




Test Report issued under the responsibility of:

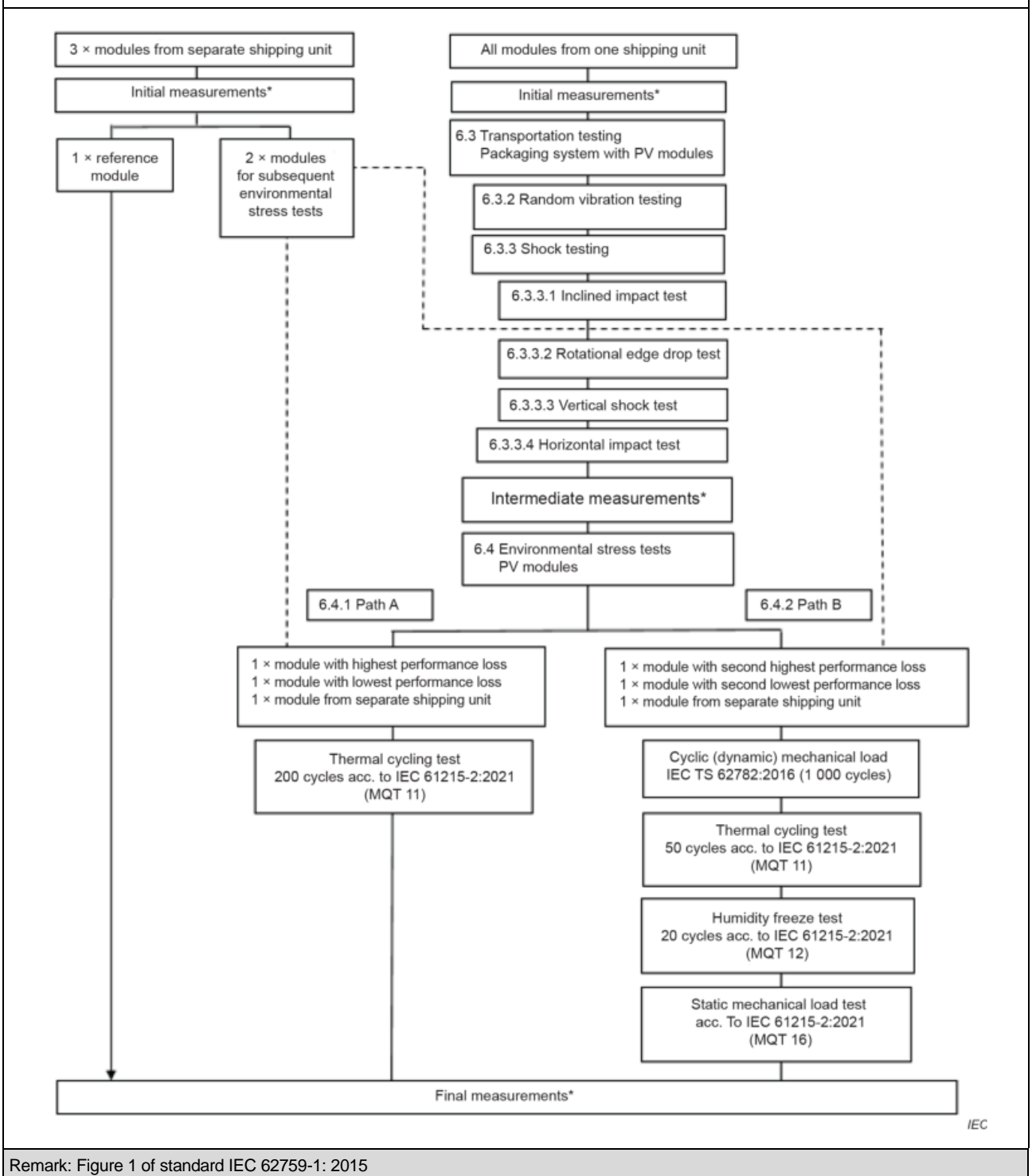


TEST REPORT IEC 62759-1:2022 Photovoltaic (PV) modules – Transportation testing Part 1: Transportation and shipping of module package units	
Report Number..... :	6187695A.50
Date of issue..... :	2024-07-09
Total number of pages..... :	71
Name of Testing Laboratory preparing the Report	DEKRA Testing and Certification (Shanghai) Ltd.
Applicant's name	Sany Silicon Energy (Zhuzhou) Co., Ltd.
Address.....	No.333, Qingxia Road, Tongtangwan Street, Shifeng District, 412005 Zhuzhou City Hunan, China
Test specification:	
Standards	IEC 62759-1:2022
Test procedure	DTA
Non-standard test method	N/A
Test Report Form No.	T&S_B
Test Report Form(s) Originator	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF	2019-12-23
General disclaimer:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Testing Laboratory. This report does not entitle to carry any test mark.	

Test item description : Photovoltaic Module shipping unit		
Trade Mark : 		
Manufacturer : Sany Silicon Energy (Zhuzhou) Co., Ltd.		
Model/Type reference : Photovoltaic Module shipping unit Three Layers Packing		
Ratings : Refer to Annex 6 for more details		
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	DEKRA Testing and Certification (Shanghai) Ltd.
	Testing location/address	3F #250 Jiangchangsan Road Building 16 Headquarter Economy Park Shibe Hi-Tech Park, Jing'an District Shanghai 200436 China
<input checked="" type="checkbox"/>	Associated Testing Laboratory:	Shanghai Institute of Quality Inspection and Technical Research
	Testing location/ address	900 Jiangyue Rd., Shanghai, China
	Tested by (name, function, signature)	Lee Huang 
	Approved by (name, function, signature)	Kevin Lu 

List of attachments (including a total number of pages in each attachment):	
	attachment number / number of pages
Installation manual:	
Drawings mechanical:	
Circuit diagram:	
Electroluminescence image	Annex 2
Component datasheets / certificates	
Others:	
CDF	Annex 6
Photographs	Annex 1
List of measurement equipment	Annex 3
IV Curves	Annex 4
Statement of test uncertainty	Annex 5
History Reports	
Summary of testing:	
Tests performed (name of test and test clause): Refer to page 7-8 for details	Testing location: Shanghai Institute of Quality Inspection and Technical Research 900 Jiangyue Rd., Shanghai, China

Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement	P (Pass)
- test object does not meet the requirement	F (Fail)
Abbreviations used in the report:	
P _{max} – Maximum power	α – Current temperature coefficient
V _{mp} – Maximum power voltage	β – Voltage temperature coefficient
I _{mp} – Maximum power current	δ – power temperature coefficient
I _{sc} – Short circuit current	NMOT – Nominal Module Operating Temperature (20°C, 800 W/m ²)
V _{oc} – Open circuit voltage	V _{FMrated} – Rated diode(s) forward voltage
FF – Fill factor	NP – Nameplate
STC – Standard Test Conditions (25°C, 1 000 W/m ²)	t ₁ – the manufacturer's rated lower production tolerance in % for P _{max}
V _{FM} – Measured diode(s) forward voltage	t ₂ – the manufacturer's rated upper production tolerance in % for V _{oc}
m ₁ – the measurement uncertainty in % of laboratory for P _{max}	t ₃ – the manufacturer's rated upper production tolerance in % for I _{sc}
m ₂ – the measurement uncertainty in % of laboratory for V _{oc}	r – P _{max} measurement reproducibility
	m ₃ – the measurement uncertainty in % of laboratory for I _{sc}
Testing Dates (YYYY-MM-DD)	
Date of first test item received	2024-04-11
Dates of tests (beginning/end).....	2024-04-16/2024-06-07

TEST SEQUENCE:

Remark: Figure 1 of standard IEC 62759-1: 2015

General remarks:**Shipping Unit Type****Product data – type Three Layers packing**

Main parts:	Plywood/THREE LAYERS PAPER/PET
Dimension of carton box:	2470mm×1130mm×1100mm
Gross weight: (Shipping unit with PV modules)	1250.2kg
Net weight: (Shipping unit without PV modules)	33.2kg
Number of PV modules:	36
Placement of PV modules:	Placed in vertical
Dimension of module:	2465mm×1134mm×30mm
Suitable PV modules:	SYM156TBDxxx (xxx=625-645, in step of 5, 156 cells)

Three Layers packing with SYMN156TBD630 was selected as representative modules.

"(See Enclosure #)" refers to additional information appended to the report.

"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Name and address of factory (factories)	Sany Silicon Energy (Zhuzhou) Co., Ltd. Sany Energy Equipment Industrial Park, No.320 Qingshui Road, Shifeng District, 412005 Zhuzhou City Hunan, China
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MODULE GROUP ASSIGNMENT:			
Sample #	Type/model	Sample S/N	Remark
1	SYMN156TBD630	240400111D01495	REF
2	SYMN156TBD630	240400111D01323	Separate module
3	SYMN156TBD630	240400119D01517	Separate module
4	SYMN156TBD630	2401012222661	With lowest loss
5	SYMN156TBD630	2401012222624	With highest loss
6	SYMN156TBD630	2401012212399	With lowest loss
7	SYMN156TBD630	240400111D01264	With highest loss
8	SYMN156TBD630	2401012214164	N/A
9	SYMN156TBD630	2401012213943	N/A
10	SYMN156TBD630	2401012225232	N/A
11	SYMN156TBD630	2401012225375	N/A
12	SYMN156TBD630	2401012225349	N/A
13	SYMN156TBD630	2401012222754	N/A
14	SYMN156TBD630	2401012220601	N/A
15	SYMN156TBD630	2401012213652	N/A
16	SYMN156TBD630	2401012210729	N/A
17	SYMN156TBD630	2401012214064	N/A
18	SYMN156TBD630	2401012213739	N/A
19	SYMN156TBD630	2401012213032	N/A
20	SYMN156TBD630	2401012214131	N/A
21	SYMN156TBD630	2401012214099	N/A
22	SYMN156TBD630	240400111D01775	N/A
23	SYMN156TBD630	240400111D01740	N/A
24	SYMN156TBD630	240400111D01739	N/A
25	SYMN156TBD630	2401012222586	N/A
26	SYMN156TBD630	2401012213856	N/A
27	SYMN156TBD630	240400111D01241	N/A
28	SYMN156TBD630	2401012213839	N/A
29	SYMN156TBD630	240400111D01216	N/A
30	SYMN156TBD630	240400111D01217	N/A
31	SYMN156TBD630	240400111D01088	N/A

32	SYMN156TBD630	240400111D01097	N/A
33	SYMN156TBD630	240400111D00402	N/A
34	SYMN156TBD630	240400111D01313	N/A
35	SYMN156TBD630	240400111D01165	N/A
36	SYMN156TBD630	240400111D01535	N/A
37	SYMN156TBD630	240400111D01138	N/A
38	SYMN156TBD630	240400111D00991	N/A
39	SYMN156TBD630	240400111D01010	N/A

Supplementary information: N/A

Refer to test groups contents in section below for detail information

* These samples were not performed the environmental testing

Filling spare modules' information are omitted.

4. TESTING GROUP			
Initial measurements	Content	All modules	
4.1	Visual inspection	See Table 01	P
4.19	Stabilization	See Table 02	P
4.2	Maximum power determination	See Table 03	P
MST 16	Insulation test	See Table 04	P
MST 17	Wet leakage current test	See Table 05	P
MST 13	Ground continuity test	See Table MST 13	P
-	Electroluminescence image	See Annex 2 of this report	P

Transportation simulation	Content	Samples #: 4-11	
ASTM D4169	Random vibration test	See Table Transportation simulation	-
ISTA 3E block 2	Incline impact test		-
ISTA 3E block 3	Rotational flat drop test		-
4.1	Visual inspection	See Table 01	P
4.2	Maximum power determination	See Table 03	P
MST 16	Insulation test	See Table 04	P
MST 17	Wet leakage current test	See Table 05	P
MST 13	Ground continuity test	See Table MST 13	P
-	Electroluminescence image	See Annex 2 of this report	P

Path A	Content	Samples #: 2, 4, 6	
4.11	Thermal cycling test 200 cycles	See Table 4.11	
4.1	Visual inspection	See Table 01	P
4.2	Maximum power determination	See Table 03	P
MST 16	Insulation test	See Table 04	P
MST 17	Wet leakage current test	See Table 05	P
MST 13	Ground continuity test	See Table MST 13	P
-	Electroluminescence image	See Annex 2 of this report	P

Path B	Content	Samples #: 3, 5, 7	
4.18	Dynamic mechanical load	See Table 4.18	P
4.11	Thermal cycling test 50 cycles	See Table 4.11	P
4.12	Humidity-freeze test	See Table 4.12	P
4.16	Static mechanical load test	See Table 4.16	P

4.1	Visual inspection	See Table 01	P
4.2	Maximum power determination	See Table 03	P
MST 16	Insulation test	See Table 04	P
MST 17	Wet leakage current test	See Table 05	P
MST 13	Ground continuity test	See Table MST 13	P
-	Electroluminescence image	See Annex 2 of this report	P

TABLE 01: Initial Visual inspection		P
Test Date [YYYY-MM-DD]: 2024-04-16		—
Sample #	Nature and position of initial findings – comments or attach photos	—
1	No visual defects	P
2	No visual defects	P
3	No visual defects	P
4	No visual defects	P
5	No visual defects	P
6	No visual defects	P
7	No visual defects	P
8	No visual defects	P
9	No visual defects	P
10	No visual defects	P
11	No visual defects	P
12	No visual defects	P
13	No visual defects	P
14	No visual defects	P
15	No visual defects	P
16	No visual defects	P
17	No visual defects	P
18	No visual defects	P
19	No visual defects	P
20	No visual defects	P
21	No visual defects	P
22	No visual defects	P
23	No visual defects	P
24	No visual defects	P
25	No visual defects	P
26	No visual defects	P
27	No visual defects	P
28	No visual defects	P
29	No visual defects	P
30	No visual defects	P
31	No visual defects	P
32	No visual defects	P

33	No visual defects	P
34	No visual defects	P
35	No visual defects	P
36	No visual defects	P
37	No visual defects	P
38	No visual defects	P
39	No visual defects	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]..... :			2024-04-16				—
Test method..... :			<input checked="" type="checkbox"/> Solar simulator <input type="checkbox"/> Natural sunlight				—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Result
1	13.93	55.98	13.38	47.24	631.88	81.05	—
2	13.93	55.98	13.38	47.20	631.66	81.01	—
3	13.93	55.98	13.38	47.23	632.04	81.05	—
4	13.93	55.98	13.38	47.22	631.65	80.99	—
5	13.93	55.98	13.39	47.11	630.81	80.87	—
6	13.93	55.98	13.40	47.09	630.85	80.88	—
7	13.94	55.98	13.37	47.23	631.23	80.92	—
8	13.93	55.98	13.38	47.21	631.48	80.98	—
9	13.93	55.98	13.38	47.20	631.48	80.96	—
10	13.93	55.98	13.57	46.51	631.31	80.96	—
11	13.93	55.98	13.38	47.17	630.95	80.90	—
12	13.93	55.98	13.38	47.18	631.29	80.95	—
13	13.93	55.98	13.38	47.21	631.74	81.01	—
14	13.93	55.98	13.38	47.23	631.80	81.00	—
15	13.93	55.98	13.37	47.21	631.44	80.98	—
16	13.93	55.98	13.37	47.24	631.65	80.98	—
17	13.93	55.98	13.57	46.52	631.28	80.95	—
18	13.93	55.98	13.37	47.23	631.61	80.99	—
19	13.93	55.98	13.37	47.21	631.30	80.94	—
20	13.93	55.98	13.37	47.23	631.43	80.97	—

