	Connector	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: HQC4, Rated DC 1500V, 30A, IP68 (1m, 1h), -40°C to 85°C TÜV SÜD certified, No. B 097074 0005 Rev. 01

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	Bypass diode	Zhejiang Jiaming Tianheyuan Photovoltaics Technology Co. Ltd Type: THY4050, Schottky, Max. peak reverse voltage 50 V, Max. average forward current 40 A, Max. junction temperature 200 °C.
	Potting material.....	Shanghai Huitian New Material Co., Ltd. Type: 5299W-S, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Adhesive for junction box	Shanghai Huitian New Material Co., Ltd. Type: HT906Z, Rated V-0 at min. 3.0 mm thick, RTI=105, CTI=0 UL certified, No. E248611
	Additional material (e. g. fixing tape, insulation tape).....	1) Fixing tape: Suzhou temosun PV Material Co., Ltd. Type: T5065, TEMOSUN Adhesive tapes, transparency, 0.06±0.02mm thick. 2) Marking label: Suzhou ZhengAo Packing Material Limited Company Type: AVERY PET

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....	0.65 mm
	Between cell and accessible surfaces.....	10.5 mm
	Between any current carrying part and accessible surfaces	10.5 mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells	132
	Serial-parallel connection of cells	SPS
	Cells per bypass diode	44
	No. of bypass diodes	3

Remark: for tested sample group M4-x

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Clause	Requirement + Test	Result - Remark	Verdict

Annex 2: Test table for verifying other alternative stabilization procedure

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

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Clause	Requirement + Test	Result - Remark		Verdict
Supplementary information:				
Step 3: Stabilization determination				
	Sample	Sample	Sample	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:				

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Clause	Requirement + Test	Result - Remark	Verdict

Annex 3: Lower and higher output power modules

TABLE A.4.1 Performance at STC before initial stabilization (Front side)							P
Test Date [YYYY-MM-DD]			2023-12-15 for Low 1-x, High 1-x, Low 4-x, High 4-x 2024-03-05 for Low 3-x, High 3-x				—
Test method			☒ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1-1	18.038	47.342	17.090	40.185	686.762	80.42	—
Low 1-2	18.011	47.332	17.087	40.146	685.975	80.47	—
High 1-1	18.290	47.623	17.347	40.483	702.259	80.62	—
High 1-2	18.343	47.588	17.350	40.455	701.894	80.41	—
Low 3-1	13.707	55.829	12.878	47.203	607.880	79.44	—
Low 3-2	13.611	55.766	12.915	47.031	607.405	80.02	—
High 3-1	13.847	56.197	13.178	47.880	630.963	81.08	—
High 3-2	13.828	56.169	13.198	47.786	630.680	81.20	—
Low 4-1	15.710	47.385	14.778	40.075	592.228	79.56	—
Low 4-2	15.704	47.455	14.698	40.235	591.374	79.35	—
High 4-1	15.775	48.187	14.879	41.004	610.099	80.26	—
High 4-2	15.864	48.187	14.932	40.986	612.003	80.06	—
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.2 Performance at STC before initial stabilization (Back side)							P
Test Date [YYYY-MM-DD]			2023-12-15 for Low 1-x, High 1-x, Low 4-x, High 4-x 2024-03-05 for Low 3-x, High 3-x				—
Test method			☒ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1-1	15.115	46.963	13.176	40.770	537.186	75.68	—
Low 1-2	15.013	46.968	13.197	40.699	537.105	76.17	—
High 1-1	14.669	47.229	13.119	41.215	540.700	78.05	—
High 1-2	14.696	47.182	13.104	41.151	539.243	77.77	—
Low 3-1	10.551	55.342	9.553	47.685	455.535	78.01	—

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Clause	Requirement + Test				Result - Remark		Verdict
Low 3-2	10.623	55.284	9.665	47.431	458.421	78.06	—
High 3-1	10.623	55.751	9.671	48.551	469.537	79.28	—
High 3-2	10.513	55.455	9.601	48.427	464.948	79.75	—
Low 4-1	12.424	47.009	10.939	40.906	447.471	76.62	—
Low 4-2	12.435	47.051	10.945	40.959	448.296	76.62	—
High 4-1	12.528	47.773	10.816	42.046	454.770	75.98	—
High 4-2	12.311	47.758	10.983	41.719	458.200	77.93	—
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.3 Performance at BNPI before initial stabilization							P
Test Date [YYYY-MM-DD]				2023-12-15 for Low 1-x, High 1-x, Low 4-x, High 4-x 2024-03-05 for Low 3-x, High 3-x			—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1-1	19.913	47.538	18.863	40.240	759.047	80.18	—
Low 1-2	19.892	47.547	18.866	40.190	758.225	80.17	—
High 1-1	20.276	47.767	19.278	40.404	778.908	80.42	—
High 1-2	20.336	47.730	19.249	40.816	785.667	80.94	—
Low 3-1	15.065	56.007	14.220	47.111	669.918	79.40	—
Low 3-2	14.995	55.930	14.267	46.950	669.836	79.87	—
High 3-1	15.223	56.374	14.484	47.880	693.494	80.81	—
High 3-2	15.193	56.335	14.494	47.725	691.726	80.82	—
Low 4-1	17.299	47.534	16.258	40.081	651.637	79.25	—
Low 4-2	17.312	47.528	16.194	40.116	649.639	78.95	—
High 4-1	17.338	48.344	16.387	40.947	670.998	80.05	—
High 4-2	17.424	48.336	16.428	40.947	672.677	79.87	—
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.4: MQT 19.1 ini: Initial Stabilization procedure							P
Light exposure method				☒ Simulator ☐ Natural sunlight			—

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Clause	Requirement + Test				Result - Remark		Verdict
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x :				1			—
Sample #	Low 1-1	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	686.762	—	—
1	5	800~1000	50 ± 10	MPPT	683.781	—	—
2	5	800~1000	50 ± 10	MPPT	681.413	0.782	Yes
Initial (R)	—	—	—	—	537.186	—	—
1	5	800~1000	50 ± 10	MPPT	534.394	—	—
2	5	800~1000	50 ± 10	MPPT	532.207	0.931	Yes
Sample #	Low 1-2	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	685.975	—	—
1	5	800~1000	50 ± 10	MPPT	684.325	—	—
2	5	800~1000	50 ± 10	MPPT	681.691	0.626	Yes
Initial (R)	—	—	—	—	537.105	—	—
1	5	800~1000	50 ± 10	MPPT	534.907	—	—
2	5	800~1000	50 ± 10	MPPT	532.238	0.910	Yes
Sample #	High 1-1	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	702.259	—	—
1	5	800~1000	50 ± 10	MPPT	700.086	—	—
2	5	800~1000	50 ± 10	MPPT	698.707	0.507	Yes
Initial (R)	—	—	—	—	540.700	—	—
1	5	800~1000	50 ± 10	MPPT	538.117	—	—
2	5	800~1000	50 ± 10	MPPT	536.918	0.702	Yes
Sample #	High 1-2	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	701.894	—	—