21	13.93	55.98	13.37	47.18	630.85	80.89	—
22	13.93	55.98	13.37	47.18	631.00	80.89	—
23	13.93	55.98	13.37	47.22	631.29	80.95	—
24	13.93	55.98	13.39	47.12	630.69	80.86	—
25	13.93	55.98	13.37	47.22	631.29	80.94	—
26	13.93	55.98	13.38	47.21	631.57	80.99	—
27	13.93	55.98	13.36	47.24	631.12	80.91	—
28	13.93	55.98	13.38	47.21	631.51	80.98	—
29	13.93	55.98	13.38	47.14	630.89	80.88	—
30	13.93	55.98	13.37	47.23	631.30	80.94	—
31	13.94	55.98	13.36	47.25	631.06	80.89	—
32	13.93	55.98	13.35	47.26	631.11	80.94	—
33	13.93	55.98	13.55	46.50	630.15	80.81	—
34	13.93	55.98	13.35	47.23	630.52	80.86	—
35	13.93	55.98	13.55	46.52	630.47	80.85	—
36	13.93	55.98	13.36	47.21	630.75	80.88	—
37	13.93	55.98	13.38	47.13	630.84	80.89	—
38	13.93	55.98	13.56	46.53	630.72	80.87	—
39	13.94	55.98	13.37	47.22	631.41	80.94	—
Supplementary information: N/A							

TABLE 02.4: MQT 19.1: Initial Stabilization procedure							P
Light exposure method				<input type="checkbox"/> Solar simulator <input checked="" type="checkbox"/> Natural sunlight			
Stabilization criterion x per IEC 61215-1-x				1			
Sample #	1	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
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	—	—	—	—	631.88	—	—
1	5	>500	—	MPPT	630.28	—	—
2	10	>500	—	MPPT	629.32	0.41	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	2	Test Date (YYYY-MM-DD) start/end :			2024-04-16/2024-04-19		
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	—	—	—	—	631.66	—	—
1	5	>500	—	MPPT	630.15	—	—
2	10	>500	—	MPPT	628.55	0.49	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	3	Test Date (YYYY-MM-DD) start/end :			2024-04-16/2024-04-19		
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	—	—	—	—	632.04	—	—
1	5	>500	—	MPPT	630.03	—	—
2	10	>500	—	MPPT	628.76	0.52	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	4	Test Date (YYYY-MM-DD) start/end :			2024-04-16/2024-04-19		
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	—	—	—	—	631.65	—	—
1	5	>500	—	MPPT	630.43	—	—
2	10	>500	—	MPPT	629.55	0.33	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	5	Test Date (YYYY-MM-DD) start/end :			2024-04-16/2024-04-19		
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	—	—	—	—	630.81	—	—
1	5	>500	—	MPPT	630.13	—	—
2	10	>500	—	MPPT	628.92	0.30	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	6	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.85	—	—
1	5	>500	—	MPPT	630.20	—	—
2	10	>500	—	MPPT	629.36	0.24	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	7	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.23	—	—
1	5	>500	—	MPPT	629.61	—	—
2	10	>500	—	MPPT	628.88	0.37	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	8	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.48	—	—
1	5	>500	—	MPPT	630.70	—	—
2	10	>500	—	MPPT	629.24	0.36	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	9	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.48	—	—
1	5	>500	—	MPPT	629.89	—	—
2	10	>500	—	MPPT	628.87	0.41	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	10	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)

Initial	—	—	—	—	631.31	—	—
1	5	>500	—	MPPT	630.40	—	—
2	10	>500	—	MPPT	629.17	0.34	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	11	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.95	—	—
1	5	>500	—	MPPT	630.13	—	—
2	10	>500	—	MPPT	628.77	0.35	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	12	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.29	—	—
1	5	>500	—	MPPT	629.72	—	—
2	10	>500	—	MPPT	629.21	0.33	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	13	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.74	—	—
1	5	>500	—	MPPT	629.97	—	—
2	10	>500	—	MPPT	629.51	0.35	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	14	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.80	—	—
1	5	>500	—	MPPT	630.18	—	—
2	10	>500	—	MPPT	629.36	0.39	Yes

3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	15	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	631.44	—	—
1	5	>500	—	MPPT	630.25	—	—
2	10	>500	—	MPPT	629.44	0.32	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	16	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	631.65	—	—
1	5	>500	—	MPPT	630.24	—	—
2	10	>500	—	MPPT	629.39	0.36	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	17	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	631.28	—	—
1	5	>500	—	MPPT	630.16	—	—
2	10	>500	—	MPPT	628.88	0.38	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	18	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	(P _{max} – P _{min}) / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	631.61	—	—
1	5	>500	—	MPPT	629.99	—	—
2	10	>500	—	MPPT	628.92	0.43	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	19	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.30	—	—
1	5	>500	—	MPPT	630.04	—	—
2	10	>500	—	MPPT	629.10	0.35	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	20	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.43	—	—
1	5	>500	—	MPPT	630.23	—	—
2	10	>500	—	MPPT	629.35	0.33	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	21	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.85	—	—
1	5	>500	—	MPPT	630.03	—	—
2	10	>500	—	MPPT	629.43	0.23	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	22	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.00	—	—
1	5	>500	—	MPPT	630.34	—	—
2	10	>500	—	MPPT	629.46	0.24	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	23	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)

Initial	—	—	—	—	631.29	—	—
1	5	>500	—	MPPT	629.55	—	—
2	10	>500	—	MPPT	629.33	0.31	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	24	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.69	—	—
1	5	>500	—	MPPT	630.32	—	—
2	10	>500	—	MPPT	629.45	0.20	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	25	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.29	—	—
1	5	>500	—	MPPT	630.11	—	—
2	10	>500	—	MPPT	629.22	0.33	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	26	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.57	—	—
1	5	>500	—	MPPT	630.30	—	—
2	10	>500	—	MPPT	629.41	0.34	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	27	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.12	—	—
1	5	>500	—	MPPT	630.34	—	—
2	10	>500	—	MPPT	629.37	0.28	Yes

3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	28	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.51	—	—
1	5	>500	—	MPPT	630.69	—	—
2	10	>500	—	MPPT	629.54	0.31	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	29	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.89	—	—
1	5	>500	—	MPPT	630.23	—	—
2	10	>500	—	MPPT	629.11	0.28	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	30	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.30	—	—
1	5	>500	—	MPPT	629.67	—	—
2	10	>500	—	MPPT	629.11	0.35	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	31	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.06	—	—
1	5	>500	—	MPPT	629.98	—	—
2	10	>500	—	MPPT	629.43	0.26	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

Sample #	32	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.11	—	—
1	5	>500	—	MPPT	629.32	—	—
2	10	>500	—	MPPT	629.55	0.28	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	33	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.15	—	—
1	5	>500	—	MPPT	629.53	—	—
2	10	>500	—	MPPT	628.82	0.21	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	34	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.52	—	—
1	5	>500	—	MPPT	629.16	—	—
2	10	>500	—	MPPT	629.53	0.22	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	35	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.47	—	—
1	5	>500	—	MPPT	629.52	—	—
2	10	>500	—	MPPT	629.60	0.15	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	36	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)

Initial	—	—	—	—	630.75	—	—
1	5	>500	—	MPPT	629.35	—	—
2	10	>500	—	MPPT	629.31	0.23	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	37	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.84	—	—
1	5	>500	—	MPPT	629.69	—	—
2	10	>500	—	MPPT	629.30	0.24	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	38	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	630.72	—	—
1	5	>500	—	MPPT	629.67	—	—
2	10	>500	—	MPPT	629.29	0.23	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
Sample #	39	Test Date (YYYY-MM-DD) start/end			2024-04-16/2024-04-19		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	$(P_{\max} - P_{\min}) / P_{\text{average}}$ (%)	Stable (Yes/No)
Initial	—	—	—	—	631.41	—	—
1	5	>500	—	MPPT	629.42	—	—
2	10	>500	—	MPPT	629.41	0.32	Yes
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—

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: Maximum power determination (Front side)							—
Test Date [YYYY-MM-DD]..... :				2024-04-22			—
Test method..... :				<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
1	13.91	55.98	13.33	47.22	629.32	80.79	—
2	13.92	55.98	13.52	46.48	628.55	80.69	—
3	13.92	55.98	13.53	46.48	628.76	80.71	—
4	13.92	55.97	13.53	46.54	629.55	80.81	—
5	13.92	55.97	13.34	47.16	628.92	80.72	—
6	13.92	55.97	13.32	47.23	629.36	80.79	—
7	13.92	55.97	13.33	47.18	628.88	80.73	—
8	13.92	55.97	13.53	46.51	629.24	80.75	—
9	13.92	55.97	13.35	47.12	628.87	80.72	—
10	13.92	55.97	13.33	47.21	629.17	80.76	—
11	13.92	55.97	13.53	46.48	628.77	80.70	—
12	13.92	55.97	13.53	46.51	629.21	80.77	—
13	13.92	55.97	13.34	47.20	629.51	80.80	—
14	13.92	55.97	13.53	46.51	629.36	80.77	—
15	13.92	55.98	13.33	47.23	629.44	80.77	—
16	13.92	55.97	13.53	46.51	629.39	80.78	—
17	13.92	55.98	13.53	46.49	628.88	80.71	—
18	13.92	55.97	13.52	46.50	628.92	80.73	—
19	13.91	55.97	13.52	46.52	629.10	80.79	—

20	13.92	55.97	13.32	47.23	629.35	80.81	—
21	13.92	55.97	13.33	47.23	629.43	80.81	—
22	13.92	55.97	13.33	47.21	629.46	80.80	—
23	13.92	55.97	13.34	47.19	629.33	80.79	—
24	13.92	55.97	13.36	47.13	629.45	80.81	—
25	13.92	55.97	13.33	47.22	629.22	80.78	—
26	13.92	55.98	13.53	46.50	629.41	80.78	—
27	13.92	55.97	13.33	47.23	629.37	80.79	—
28	13.92	55.98	13.33	47.22	629.54	80.80	—
29	13.92	55.97	13.33	47.21	629.11	80.76	—
30	13.92	55.97	13.33	47.19	629.11	80.76	—
31	13.92	55.97	13.33	47.20	629.43	80.79	—
32	13.92	55.97	13.33	47.21	629.55	80.81	—
33	13.92	55.97	13.53	46.49	628.82	80.73	—
34	13.92	55.97	13.33	47.21	629.53	80.81	—
35	13.92	55.97	13.33	47.22	629.60	80.82	—
36	13.92	55.97	13.34	47.19	629.31	80.77	—
37	13.92	55.97	13.53	46.52	629.30	80.78	—
38	13.92	55.97	13.35	47.13	629.29	80.77	—
39	13.92	55.97	13.33	47.22	629.41	80.80	—

Supplementary information: N/A

TABLE 04: Initial Insulation test				P
Test Date [YYYY-MM-DD]		2024-04-22		—
Test Voltage applied [V]		8000/1500		—
Size of module [m²]		2.80		—
Required Resistance [MΩ]		≥14.3		—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	40240	-	No	P
2	39440	-	No	P
3	38770	-	No	P
4	41230	-	No	P
5	>50000	-	No	P
6	>50000	-	No	P

7	>50000	-	No	P
8	38460	-	No	P
9	>50000	-	No	P
10	>50000	-	No	P
11	>50000	-	No	P
12	39990	-	No	P
13	>50000	-	No	P
14	43570	-	No	P
15	>50000	-	No	P
16	>50000	-	No	P
17	>50000	-	No	P
18	34700	-	No	P
19	36800	-	No	P
20	>50000	-	No	P
21	>50000	-	No	P
22	42780	-	No	P
23	>50000	-	No	P
24	>50000	-	No	P
25	>50000	-	No	P
26	32570	-	No	P
27	42700	-	No	P
28	>50000	-	No	P
29	>50000	-	No	P
30	43200	-	No	P
31	>50000	-	No	P
32	40040	-	No	P
33	>50000	-	No	P
34	>50000	-	No	P
35	>50000	-	No	P
36	>50000	-	No	P
37	38670	-	No	P
38	>50000	-	No	P
39	>50000	-	No	P
Supplementary information: N/A				

TABLE 05: Initial Wet leakage current test			P
Test Date [YYYY-MM-DD]		2024-04-22	—
Test Voltage applied [V]		1500	—
Solution temperature [°C]		22.7	—
Size of module [m²]		2.80	—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
1	≥14.3	8244	P
2	≥14.3	7854	P
3	≥14.3	6327	P
4	≥14.3	7247	P
5	≥14.3	8267	P
6	≥14.3	8446	P
7	≥14.3	6860	P
8	≥14.3	7214	P
9	≥14.3	10240	P
10	≥14.3	9475	P
11	≥14.3	8244	P
12	≥14.3	8012	P
13	≥14.3	9356	P
14	≥14.3	8647	P
15	≥14.3	7445	P
16	≥14.3	6245	P
17	≥14.3	7747	P
18	≥14.3	8245	P
19	≥14.3	9023	P
20	≥14.3	8475	P
21	≥14.3	6144	P
22	≥14.3	8755	P
23	≥14.3	7146	P
24	≥14.3	9356	P
25	≥14.3	8882	P
26	≥14.3	9977	P
27	≥14.3	11450	P
28	≥14.3	8144	P
29	≥14.3	7454	P
30	≥14.3	8888	P

31	≥14.3	8214	P
32	≥14.3	7447	P
33	≥14.3	8315	P
34	≥14.3	8254	P
35	≥14.3	7124	P
36	≥14.3	8846	P
37	≥14.3	7847	P
38	≥14.3	9544	P
39	≥14.3	5022	P
Supplementary information: N/A			

Table 11: MST 13 - Continuity test of equipotential bonding				
Test Date examination (YYYY-MM-DD).....		2024-04-22		—
Maximum over-current protection rating (A)		30		—
Current applied (A)		75		—
Location of designated grounding point		The center of one longer side		—
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
1	The center of the other longer side	0.28	0.004	P
	The center of one shorter longer side	0.32	0.004	P
	The center of the other shorter side	0.42	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
2	The center of the other longer side	0.36	0.006	P
	The center of one shorter longer side	0.35	0.006	P
	The center of the other shorter side	0.37	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
3	The center of the other longer side	0.42	0.005	P
	The center of one shorter longer side	0.41	0.004	P
	The center of the other shorter side	0.44	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
4	The center of the other longer side	0.38	0.006	P
	The center of one shorter longer side	0.32	0.006	P

	The center of the other shorter side	0.35	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
5	The center of the other longer side	0.34	0.006	P
	The center of one shorter longer side	0.31	0.005	P
	The center of the other shorter side	0.41	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
6	The center of the other longer side	0.35	0.006	P
	The center of one shorter longer side	0.36	0.003	P
	The center of the other shorter side	0.38	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
7	The center of the other longer side	0.37	0.005	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.37	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
8	The center of the other longer side	0.38	0.005	P
	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.45	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
9	The center of the other longer side	0.39	0.004	P
	The center of one shorter longer side	0.31	0.005	P
	The center of the other shorter side	0.35	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
10	The center of the other longer side	0.32	0.004	P
	The center of one shorter longer side	0.33	0.004	P
	The center of the other shorter side	0.36	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
11	The center of the other longer side	0.41	0.004	P

	The center of one shorter longer side	0.42	0.004	P
	The center of the other shorter side	0.44	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
12	The center of the other longer side	0.35	0.006	P
	The center of one shorter longer side	0.36	0.006	P
	The center of the other shorter side	0.39	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
13	The center of the other longer side	0.25	0.005	P
	The center of one shorter longer side	0.26	0.005	P
	The center of the other shorter side	0.26	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
14	The center of the other longer side	0.31	0.005	P
	The center of one shorter longer side	0.42	0.005	P
	The center of the other shorter side	0.42	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
15	The center of the other longer side	0.36	0.006	P
	The center of one shorter longer side	0.34	0.005	P
	The center of the other shorter side	0.39	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
16	The center of the other longer side	0.32	0.003	P
	The center of one shorter longer side	0.31	0.005	P
	The center of the other shorter side	0.33	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
17	The center of the other longer side	0.39	0.004	P
	The center of one shorter longer side	0.35	0.004	P
	The center of the other shorter side	0.39	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P

18	The center of the other longer side	0.22	0.004	P
	The center of one shorter longer side	0.29	0.003	P
	The center of the other shorter side	0.32	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
19	The center of the other longer side	0.31	0.003	P
	The center of one shorter longer side	0.36	0.004	P
	The center of the other shorter side	0.29	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
20	The center of the other longer side	0.32	0.004	P
	The center of one shorter longer side	0.31	0.004	P
	The center of the other shorter side	0.35	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
21	The center of the other longer side	0.42	0.005	P
	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.45	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
22	The center of the other longer side	0.32	0.006	P
	The center of one shorter longer side	0.35	0.004	P
	The center of the other shorter side	0.41	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
23	The center of the other longer side	0.38	0.005	P
	The center of one shorter longer side	0.39	0.005	P
	The center of the other shorter side	0.41	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
24	The center of the other longer side	0.36	0.003	P
	The center of one shorter longer side	0.38	0.004	P
	The center of the other shorter side	0.39	0.004	P

Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
25	The center of the other longer side	0.44	0.004	P
	The center of one shorter longer side	0.45	0.005	P
	The center of the other shorter side	0.46	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
26	The center of the other longer side	0.32	0.006	P
	The center of one shorter longer side	0.36	0.006	P
	The center of the other shorter side	0.37	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
27	The center of the other longer side	0.41	0.005	P
	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.42	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
28	The center of the other longer side	0.51	0.006	P
	The center of one shorter longer side	0.46	0.005	P
	The center of the other shorter side	0.44	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
29	The center of the other longer side	0.35	0.005	P
	The center of one shorter longer side	0.31	0.005	P
	The center of the other shorter side	0.36	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
30	The center of the other longer side	0.44	0.005	P
	The center of one shorter longer side	0.42	0.006	P
	The center of the other shorter side	0.41	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
31	The center of the other longer side	0.42	0.005	P
	The center of one shorter longer side	0.38	0.005	P

	The center of the other shorter side	0.44	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
32	The center of the other longer side	0.36	0.004	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.42	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
33	The center of the other longer side	0.49	0.006	P
	The center of one shorter longer side	0.44	0.006	P
	The center of the other shorter side	0.46	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
34	The center of the other longer side	0.35	0.006	P
	The center of one shorter longer side	0.31	0.006	P
	The center of the other shorter side	0.42	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
35	The center of the other longer side	0.47	0.004	P
	The center of one shorter longer side	0.41	0.005	P
	The center of the other shorter side	0.46	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
36	The center of the other longer side	0.31	0.004	P
	The center of one shorter longer side	0.36	0.005	P
	The center of the other shorter side	0.31	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
37	The center of the other longer side	0.32	0.006	P
	The center of one shorter longer side	0.36	0.006	P
	The center of the other shorter side	0.32	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
38	The center of the other longer side	0.41	0.006	P

	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.45	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
39	The center of the other longer side	0.36	0.004	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.42	0.005	P
Supplementary information: N/A				

TABLE Transportation simulation		—	
Test period [YYYY-MM-DD / YYYY-MM-DD]..... :	2024-04-23/2024-04-28	—	
Random vibration test			
Excitation axis :	Vertical		
Duration [min]..... :	180		
Test severity gRMS..... :	0.54		
Frequency range..... :	1 16 40 80 200	—	
Shock testing- Incline impact test			
Impact velocity [m/s]	1.1		—
Impact number of times	4 (face 2, face 4, face 5, face6)		—
Shock testing- Rotational edge drop test			
Drop height range (mm)	200	—	
Drop number of times	2 (edge3-6 and edge3-4)	—	
Shock testing- Vertical shock test		—	
Shock times (half sinusoidal)	100		
Shock pulse width (ms)	11	—	
Horizontal impact test		—	
Amplitude (g)	1		
Pulse duration (ms)	350		
Impact number of times	4	—	
Supplementary information: N/A			

TABLE 01: Visual inspection after transportation simulation		P
Test Date [YYYY-MM-DD] : 2024-04-29		—
Sample #	Nature and position of initial findings – comments or attach photos	—
4	No visual defects	P
5	No visual defects	P
6	No visual defects	P
7	No visual defects	P
8	No visual defects	P
9	No visual defects	P
10	No visual defects	P
11	No visual defects	P
12	No visual defects	P
13	No visual defects	P
14	No visual defects	P
15	No visual defects	P
16	No visual defects	P
17	No visual defects	P
18	No visual defects	P
19	No visual defects	P
20	No visual defects	P
21	No visual defects	P
22	No visual defects	P
23	No visual defects	P
24	No visual defects	P
25	No visual defects	P
26	No visual defects	P
27	No visual defects	P
28	No visual defects	P
29	No visual defects	P
30	No visual defects	P
31	No visual defects	P
32	No visual defects	P
33	No visual defects	P
34	No visual defects	P
35	No visual defects	P
36	No visual defects	P

37	No visual defects	P
38	No visual defects	P
39	No visual defects	P
Supplementary information: N/A		

TABLE 03: Maximum power determination after transportation simulation(Front side)							P
Test Date [YYYY-MM-DD]..... :				2024-04-29			—
Test method				<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
4	13.92	55.98	13.52	46.51	628.90	80.72	—
5	13.92	55.98	13.54	46.50	629.82	80.83	—
6	13.92	55.97	13.32	47.18	628.58	80.68	—
7	13.92	55.98	13.34	47.21	629.76	80.83	—
8	13.91	55.98	13.33	47.20	629.19	80.79	—
9	13.91	55.98	13.32	47.24	629.15	80.77	—
10	13.92	55.98	13.52	46.52	628.71	80.71	—
11	13.92	55.98	13.33	47.15	628.70	80.71	—
12	13.92	55.98	13.32	47.24	628.96	80.74	—
13	13.92	55.98	13.35	47.14	629.12	80.75	—
14	13.92	55.98	13.33	47.18	628.74	80.70	—
15	13.92	55.97	13.32	47.21	628.88	80.73	—
16	13.92	55.97	13.32	47.22	628.88	80.72	—
17	13.92	55.97	13.33	47.22	629.26	80.78	—
18	13.92	55.97	13.53	46.48	628.91	80.72	—
19	13.92	55.97	13.52	46.52	628.81	80.71	—
20	13.92	55.97	13.32	47.23	629.27	80.78	—
21	13.92	55.97	13.33	47.20	629.42	80.79	—
22	13.92	55.98	13.33	47.22	629.65	80.81	—
23	13.92	55.98	13.34	47.20	629.68	80.82	—
24	13.92	55.98	13.33	47.20	629.35	80.77	—
25	13.92	55.98	13.54	46.50	629.55	80.80	—
26	13.92	55.97	13.52	46.51	629.08	80.76	—
27	13.91	55.98	13.53	46.53	629.44	80.81	—
28	13.92	55.96	13.33	47.20	629.12	80.76	—

29	13.92	55.98	13.34	47.21	629.70	80.82	—
30	13.92	55.98	13.53	46.52	629.35	80.77	—
31	13.92	55.98	13.36	47.09	629.01	80.73	—
32	13.92	55.98	13.33	47.19	629.18	80.76	—
33	13.92	55.98	13.33	47.23	629.34	80.77	—
34	13.92	55.98	13.34	47.23	629.87	80.85	—
35	13.92	55.97	13.53	46.51	629.22	80.76	—
36	13.92	55.97	13.35	47.13	629.13	80.75	—
37	13.92	55.97	13.35	47.14	629.46	80.78	—
38	13.92	55.97	13.54	46.50	629.59	80.82	—
39	13.92	55.97	13.36	47.14	629.90	80.86	—

Supplementary information: N/A

TABLE 04: Insulation test after transportation simulation				P
Test Date [YYYY-MM-DD]		2024-04-29		—
Test Voltage applied [V]		8000/1500		—
Size of module [m ²]		2.80		—
Required Resistance [MΩ]		≥14.3		—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
4	42780	-	No	P
5	33140	-	No	P
6	31260	-	No	P
7	>50000	-	No	P
8	38140	-	No	P
9	>50000	-	No	P
10	>50000	-	No	P
11	40050	-	No	P
12	38970	-	No	P
13	30450	-	No	P
14	41140	-	No	P
15	>50000	-	No	P
16	39470	-	No	P
17	>50000	-	No	P
18	>50000	-	No	P

19	30060	-	No	P
20	42680	-	No	P
21	>50000	-	No	P
22	37890	-	No	P
23	.39570	-	No	P
24	43100	-	No	P
25	>50000	-	No	P
26	>50000	-	No	P
27	>50000	-	No	P
28	>50000	-	No	P
29	34510	-	No	P
30	28940	-	No	P
31	34470	-	No	P
32	>50000	-	No	P
33	>50000	-	No	P
34	>50000	-	No	P
35	42700	-	No	P
36	>50000	-	No	P
37	34700	-	No	P
38	39740	-	No	P
39	>50000	-	No	P
Supplementary information: N/A				

TABLE 05: Wet leakage current test after transportation simulation				P
Test Date [YYYY-MM-DD]		2024-04-29		—
Test Voltage applied [V]		1500		—
Solution temperature [°C]		22.9		—
Size of module [m²]		2.80		—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result	
4	≥14.3	5147	P	
5	≥14.3	6233	P	
6	≥14.3	6814	P	
7	≥14.3	5245	P	
8	≥14.3	4577	P	
9	≥14.3	5368	P	
10	≥14.3	5964	P	

11	≥14.3	5021	P
12	≥14.3	5555	P
13	≥14.3	6314	P
14	≥14.3	6897	P
15	≥14.3	6222	P
16	≥14.3	5961	P
17	≥14.3	5641	P
18	≥14.3	6317	P
19	≥14.3	5214	P
20	≥14.3	4574	P
21	≥14.3	4958	P
22	≥14.3	5333	P
23	≥14.3	6214	P
24	≥14.3	5316	P
25	≥14.3	4968	P
26	≥14.3	5114	P
27	≥14.3	6845	P
28	≥14.3	7121	P
29	≥14.3	8364	P
30	≥14.3	7254	P
31	≥14.3	4688	P
32	≥14.3	5244	P
33	≥14.3	5364	P
34	≥14.3	4512	P
35	≥14.3	6344	P
36	≥14.3	7605	P
37	≥14.3	7134	P
38	≥14.3	6023	P
39	≥14.3	5745	P
Supplementary information: N/A			

Table 11: MST 13 - Continuity test of equipotential bonding after transportation simulation		
Test Date examination (YYYY-MM-DD).....	2024-04-29	—
Maximum over-current protection rating (A).....	30	—
Current applied (A)	75	—
Location of designated grounding point	The center of one longer side	—

Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
4	The center of the other longer side	0.25	0.003	P
	The center of one shorter longer side	0.31	0.004	P
	The center of the other shorter side	0.34	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
5	The center of the other longer side	0.44	0.006	P
	The center of one shorter longer side	0.45	0.006	P
	The center of the other shorter side	0.46	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
6	The center of the other longer side	0.54	0.005	P
	The center of one shorter longer side	0.47	0.004	P
	The center of the other shorter side	0.46	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
7	The center of the other longer side	0.47	0.006	P
	The center of one shorter longer side	0.41	0.006	P
	The center of the other shorter side	0.46	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
8	The center of the other longer side	0.45	0.006	P
	The center of one shorter longer side	0.47	0.005	P
	The center of the other shorter side	0.47	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
9	The center of the other longer side	0.44	0.006	P
	The center of one shorter longer side	0.46	0.003	P
	The center of the other shorter side	0.41	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
10	The center of the other longer side	0.32	0.005	P
	The center of one shorter longer side	0.34	0.005	P

	The center of the other shorter side	0.41	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
11	The center of the other longer side	0.24	0.005	P
	The center of one shorter longer side	0.26	0.005	P
	The center of the other shorter side	0.27	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
12	The center of the other longer side	0.32	0.004	P
	The center of one shorter longer side	0.35	0.005	P
	The center of the other shorter side	0.38	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
13	The center of the other longer side	0.44	0.004	P
	The center of one shorter longer side	0.41	0.004	P
	The center of the other shorter side	0.42	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
14	The center of the other longer side	0.36	0.004	P
	The center of one shorter longer side	0.39	0.004	P
	The center of the other shorter side	0.41	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
15	The center of the other longer side	0.42	0.006	P
	The center of one shorter longer side	0.38	0.006	P
	The center of the other shorter side	0.44	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
16	The center of the other longer side	0.28	0.005	P
	The center of one shorter longer side	0.29	0.005	P
	The center of the other shorter side	0.23	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
17	The center of the other longer side	0.32	0.005	P