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Clause	Requirement + Test				Result - Remark		Verdict
1	5	800~1000	50 ± 10	MPPT	699.845	—	—
2	5	800~1000	50 ± 10	MPPT	698.041	0.550	Yes
Initial (R)	—	—	—	—	539.243	—	—
1	5	800~1000	50 ± 10	MPPT	537.008	—	—
2	5	800~1000	50 ± 10	MPPT	535.613	0.676	Yes
Sample #	Low 3-1	Test Date (YYYY-MM-DD) start/end :			2024-03-05 / 2024-03-07		
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 (F)	—	—	—	—	607.880	—	—
1	5	800~1000	50 ± 10	MPPT	606.540	—	—
2	5	800~1000	50 ± 10	MPPT	605.286	0.428	Yes
Initial (R)	—	—	—	—	455.535	—	—
1	5	800~1000	50 ± 10	MPPT	452.828	—	—
2	5	800~1000	50 ± 10	MPPT	451.877	0.807	Yes
Sample #	Low 3-2	Test Date (YYYY-MM-DD) start/end :			2024-03-05 / 2024-03-07		
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 (F)	—	—	—	—	607.405	—	—
1	5	800~1000	50 ± 10	MPPT	606.773	—	—
2	5	800~1000	50 ± 10	MPPT	604.198	0.529	Yes
Initial (R)	—	—	—	—	458.421	—	—
1	5	800~1000	50 ± 10	MPPT	456.436	—	—
2	5	800~1000	50 ± 10	MPPT	456.563	0.434	Yes
Sample #	High 3-1	Test Date (YYYY-MM-DD) start/end :			2024-03-05 / 2024-03-07		
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 (F)	—	—	—	—	630.963	—	—
1	5	800~1000	50 ± 10	MPPT	628.758	—	—
2	5	800~1000	50 ± 10	MPPT	626.627	0.690	Yes
Initial (R)	—	—	—	—	469.537	—	—
1	5	800~1000	50 ± 10	MPPT	468.996	—	—
2	5	800~1000	50 ± 10	MPPT	468.855	0.145	Yes
Sample #	High 3-2	Test Date (YYYY-MM-DD) start/end :			2024-03-05 / 2024-03-07		

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Clause	Requirement + Test				Result - Remark		Verdict
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 (F)	—	—	—	—	630.680	—	—
1	5	800~1000	50 ± 10	MPPT	628.136	—	—
2	5	800~1000	50 ± 10	MPPT	627.076	0.573	Yes
Initial (R)	—	—	—	—	464.948	—	—
1	5	800~1000	50 ± 10	MPPT	462.034	—	—
2	5	800~1000	50 ± 10	MPPT	461.349	0.778	Yes
Sample #	Low 4-1	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	592.228	—	—
1	5	800~1000	50 ± 10	MPPT	589.219	—	—
2	5	800~1000	50 ± 10	MPPT	588.080	0.703	Yes
Initial (R)	—	—	—	—	447.471	—	—
1	5	800~1000	50 ± 10	MPPT	444.644	—	—
2	5	800~1000	50 ± 10	MPPT	443.516	0.888	Yes
Sample #	Low 4-2	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	591.374	—	—
1	5	800~1000	50 ± 10	MPPT	589.280	—	—
2	5	800~1000	50 ± 10	MPPT	586.827	0.772	Yes
Initial (R)	—	—	—	—	448.296	—	—
1	5	800~1000	50 ± 10	MPPT	446.444	—	—
2	5	800~1000	50 ± 10	MPPT	444.317	0.891	Yes
Sample #	High 4-1	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
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 (F)	—	—	—	—	610.099	—	—
1	5	800~1000	50 ± 10	MPPT	608.410	—	—
2	5	800~1000	50 ± 10	MPPT	607.200	0.476	Yes
Initial (R)	—	—	—	—	454.770	—	—

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Clause	Requirement + Test				Result - Remark		Verdict
1	5	800~1000	50 ± 10	MPPT	452.365	—	—
2	5	800~1000	50 ± 10	MPPT	451.349	0.755	Yes
Sample #	High 4-2	Test Date (YYYY-MM-DD) start/end :			2023-12-15 / 2023-12-17		
Test cycle	Integrated irradiation (kWh/m²)	Irradiance (W/m²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	612.003	—	—
1	5	800~1000	50 ± 10	MPPT	611.210	—	—
2	5	800~1000	50 ± 10	MPPT	610.487	0.248	Yes
Initial (R)	—	—	—	—	458.200	—	—
1	5	800~1000	50 ± 10	MPPT	455.331	—	—
2	5	800~1000	50 ± 10	MPPT	454.691	0.769	Yes
Supplementary information: N/A							
☐ Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end :						
Low 1							
Low 2							
High 1							
High 2							
Test method description:							
Supplementary information: see Annex 3 for verification of this alternative stabilization procedure							