	The center of one shorter longer side	0.33	0.005	P
	The center of the other shorter side	0.35	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
18	The center of the other longer side	0.44	0.006	P
	The center of one shorter longer side	0.38	0.005	P
	The center of the other shorter side	0.42	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
19	The center of the other longer side	0.36	0.003	P
	The center of one shorter longer side	0.38	0.005	P
	The center of the other shorter side	0.39	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
20	The center of the other longer side	0.44	0.004	P
	The center of one shorter longer side	0.42	0.004	P
	The center of the other shorter side	0.46	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
21	The center of the other longer side	0.45	0.004	P
	The center of one shorter longer side	0.44	0.003	P
	The center of the other shorter side	0.47	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
22	The center of the other longer side	0.47	0.003	P
	The center of one shorter longer side	0.44	0.004	P
	The center of the other shorter side	0.42	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
23	The center of the other longer side	0.38	0.004	P
	The center of one shorter longer side	0.39	0.004	P
	The center of the other shorter side	0.42	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P

24	The center of the other longer side	0.44	0.005	P
	The center of one shorter longer side	0.45	0.005	P
	The center of the other shorter side	0.46	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
25	The center of the other longer side	0.47	0.006	P
	The center of one shorter longer side	0.49	0.004	P
	The center of the other shorter side	0.51	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
26	The center of the other longer side	0.44	0.005	P
	The center of one shorter longer side	0.42	0.005	P
	The center of the other shorter side	0.35	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
27	The center of the other longer side	0.39	0.003	P
	The center of one shorter longer side	0.42	0.004	P
	The center of the other shorter side	0.44	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
28	The center of the other longer side	0.38	0.004	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.39	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
29	The center of the other longer side	0.44	0.006	P
	The center of one shorter longer side	0.46	0.006	P
	The center of the other shorter side	0.47	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
30	The center of the other longer side	0.39	0.005	P
	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.45	0.006	P

Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
31	The center of the other longer side	0.31	0.006	P
	The center of one shorter longer side	0.32	0.005	P
	The center of the other shorter side	0.35	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
32	The center of the other longer side	0.38	0.005	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.41	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
33	The center of the other longer side	0.42	0.005	P
	The center of one shorter longer side	0.44	0.006	P
	The center of the other shorter side	0.47	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
34	The center of the other longer side	0.35	0.005	P
	The center of one shorter longer side	0.37	0.005	P
	The center of the other shorter side	0.39	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
35	The center of the other longer side	0.42	0.004	P
	The center of one shorter longer side	0.44	0.005	P
	The center of the other shorter side	0.31	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
36	The center of the other longer side	0.39	0.006	P
	The center of one shorter longer side	0.31	0.006	P
	The center of the other shorter side	0.37	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
37	The center of the other longer side	0.39	0.006	P
	The center of one shorter longer side	0.33	0.006	P

	The center of the other shorter side	0.32	0.006	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
38	The center of the other longer side	0.34	0.004	P
	The center of one shorter longer side	0.33	0.005	P
	The center of the other shorter side	0.35	0.004	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
39	The center of the other longer side	0.41	0.004	P
	The center of one shorter longer side	0.42	0.005	P
	The center of the other shorter side	0.44	0.005	P
Supplementary information: N/A				

TABLE 18: Dynamic mechanical load		P
Test Date [YYYY-MM-DD] start/end : 2024-05-05 / 2024-05-07		—
Total cycles : 1000		—
Mechanical load for both side [Pa] : 1000		—
Sample #	Open circuits (yes/no)	—
3	No	P
5	No	P
6	No	P
Supplementary information: N/A		

TABLE 15: MQT 11 - Thermal cycling 50 test			P	
Test Date [YYYY-MM-DD] start/end		2024-05-08/2024-05-15	—	
Total cycles (50)		50	—	
Applied current (A)		During the heat up cycle from - 40 °C to 80 °C	13.33	—
		Other stages	0.13	—
Sample #	Open circuits (yes/no)			—
3	no			P
5	no			P
6	no			P
Supplementary information: N/A				

TABLE 16: MQT 12 - Humidity freeze 20 test		P
Test Date [YYYY-MM-DD] start/end	2024-05-16 / 2024-06-05	—
Total cycles (20)	20	—
Applied current (A)	0.07	—
Sample #	Open circuits (yes/no)	—
3	no	P
5	no	P
6	no	P
Supplementary information: N/A		

TABLE 19.5: MQT 16 Static mechanical load test			P
Sample # :	3		—
Design load(front side/ back side)	1600/1600		—
Safety factors	1.5		—
Test Date [YYYY-MM-DD]	2024-06-05		—
Mounting method	2 rails with 4 clamps		—
Load applied to	front side	back side	—
First cycle Mechanical load [Pa]	2400	2400	—
Intermittent open-circuit (yes/no)	no	no	P
Second cycle Mechanical load [Pa]	2400	2400	—
Intermittent open-circuit (yes/no)	no	no	P
Third cycle Mechanical load [Pa]	2400	2400	—
Intermittent open-circuit (yes/no)	no	no	P
Supplementary information: may need to be performed with each mounting situation			

TABLE 19.5: MQT 16 Static mechanical load test			P
Sample # :	5		—
Design load(front side/ back side)	1600/1600		—
Safety factors	1.5		—
Test Date [YYYY-MM-DD]	2024-06-06		—
Mounting method	2 rails with 4 clamps		—
Load applied to	front side	back side	—
First cycle Mechanical load [Pa]	2400	2400	—
Intermittent open-circuit (yes/no)	no	no	P
Second cycle Mechanical load [Pa]	2400	2400	—
Intermittent open-circuit (yes/no)	no	no	P

Third cycle Mechanical load [Pa]..... :	2400	2400	—
Intermittent open-circuit (yes/no) :	no	no	P
Supplementary information: may need to be performed with each mounting situation			

TABLE 19.5: MQT 16 Static mechanical load test			P
Sample # :	6		—
Design load(front side/ back side) :	1600/1600		—
Safety factors :	1.5		—
Test Date [YYYY-MM-DD]..... :	2024-06-07		—
Mounting method :	2 rails with 4 clamps		—
Load applied to..... :	front side	back side	—
First cycle Mechanical load [Pa]..... :	2400	2400	—
Intermittent open-circuit (yes/no) :	no	no	P
Second cycle Mechanical load [Pa]..... :	2400	2400	—
Intermittent open-circuit (yes/no) :	no	no	P
Third cycle Mechanical load [Pa]..... :	2400	2400	—
Intermittent open-circuit (yes/no) :	no	no	P
Supplementary information: may need to be performed with each mounting situation			

TABLE 19.6: MQT 01 - Visual inspection after Path B		P
Test Date [YYYY-MM-DD].....: 2024-06-07		—
Sample #	Nature and position of initial findings – comments or attach photos	—
3	no	P
5	no	P
6	no	P
Supplementary information: N/A		

TABLE 03: Maximum power determination after Path B							P
Test Date [YYYY-MM-DD]		2024-06-07					—
Test method		<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight					—
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]	Result
3	55.85	46.31	13.79	13.38	619.72	80.44	P
5	55.85	46.98	13.80	13.19	619.58	80.40	P
6	55.85	46.99	13.81	13.20	620.44	80.44	P
Supplementary information: N/A							

TABLE 19.7: MQT 15 - Wet leakage current test after Path B				P
Test Date [YYYY-MM-DD]		2024-06-07		—
Test Voltage applied [V]		1500		—
Solution temperature [°C]		23.1		—
Size of module [m²]		2.80		—
Required Resistance [MΩ]		≥14.3		—
Sample #	Measured [MΩ]		Limit [MΩ]	Result
3	5712		≥14.3	P
5	6300		≥14.3	P
6	4676		≥14.3	P
Supplementary information: N/A				

TABLE 04: Insulation test after Path B			P
Test Date [YYYY-MM-DD]		2024-06-07	—
Test Voltage applied [V]		8000/1500	—
Size of module [m²]		2.80	—
Required Resistance [MΩ]		≥14.3	—
Sample #	Measured	Dielectric breakdown	Result

	MΩ	Yes (description)	No	
3	41410		√	P
5	31490		√	P
6	40120		√	P
Supplementary information: -				

Table 11: MST 13 - Continuity test of equipotential bonding after Path B				
Test Date examination (YYYY-MM-DD) :		2024-06-07		—
Maximum over-current protection rating (A) :		30		—
Current applied (A)		75		—
Location of designated grounding point :		The center of one longer side		—
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
3	The center of the other longer side	0.41	0.005	P
	The center of one shorter longer side	0.42	0.004	P
	The center of the other shorter side	0.44	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
5	The center of the other longer side	0.31	0.006	P
	The center of one shorter longer side	0.32	0.006	P
	The center of the other shorter side	0.35	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
6	The center of the other longer side	0.39	0.005	P
	The center of one shorter longer side	0.42	0.004	P
	The center of the other shorter side	0.48	0.005	P
Supplementary information:-				

TABLE 18: MQT 11 - Thermal cycling 200 test				P
Test Date [YYYY-MM-DD] start/end		2024-04-29/2024-05-29		—
Total cycles (200).....		200		—
Applied current (A)	During the heat up cycle from – 40 °C to 80 °C	13.33		—
	Other stages	0.13		—
Sample #	Open circuits (yes/no)			—

2	No	P
4	No	P
7	No	P
Supplementary information:		

TABLE 19.6: MQT 01 - Visual inspection after Path A		P
Test Date [YYYY-MM-DD]	2024-05-29	—
Sample #	Nature and position of initial findings – comments or attach photos	—
2	No	P
4	No	P
7	No	P
Supplementary information: -		

TABLE 03: Maximum power determination after Path A							P
Test Date [YYYY-MM-DD]	2024-05-29						—
Test method	<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight						—
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]	Result
2	55.92	47.04	13.85	13.28	624.48	80.66	P
4	55.91	47.09	13.85	13.28	625.20	80.74	P
7	55.91	46.41	13.84	13.44	623.58	80.61	P
Supplementary information: N/A							









TABLE 19.7: MQT 15 - Wet leakage current test after Path A			P
Test Date [YYYY-MM-DD]		2024-05-29	—
Test Voltage applied [V].....		1500	—
Solution temperature [°C]		23.0	—
Size of module [m²]		2.80	—
Required Resistance [MΩ].....		≥14.3	—
Sample #	Measured [MΩ]	Limit [MΩ]	Result
2	4744	≥14.3	P
4	5021	≥14.3	P
7	6517	≥14.3	P
Supplementary information: N/A			





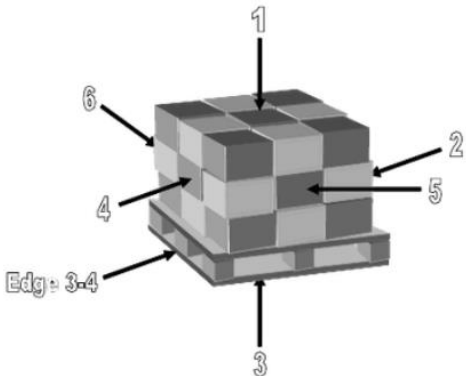



TABLE 04: Insulation test after Path A		P
Test Date [YYYY-MM-DD]	2024-05-29	—









Test Voltage applied [V]		8000/1500		—
Size of module [m ²]		2.80		—
Required Resistance [MΩ].....		≥14.3		—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
2	31240		√	P
4	29470		√	P
7	32240		√	P
Supplementary information: N/A				





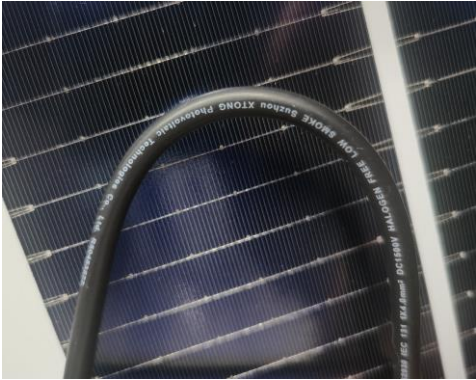

Table 11: MST 13 - Continuity test of equipotential bonding after Path A				
Test Date examination (YYYY-MM-DD) :		2024-05-29		—
Maximum over-current protection rating (A) :		30		—
Current applied (A)		75		—
Location of designated grounding point :		The center of one longer side		—
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance []	P
2	The center of the other longer side	0.25	0.003	P
	The center of one shorter longer side	0.26	0.004	P
	The center of the other shorter side	0.33	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
4	The center of the other longer side	0.31	0.006	P
	The center of one shorter longer side	0.32	0.006	P
	The center of the other shorter side	0.37	0.005	P
Sample #	Location of 2nd contacting point	Voltage [V]	Resistance [Ω]	P
7	The center of the other longer side	0.41	0.005	P
	The center of one shorter longer side	0.31	0.004	P
	The center of the other shorter side	0.35	0.005	P
Supplementary information:				

Annex1: Photographs

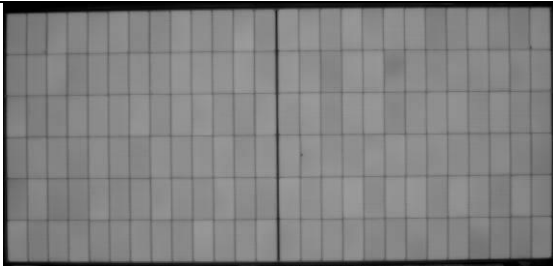
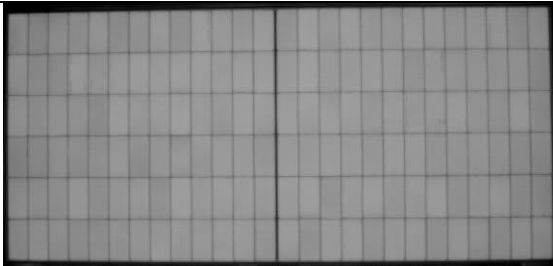
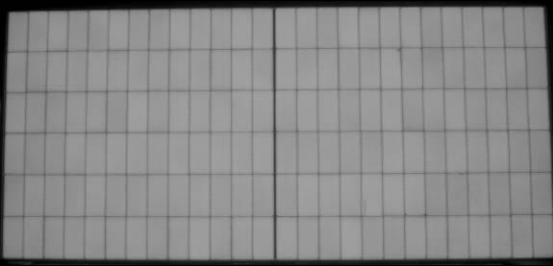
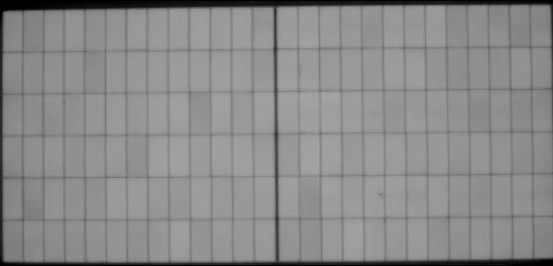
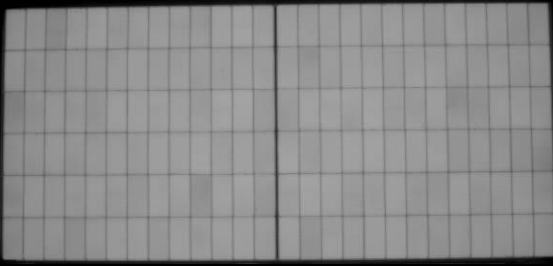
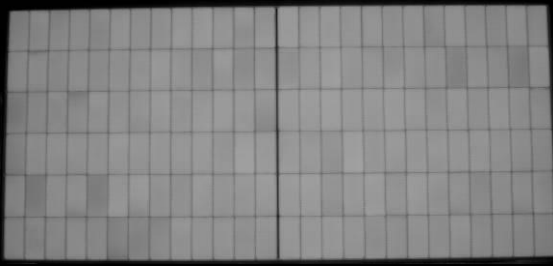
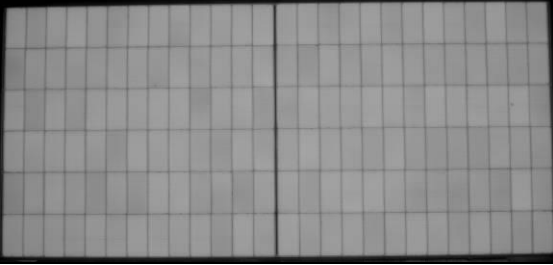
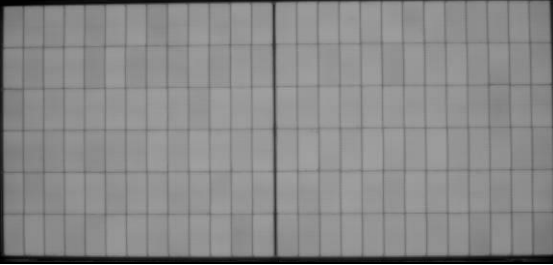
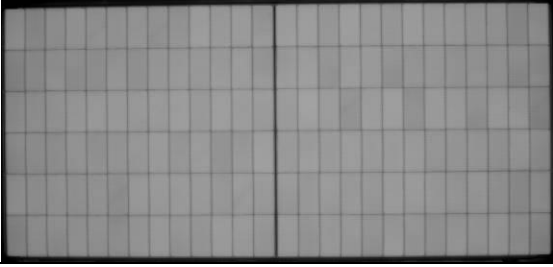
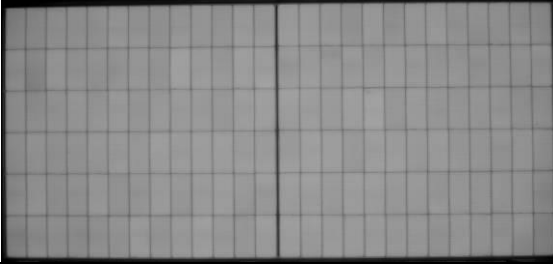
	
Front overview of pallet	Rear overview of pallet
	
Rear overview of pallet	Side overview of pallet
	
Outside overview of carton	Inside overview of modules
	
Outside overview of carton	Inside overview of modules

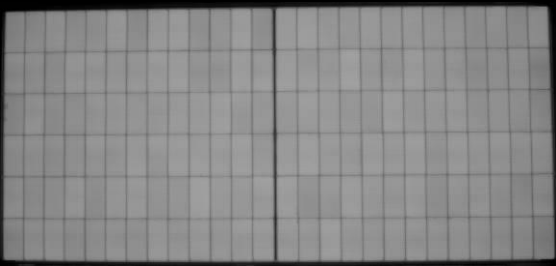
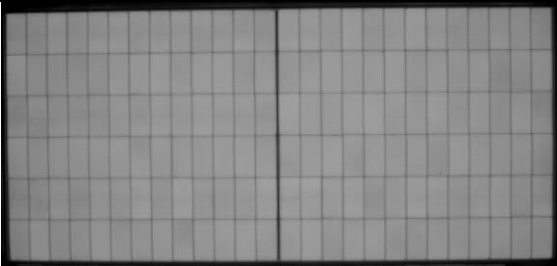
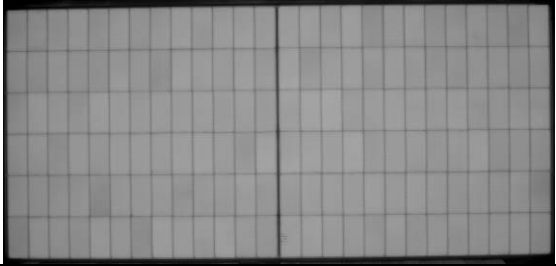
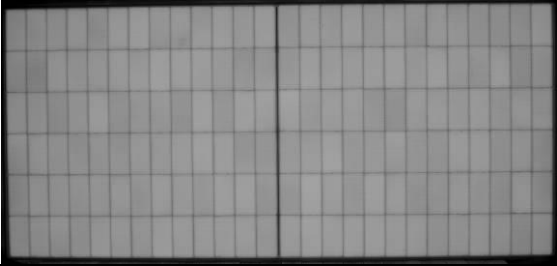
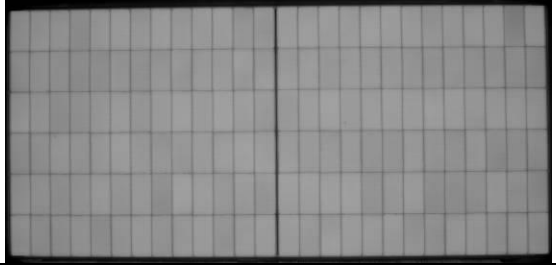
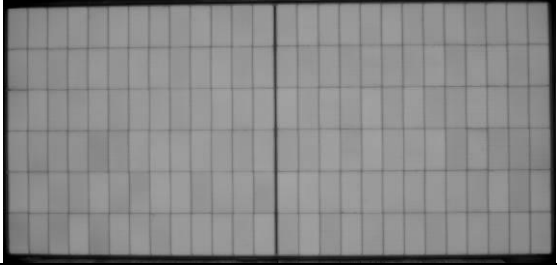
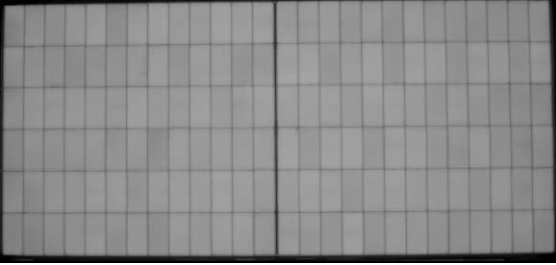
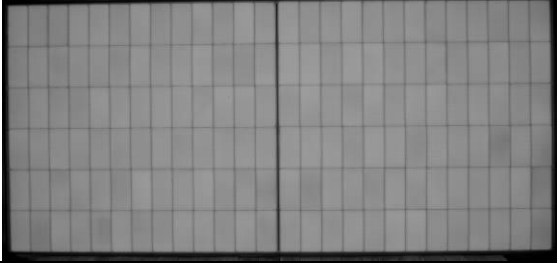
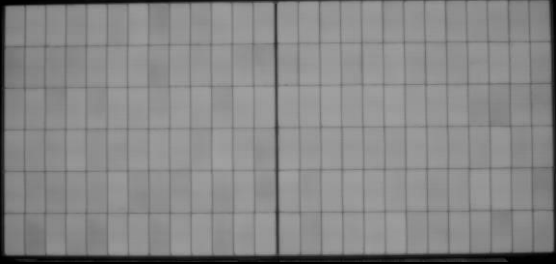
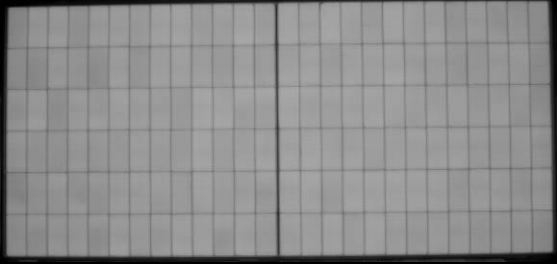
	
Thickness of carton body	Thickness of carton cap
	
Thickness of belt	Width of belt
	
Direction	Random vibration test
	
Incline impact test	Incline impact test

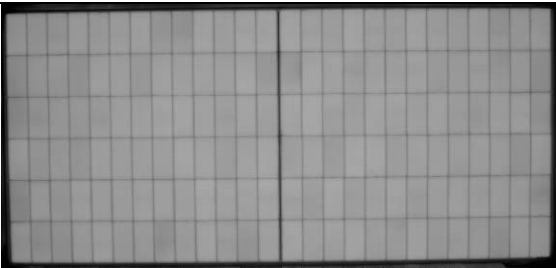
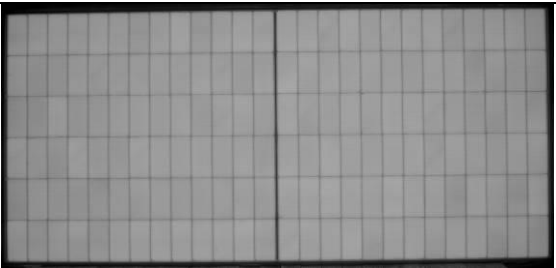
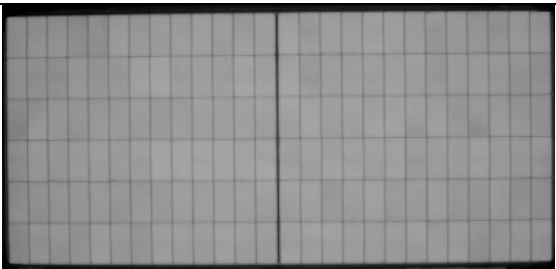
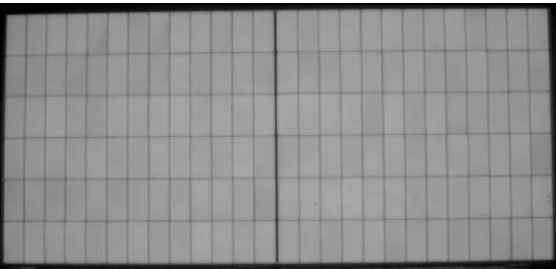
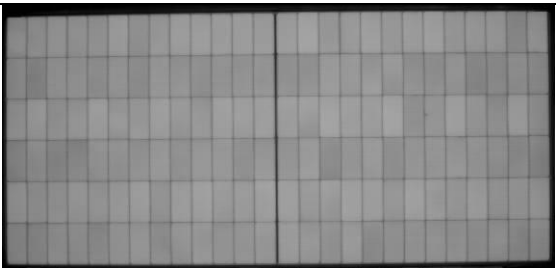
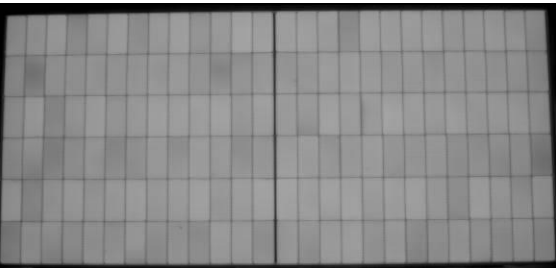
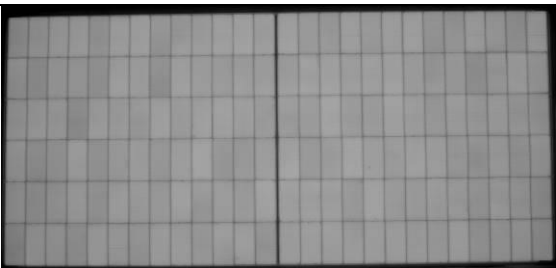
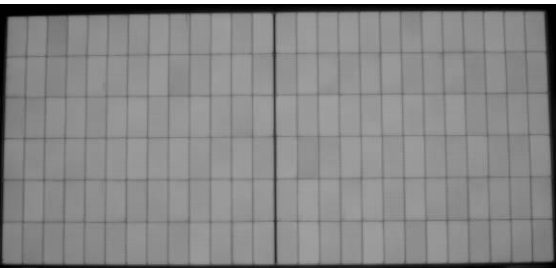
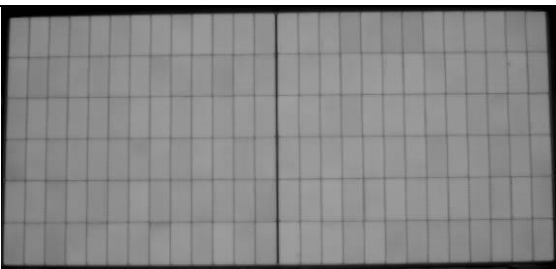
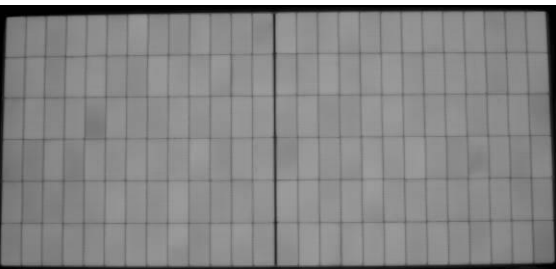
	