TABLE A.4.7: MQT 6.1 Performance at STC after initial stabilization (Front side)							P
Test Date [YYYY-MM-DD] :				2023-12-17			—
				Lower end power class	Higher end power class		
P _{max} (lab) (W) :				≤ 708.340, ≥ 638.108	≥ 676.204		
$\bar{P}_{max}(Lab)$ (W) :				≥ 657.843	≥ 697.117		
P _{max4} (NP) (W) :				675	715		
V _{oc} (lab) (V) :				≤ 47.934	≤ 49.516		
I _{sc} (lab) (A) :				≤ 18.324	≤ 18.790		
Test method :				☒ Simulator	☐ Natural sunlight		
Sample #	I _{sc} [A]	V _{oc} [V]	I _{mp} [A]	V _{mp} [V]	P _{max} [W]	FF [%]	Result
Low 1-1	18.035	47.313	17.043	39.982	681.413	79.86	P
Low 1-2	18.012	47.304	17.079	39.914	681.691	80.01	P

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Clause	Requirement + Test				Result - Remark		Verdict
High 1-1	18.284	47.597	17.351	40.269	698.707	80.29	P
High 1-2	18.342	47.563	17.356	40.219	698.041	80.01	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.8: MQT 6.1 Performance at STC after initial stabilization (Back side)							P
Test Date [YYYY-MM-DD]				2023-12-17			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ -	≥ -	≥ -	—
$\bar{P}_{max}(Lab)$ (W)				≥ -	≥ -	≥ -	—
Voc(lab) (V)				≤ -	≤ -	≤ -	—
Isc (lab) (A)				≤ -	≤ -	≤ -	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1-1	15.116	46.936	13.105	40.611	532.207	75.01	P
Low 1-2	15.014	46.942	13.130	40.536	532.238	75.52	P
High 1-1	14.671	47.205	13.101	40.983	536.918	77.53	P
High 1-2	14.695	47.156	13.096	40.899	535.613	77.29	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.9: MQT 6.1 Performance at BNPI after initial stabilization							P
Test Date [YYYY-MM-DD]				2023-12-17			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ 780.748	≥ 703.823	≥ 745.729	—
$\bar{P}_{max}(Lab)$ (W)				≥ 725.591	≥ 768.793	≥ 768.793	—
Voc(lab) (V)				≤ 47.934	≤ 49.516	≤ 49.516	—
Isc (lab) (A)				≤ 20.211	≤ 20.728	≤ 20.728	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1-1	19.909	47.512	18.874	39.979	754.564	79.77	P
Low 1-2	19.888	47.526	18.914	39.902	754.706	79.85	P
High 1-1	20.268	47.745	19.279	40.183	774.688	80.05	P

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Clause	Requirement + Test				Result - Remark		Verdict
High 1-2	20.334	47.701	19.197	40.648	780.320	80.45	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.7: MQT 6.1 Performance at STC after initial stabilization (Front side)							P
Test Date [YYYY-MM-DD]				2024-03-07			—
				Lower end power class		Higher end power class	—
Pmax(lab) (W)				≤ 634.883	≥ 571.440	≥ 604.774	—
$\bar{P}_{max}(Lab)$ (W)				≥ 589.113		≥ 623.478	—
Pmax4(NP) (W)				605		640	
Voc(lab) (V)				≤ 55.845		≤ 57.427	—
Isc (lab) (A)				≤ 14.083		≤ 14.499	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 3-1	13.712	55.806	12.885	46.976	605.286	79.10	P
Low 3-2	13.611	55.736	12.908	46.808	604.198	79.64	P
High 3-1	13.844	56.174	13.144	47.674	626.627	80.58	P
High 3-2	13.822	56.133	13.193	47.531	627.076	80.82	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.8: MQT 6.1 Performance at STC after initial stabilization (Back side)							P
Test Date [YYYY-MM-DD]				2024-03-07			—
				Lower end power class		Higher end power class	—
Pmax(lab) (W)				≤ -	≥ -	≥ -	—
$\bar{P}_{max}(Lab)$ (W)				≥ -		≥ -	—
Voc(lab) (V)				≤ -		≤ -	—
Isc (lab) (A)				≤ -		≤ -	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 3-1	10.546	55.320	9.517	47.481	451.877	77.46	P
Low 3-2	10.620	55.254	9.667	47.229	456.563	77.81	P
High 3-1	10.618	55.730	9.716	48.256	468.855	79.23	P