Rotational edge drop test	Rotational edge drop test
	
Horizontal impact test	Horizontal impact test
	
Random vibration test	Random vibration test
	
Front overview	Back overview

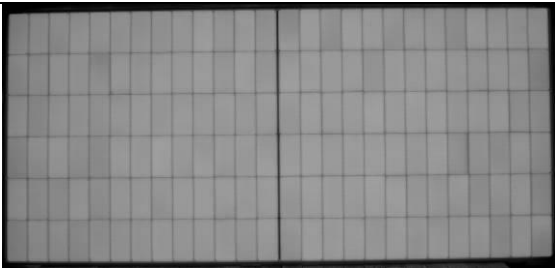
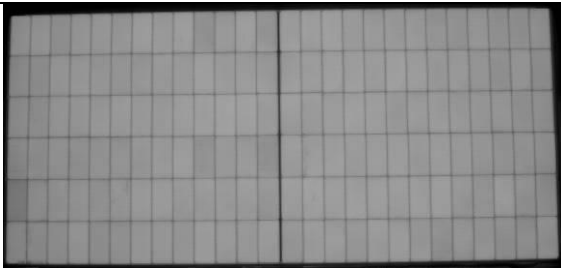
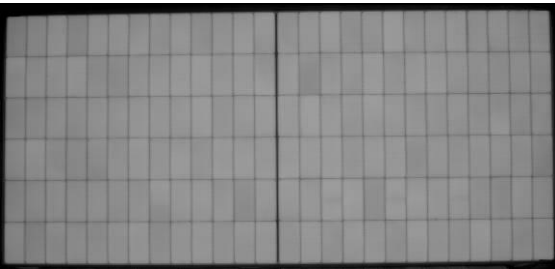
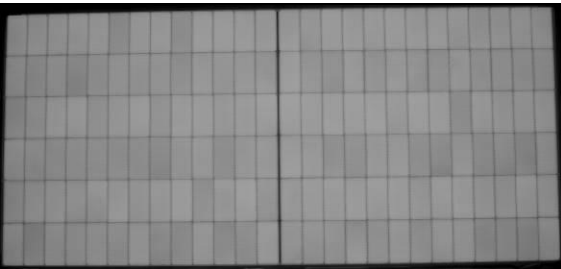
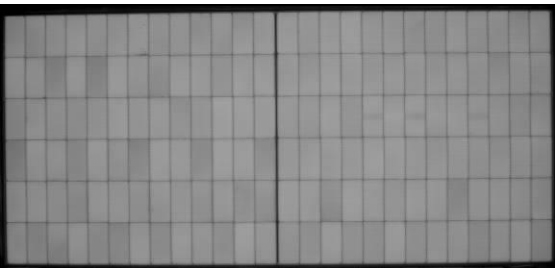
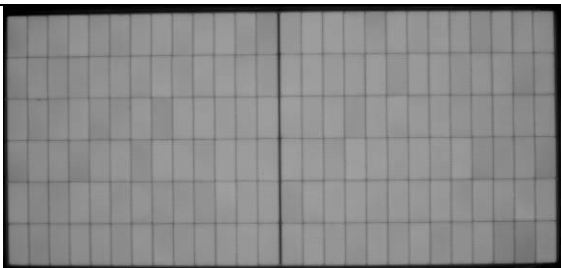
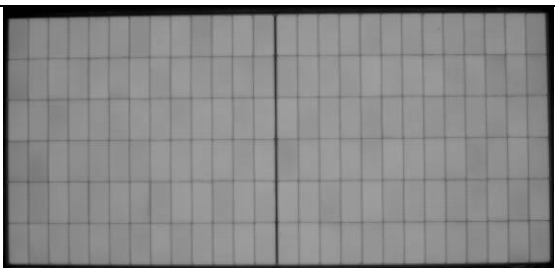
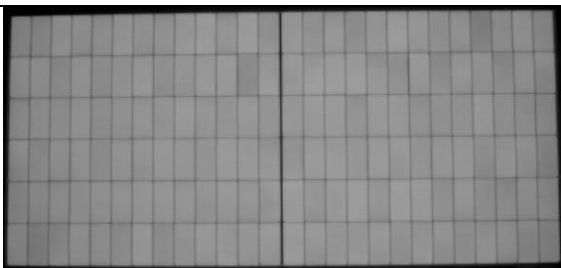
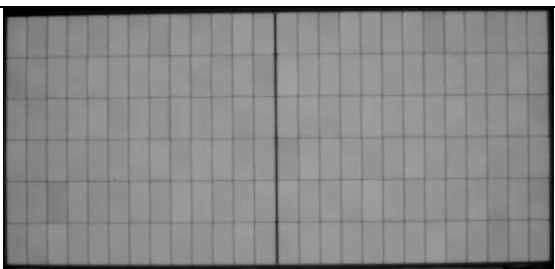
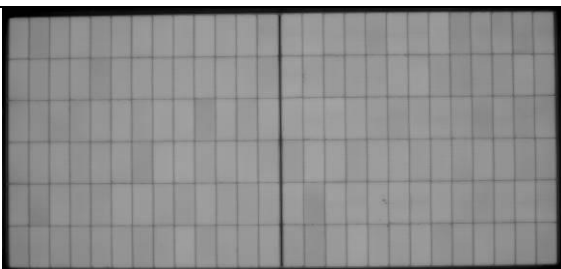
	
<i>Solar cell</i>	<i>Frame</i>
	
<i>Grounding Mark</i>	<i>Connectors</i>
	
<i>Cable</i>	<i>Junction box</i>

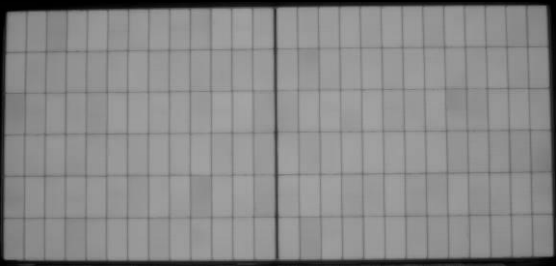
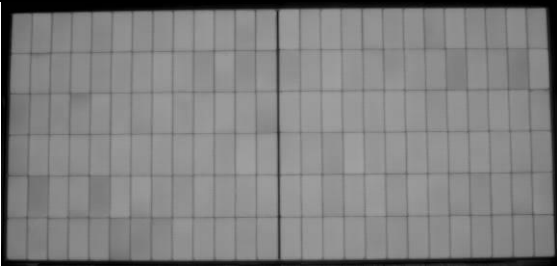
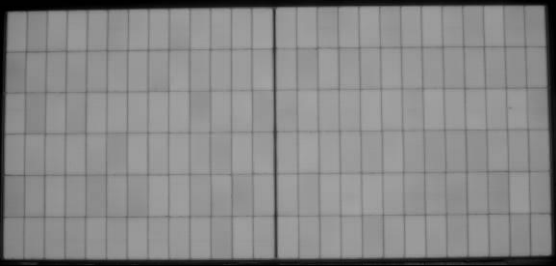
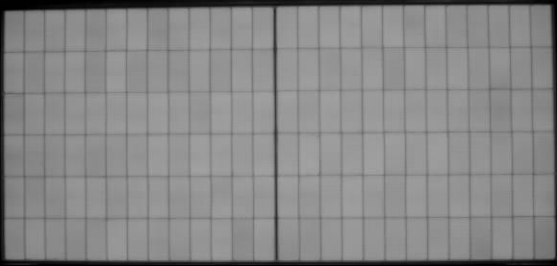
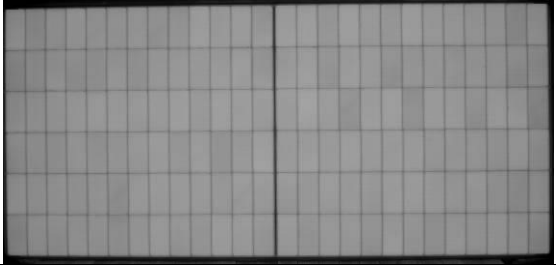
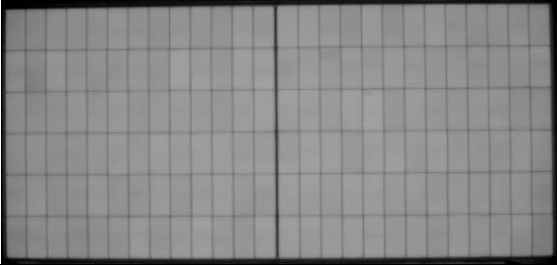
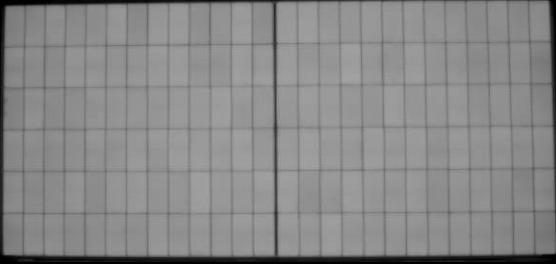
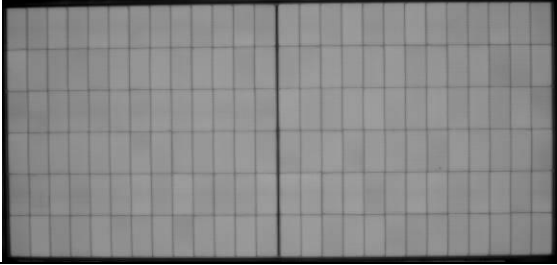
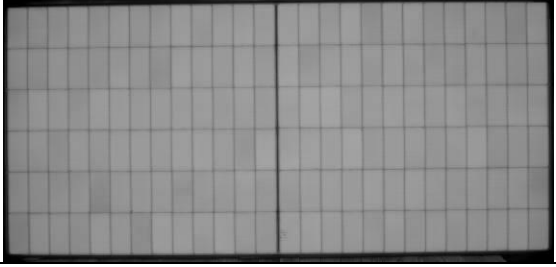
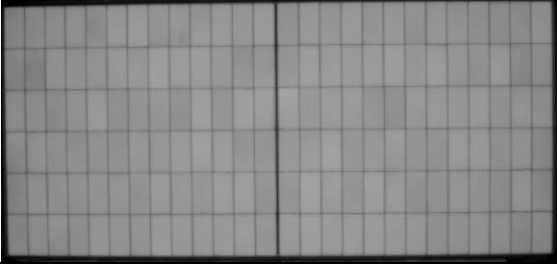
Annex2: EL

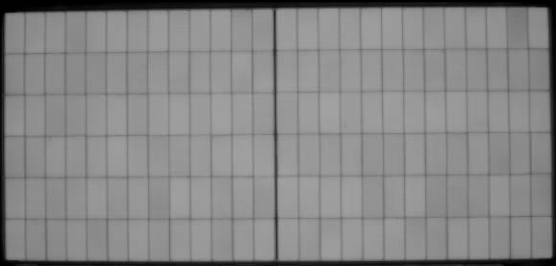
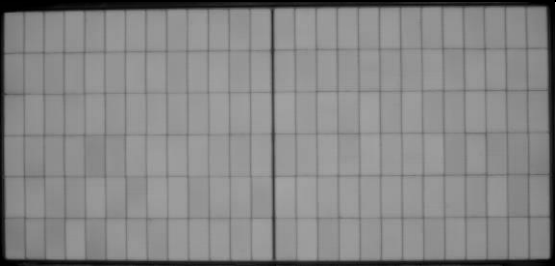
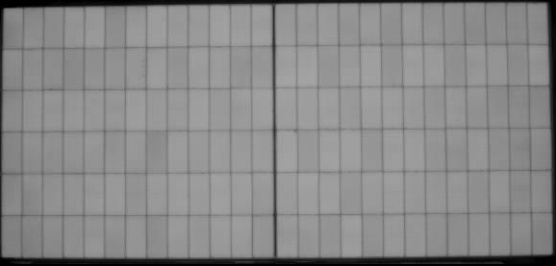
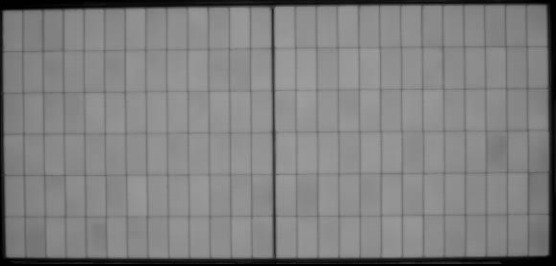
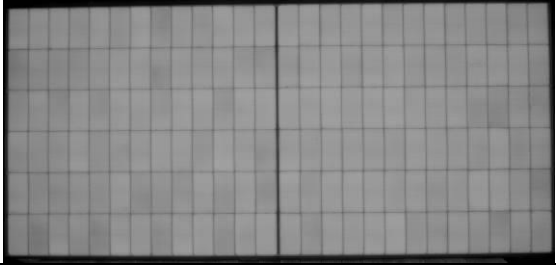
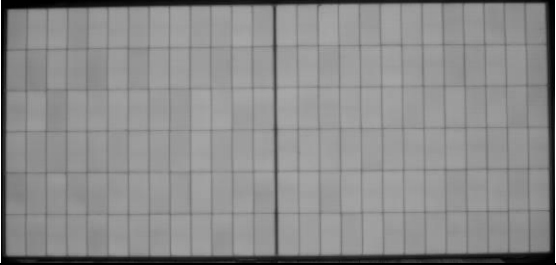
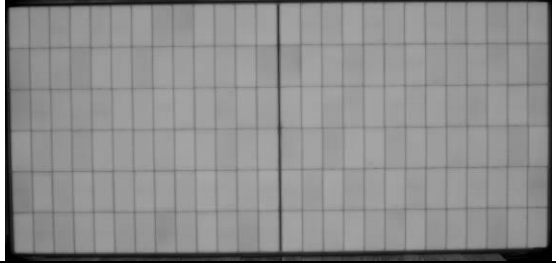
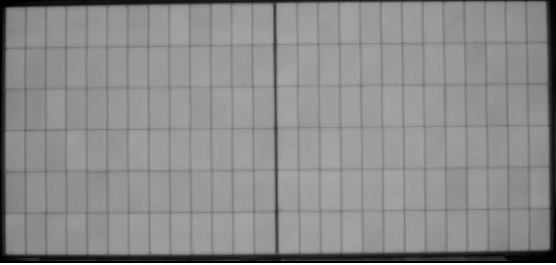
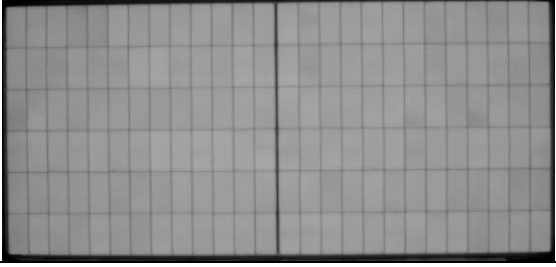
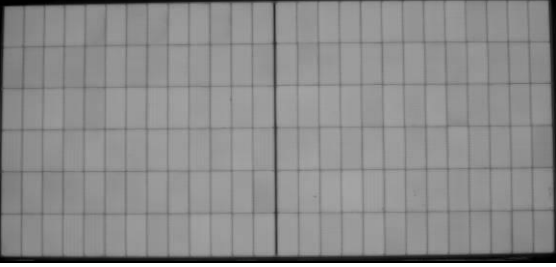
	
1# EL (Initial)	2# EL (Initial)
	
3# EL (Initial)	4# EL (Initial)
	
5# EL (Initial)	6# EL (Initial)
	
7# EL (Initial)	8# EL (Initial)
	
9# EL (Initial)	10# EL (Initial)