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Clause	Requirement + Test				Result - Remark		Verdict
High 3-2	10.514	55.429	9.565	48.233	461.349	79.16	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.9: MQT 6.1 Performance at BNPI after initial stabilization							P
Test Date [YYYY-MM-DD]..... :				2024-03-07			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ 699.945	≥ 630.489	≥ 666.680	—
$\bar{P}_{max}(Lab)$ (W)				≥ 649.988		≥ 687.299	—
Voc(lab) (V)				≤ 55.845		≤ 57.427	—
Isc (lab) (A)				≤ 15.534		≤ 15.980	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 3-1	15.063	55.844	14.197	46.804	664.476	78.99	P
Low 3-2	14.999	55.829	14.218	46.739	664.535	79.36	P
High 3-1	15.215	56.350	14.440	47.684	688.557	80.31	P
High 3-2	15.192	56.305	14.470	47.509	687.455	80.37	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.7: MQT 6.1 Performance at STC after initial stabilization (Front side)							P
Test Date [YYYY-MM-DD]..... :				2023-12-17			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ 619.142	≥ 557.154	≥ 590.488	—
$\bar{P}_{max}(Lab)$ (W)				≥ 574.385		≥ 608.750	—
P _{max4} (NP) (W)				590		625	—
Voc(lab) (V)				≤ 47.730		≤ 49.322	—
Isc (lab) (A)				≤ 16.071		≤ 16.477	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 4-1	15.711	47.361	14.754	39.859	588.080	79.03	P
Low 4-2	15.705	47.421	14.652	40.051	586.827	78.80	P
High 4-1	15.775	48.156	14.905	40.738	607.200	79.93	P

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Clause	Requirement + Test				Result - Remark		Verdict
High 4-2	15.866	48.159	14.989	40.729	610.487	79.90	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.8: MQT 6.1 Performance at STC after initial stabilization (Back side)							P
Test Date [YYYY-MM-DD]				2023-12-17			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ - ,	≥ -	≥ -	—
$\bar{P}_{max}(Lab)$ (W)				≥ -		≥ -	—
Voc(lab) (V)				≤ -		≤ -	—
Isc (lab) (A)				≤ -		≤ -	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 4-1	12.423	46.981	10.898	40.697	443.516	75.99	P
Low 4-2	12.427	47.026	10.896	40.778	444.317	76.03	P
High 4-1	12.524	47.744	10.779	41.873	451.349	75.48	P
High 4-2	12.308	47.735	10.958	41.494	454.691	77.39	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

TABLE A.4.9: MQT 6.1 Performance at BNPI after initial stabilization							P
Test Date [YYYY-MM-DD]				2023-12-17			—
				Lower end power class		Higher end power class	—
P _{max} (lab) (W)				≤ 682.105,	≥ 614.298	≥ 651.441	—
$\bar{P}_{max}(Lab)$ (W)				≥ 633.297		≥ 671.589	—
Voc(lab) (V)				≤ 47.730		≤ 49.322	—
Isc (lab) (A)				≤ 17.715		≤ 18.171	—
Test method				☒ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 4-1	17.297	47.504	16.271	39.868	648.692	78.95	P
Low 4-2	17.311	47.506	16.186	39.874	645.401	78.48	P
High 4-1	17.331	48.315	16.340	40.744	665.757	79.51	P
High 4-2	17.426	48.307	16.456	40.679	669.414	79.52	P

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Clause	Requirement + Test	Result - Remark	Verdict
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.			

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Clause	Requirement + Test	Result - Remark	Verdict

Annex 4: List of measurement equipment

A completed list of used test equipment shall be provided in the Test Reports when a Manufacturer Testing Laboratory according to CTF stage 1 or CTF stage 2 procedure has been used.

Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
N/A	N/A	N/A	N/A	N/A	N/A