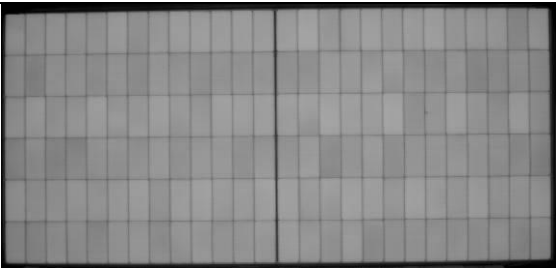
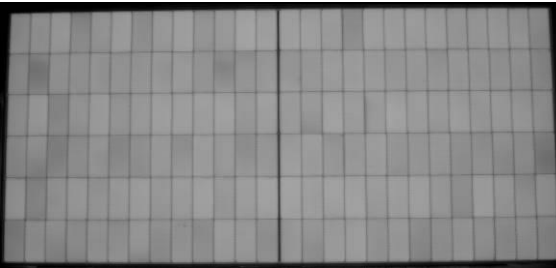
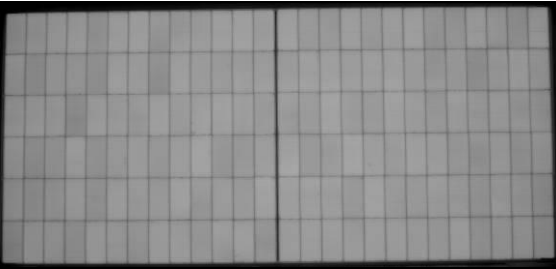
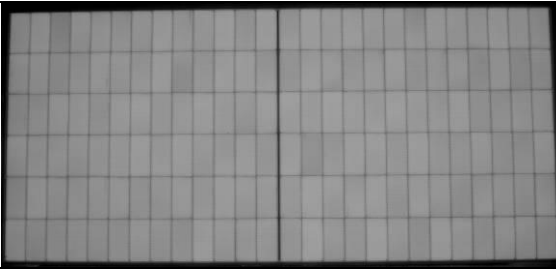
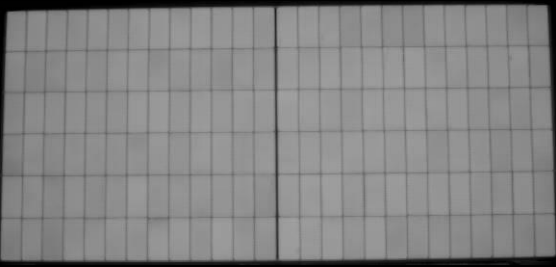
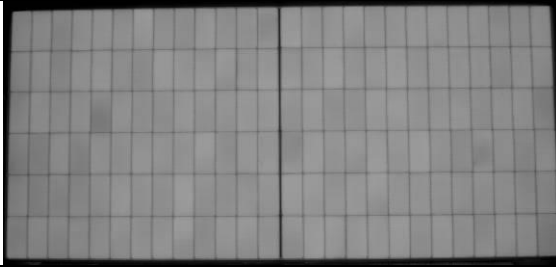
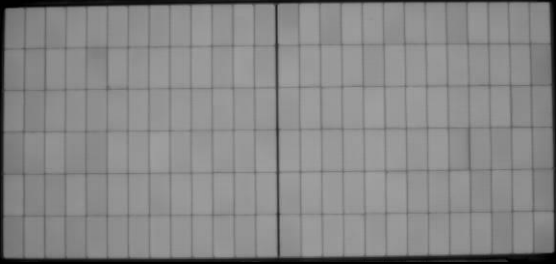
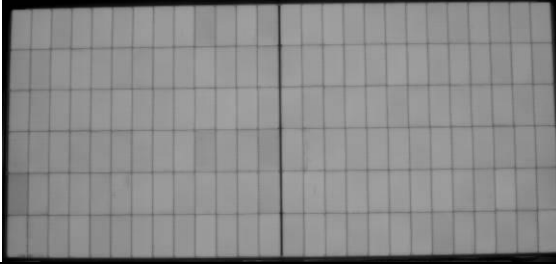
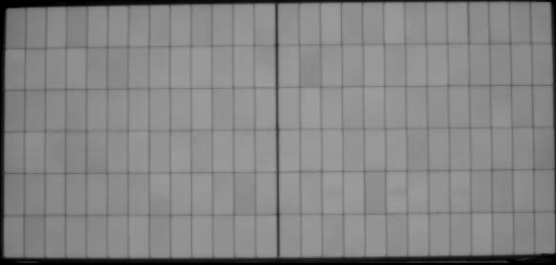
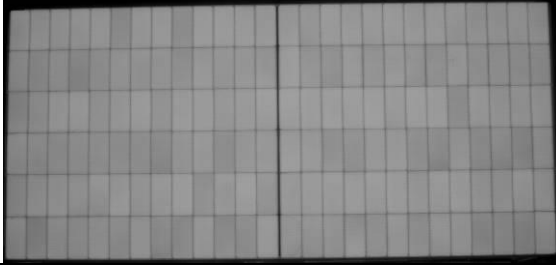
	
11# EL (Initial)	12# EL (Initial)
	
13# EL (Initial)	14# EL (Initial)
	
15# EL (Initial)	16# EL (Initial)
	
17# EL (Initial)	18# EL (Initial)
	
19# EL (Initial)	20# EL (Initial)

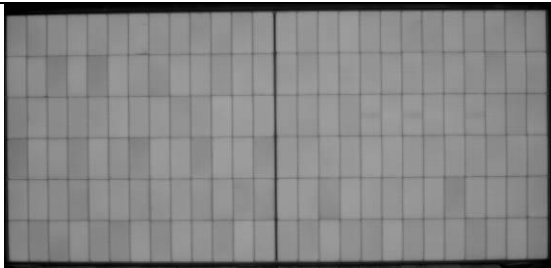
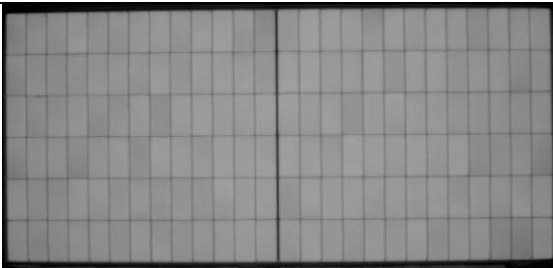
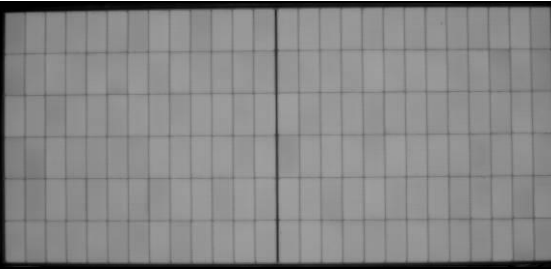
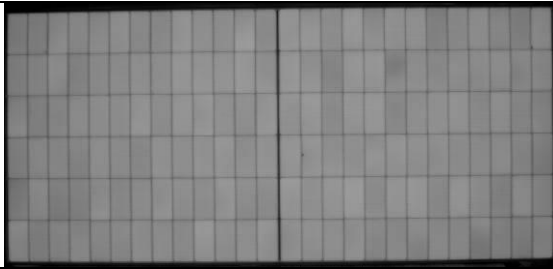
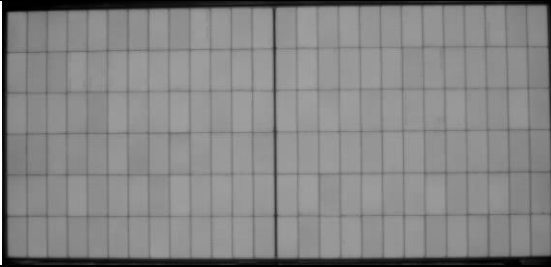
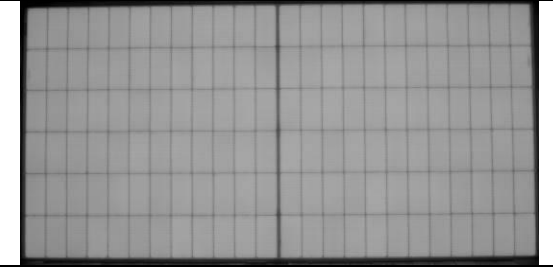
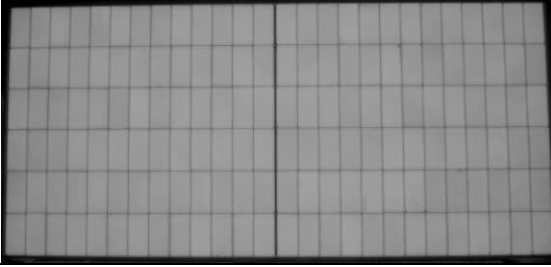
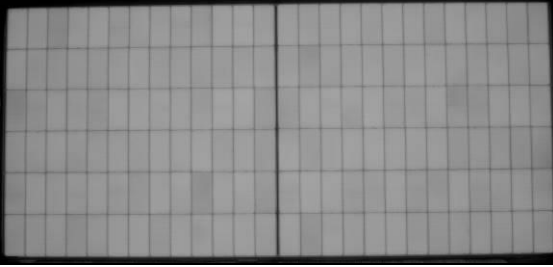
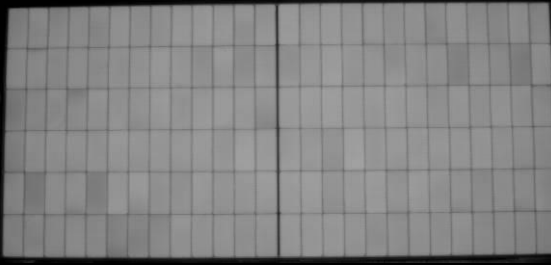
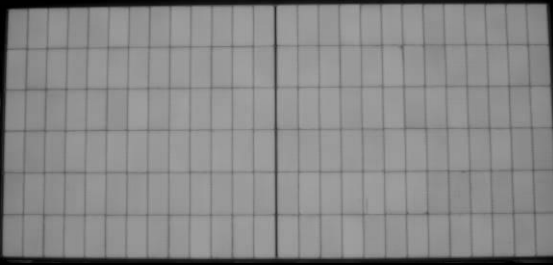
	
21# EL (Initial)	22# EL (Initial)
	
23# EL (Initial)	24# EL (Initial)
	
25# EL (Initial)	26# EL (Initial)
	
27# EL (Initial)	28# EL (Initial)
	
29# EL (Initial)	30# EL (Initial)

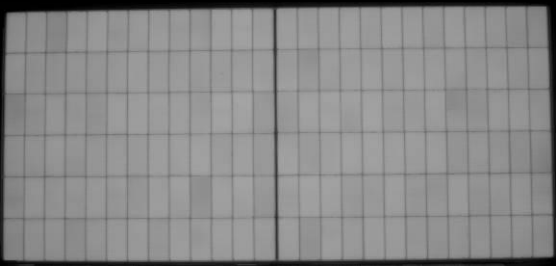
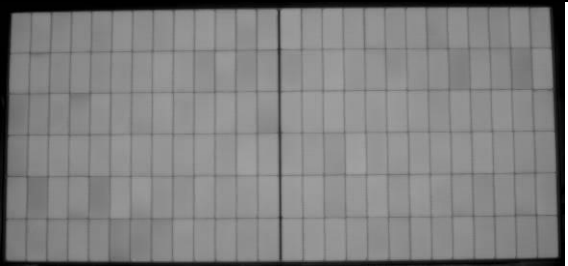
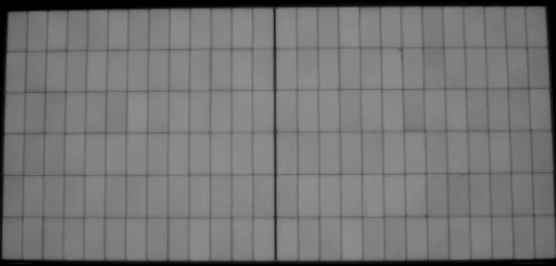
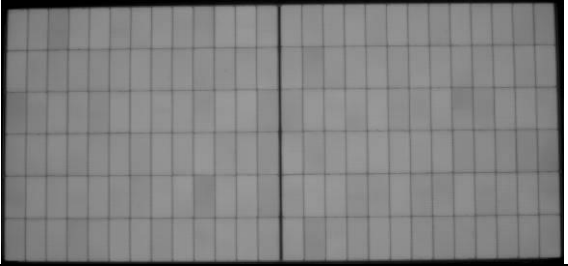
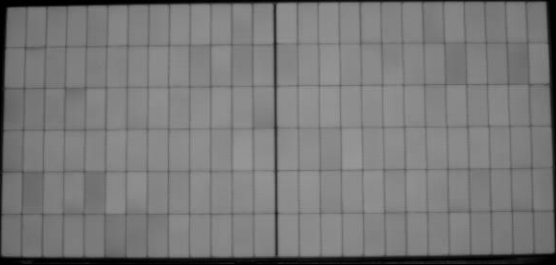
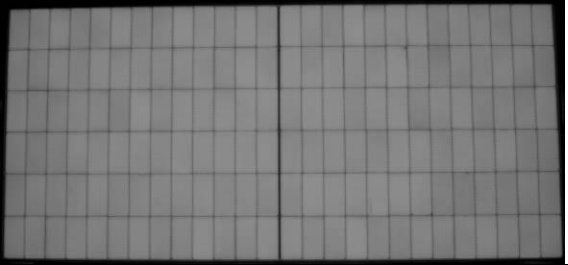
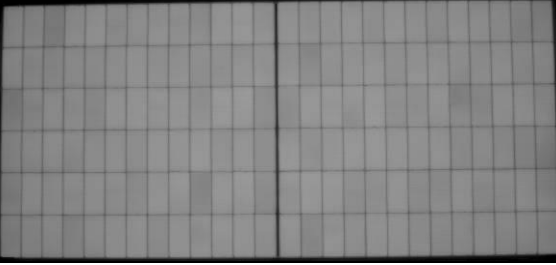
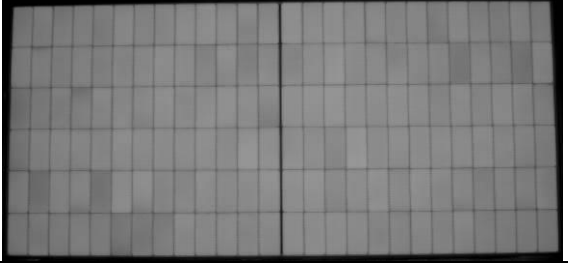
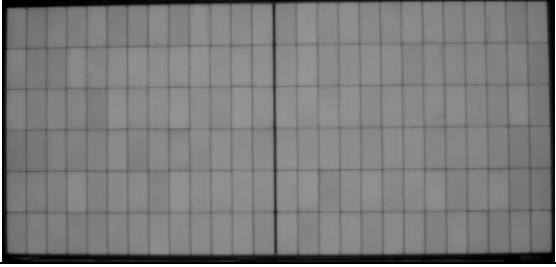
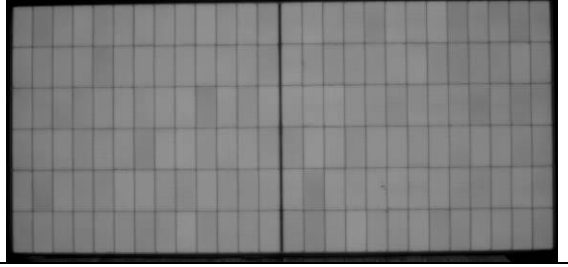
	
31# EL (Initial)	32# EL (Initial)
	
33# EL (Initial)	34# EL (Initial)
	
35# EL (Initial)	36# EL (Initial)
	
37# EL (Initial)	38# EL (Initial)
	
39# EL (Initial)	4# EL(after rotational flat drop test)

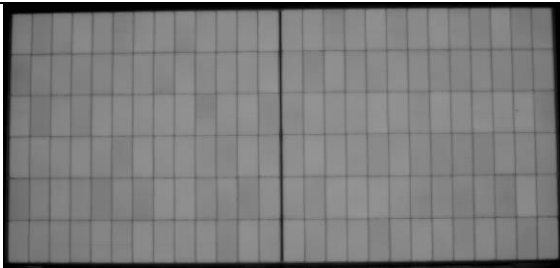
	
5# EL(after rotational flat drop test)	6# EL(after rotational flat drop test)
	
7# EL(after rotational flat drop test)	8# EL(after rotational flat drop test)
	
9# EL(after rotational flat drop test)	10# EL(after rotational flat drop test)
	
11# EL(after rotational flat drop test)	12# EL(after rotational flat drop test)
	
13# EL(after rotational flat drop test)	14# EL(after rotational flat drop test)

	
15# EL(after rotational flat drop test)	16# EL(after rotational flat drop test)
	
17# EL(after rotational flat drop test)	18# EL(after rotational flat drop test)
	
19# EL(after rotational flat drop test)	20# EL(after rotational flat drop test)
	
21# EL(after rotational flat drop test)	22# EL(after rotational flat drop test)
	
23# EL(after rotational flat drop test)	24# EL(after rotational flat drop test)

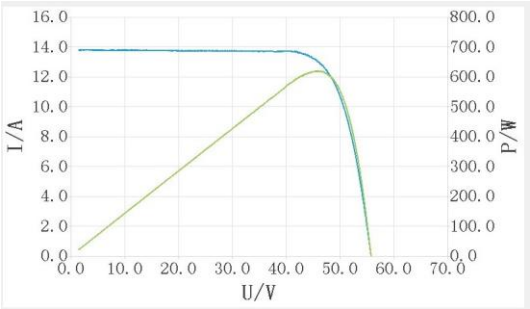
	
25# EL(after rotational flat drop test)	26# EL(after rotational flat drop test)
	
27# EL(after rotational flat drop test)	28# EL(after rotational flat drop test)
	
29# EL(after rotational flat drop test)	30# EL(after rotational flat drop test)
	
31# EL(after rotational flat drop test)	32# EL(after rotational flat drop test)
	
33# EL(after rotational flat drop test)	34# EL(after rotational flat drop test)

	
35# EL(after rotational flat drop test)	36# EL(after rotational flat drop test)
	
37# EL(after rotational flat drop test)	38# EL(after rotational flat drop test)
	
39# EL(after rotational flat drop test)	4# EL(after rotational flat drop test)
	
3# EL(after DML)	5# EL(after DML)
	
6# EL(after DML)	3# EL(after TC50)

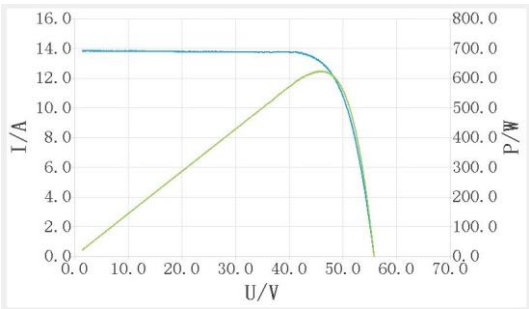
	
5# EL(after TC50)	6# EL(after TC50)
	
3# EL(after HF20)	5# EL(after HF20)
	
6# EL(after HF20)	3# EL(after ML)
	
5# EL(after ML)	6# EL(after ML)
	
2# EL(after TC200)	4# EL(after TC200)

			
7# EL(after TC200)			

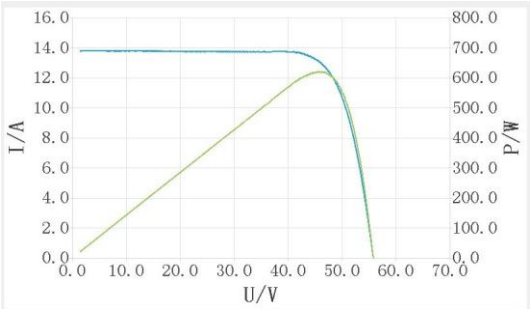
Annex3: IV Curves



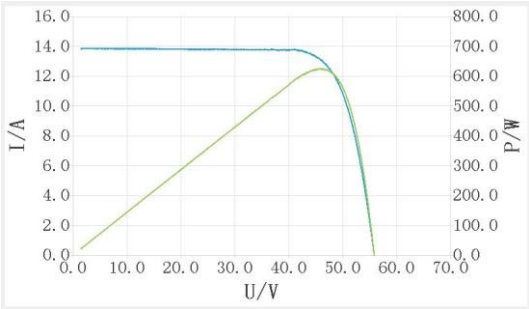
2# IV curve of final test



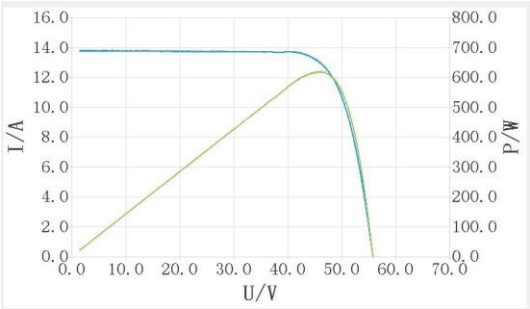
3# IV curve of final test



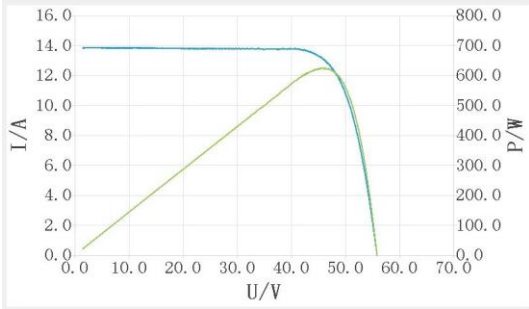
4# IV curve of final test



5# IV curve of final test



6# IV curve of final test



7# IV curve of final test

Annex4: List of measurement equipment

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
1	Visual inspection	Digital illuminometer (DZ-B-A1-0200)	0~2000lux	2024.01.30	2025.01.29
2	Maximum power determination	Module pulse simulator (DZ-A-A2-0140)	200~1200W/m ²	2023.10.11	2024.10.10
		Reference solar cell (DZ-B-A2-0109)	182mm cell	2023.08.24	2024.08.23
3	Initial stabilization	Module pulse simulator (DZ-A-A2-0140)	200~1200W/m ²	2023.10.11	2024.10.10
		Electronic load (DZ-B-A1-0162)	30A,60V	2023.09.27	2024.09.26
4	Insulation test	Withstanding voltage (DZ-A-A1-0238)	0~10kV	2024.02.04	2025.02.03
		Insulation resistance tester (DZ-A-A1-0258)	Test voltage: 0~6kV Result range: 0~50000MΩ	2023.07.05	2024.07.04
4	Wet leakage current test	Insulation resistance tester (DZ-A-A1-0258)	Test voltage: 0~6kV Result range: 0~50000MΩ	2023.07.05	2024.07.04
		conductivity meter (DZ-B-A2-0055)	0μS/cm~100mS/cm, 0.0~60.0 °C	2023.06.08	2024.06.07
5	Ground continuity test	High current grounding resistance tester (DZ-A-A1-0323)	0~200A	2023.07.01	2024.06.30
6	Dynamic Mechanical load Test	Dynamic mechanical load Tester (DZ-A-A2-0169)	0~8000Pa	2023.09.05	2024.09.04
7	Static mechanical load Test	Static mechanical load Tester (DZ-A-A2-0020)	2000~10000Pa	2023.09.05	2024.09.04
		DC Power Supply (DZ-A-A1-0098)	100V/17A	2023.07.17	2024.07.16
8	EL	EL Test System (DZ-A-A1-0274)	-	2019.08.27	2029.08.26
9	Humidity-freeze test	DC Power Supply (DZ-A-A1-0259)	100V/10A	2024.04.19	2025.05.18
		Chamber (DZ-A-A3-0027)	-40~90°C, 0~95%RH	2024.04.19	2025.04.18

10	Random vibration test	Electro-hydraulic Vibration Table (DC-6000-60/ST-1515/RC-2000)	-	2024.03.05	2025.03.04
11	Incline Impact test	Incline Impact testing Machine (YQ-02)	GX5210	2023.10.20	2024.10.19
12	Rotational flat drop test	Shedding Lifting Hook Testing Machine (YQ-07)	5T	2023.12.13	2024.12.12
13	Thermal cycling test	Chamber (DZ-A-A3-0027)	-40~90°C, 0~95%RH	2024.04.19	2025.04.18
		DC Power Supply (DZ-A-A1-0259)	100V/10A	2024.04.19	2025.05.18


Annex 5 Statement of test uncertainty


The total measuring uncertainty of P_{mpp} is ≤ 2.1%

The total measuring uncertainty of I_{sc} is ≤ 2.0%

The total measuring uncertainty of V_{oc} is ≤ 0.8%

Annex 6 CDF

Produkte Products		
Our Reference	6187695A.50	Appendix No. 1
Constructional Data Form (CDF) for Photovoltaic (PV) Modules		Page 1 of 4

License Holder (full address)	Sany Silicon Energy (Zhuzhou) Co., Ltd. No.333, Qingxia Road, Tongtangwan Street, Shifeng District, 412005 Zhuzhou City Hunan, China
Production Factory 1 (full address)	Sany Silicon Energy (Zhuzhou) Co., Ltd. Sany Energy Equipment Industrial Park, No.320 Qingshui Road, Shifeng District, 412005 Zhuzhou City Hunan, China
Type of Product	Photovoltaic (PV) modules
Trademark	

Module family A:

Type Name or Model No(1500V)	SYMN156TBDxxx (xxx=625-645, in step of 5, 156 cells)	
Over-current protection rating[A]	30	
Dimensions (l x w x h) [mm]	2465x1134x30	

List of Critical Components (add lines for multiple material sources)

Main parts Module Packing- Three Layers packing Module family A:				
Main parts:	Plywood/THREE LAYERS PAPER/PET			
Dimension of carton box:	2470mm×1130mm×1100mm			
Total weight:	1250.2kg			
Net weight:	33.2kg			
Number of PV modules:	36			
Placement of PV modules:	Placed in vertical			
Dimension of module:	2465mm×1134mm×30mm			
Suitable PV modules:	SYMN156TBDxxx (xxx=625-645, in step of 5, 156 cells)			
Module packing				
Wooden box with integrated pallet	Plywood	2516mm×1115mm×108mm	—	—

Shanghai, 13/07/2024


DEKRA Testing and Certification
(Shanghai) Ltd.

DSTD-0131

Zhuzhou
(City)13/07/2024
(Date)

(Stamp and/or signature of applicant)

Version: 1.0 / 2019-01-31/ approved by: Jacky Bai

Produkte Products		
Our Reference	6187695A.50	Appendix No. 1
Constructional Data Form (CDF) for Photovoltaic (PV) Modules		Page 2 of 4

List of Critical Components (add lines for multiple material sources)

Carton fence	THREE LAYERS PAPER	2470mm×1130mm×1100mm Thickness = 5 ± 0.5 mm 1st layer: 2A250g 2st layer: AA170g 3st layer: 2A250g	—	—
Carton cover	THREE LAYERS PAPER	2470mm×1130mm×1100mm Thickness = 5 ± 0.5 mm 1st layer: 3A230g 2st layer: 3A130g 3st layer: 3A230g	—	—
Fixing belts	PET	Width= 16 ± 0.5 mm Thickness= 0.8 ± 0.5 mm	—	—

Shanghai, 13/07/2024


DEKRA Testing and Certification
(Shanghai) Ltd.

DSTD-0131

Zhuzhou
(City)13/07/2024
(Date)

(Stamp and/or signature of applicant)

Version: 1.0 / 2019-01-31/ approved by: Jacky Bai

Produkte Products		
Our Reference	6187695A.50	Appendix No. 1
Constructional Data Form (CDF) for Photovoltaic (PV) Modules		Page 3 of 4

Module Components					
Object	Manufacturer / trademark	Type / model	Technical data / ratings	Standard (if applicable)	Certificates (if applicable)
Front cover 1	Hunan Kibing Solar Technology Co., Ltd.	Semi-tempered AR coated glass	Thickness [mm]: =2.0±0.2mm	—	—
Rear cover 1	Hunan Kibing Solar Technology Co., Ltd.	Semi-Tempered back glass	Thickness [mm]: =2.0±0.2mm	—	—
Encapsulation material 1	HANGZHOU FIRST APPLIED MATERIAL CO., LTD	EP304 (above cells)	Thickness = 0.5mm±10% gram weight: 380g/m ² ±10%	—	—
Encapsulation material 1	HANGZHOU FIRST APPLIED MATERIAL CO., LTD	F460PS(below cells)	Thickness = 0.5mm±10% gram weight: 400g/m ² ±10%	—	—
Solar cell	Sany Silicon Energy (Zhuzhou) Co., Ltd.	SYCN182T16 (combined with Encapsulation material 1,2)	L x W x T [mm]: 182.2 x 91.875 (±0.25) x 0.13 (±0.015) Topcon Mono-Si, 16BB	—	—
Cell connector	Changzhou Shengyue metal new material Co., Ltd	Sn60Pb40	Dimensions [mm]: Ø= 0.26±0.026mm	—	—
String connector	Changzhou Shengyue metal new material Co., Ltd	Sn60Pb40	Dimensions [mm]: 0.3±0.03mm x 6.0±0.6mm 0.3±0.03mm x 4.0±0.4mm	—	—
Frame parts	CHANGSHU DONGNENG SOLAR TECHNOLOGY CO., LTD	Anodized Aluminium Alloy 6005-T6 (Silver)	H(mm) x W(mm): 30x30mm (long frame) 30x15mm (short frame)	—	—
Adhesive 1 (frame)	Jiangsu Materials CO., LTD Tianchen New	HT-8258	Color: White	—	—
Fluxing agent	Shenzhen Tongfang Electronic New-Material CO., LTD	AATF9800-MBB	—	—	—
Insulation tape	SuZhou Rongzhi Electronic Technology Co., Ltd	D60F6-2	Thickness =100±40um	—	—
(Optional) Accessories				—	—

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DSTD-0131

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(City)13/07/2024
(Date)

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Produkte Products		
Our Reference	6187695A.50	Appendix No. 1
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Object	Manufacturer / trademark	Type / model	Technical data / ratings	Standard	Certificates
Junction Box Combination					
Junction box	Suzhou Xtong Photovoltaic Technologies Co., Ltd.	PV-XT1609Nxyz (x=4; y=3; z=1 or 2)	Rated. Voltage = 1500V Rated. Current = 25A Reverse current: 40A IP68	IEC 62790: 2020 EN IEC 62790: 2020	R 50524457
Cable	Suzhou Xtong Photovoltaic Technologies Co., Ltd.	62930 IEC 131 1 x 2,5mm ² / 1 x 4,0mm ² / 1 x 6,0mm ² HALOGEN FREE LOW SMOKE	Max. Voltage = 1500VDC	IEC 62930	R 50453577
Connector	Suzhou Xtong Photovoltaic Technologies Co., Ltd.	PV-XT101.2	Rated. Voltage = 1500V Rated. Current = 41A	IEC 62852:2014	R 50568733
Bypass diode	Suzhou Xtong Photovoltaic Technologies Co., Ltd.	XT4050M-B	Tj max = 200°C		
Adhesive	Jiangsu Tianchen New Materials CO., LTD.	HT-8258	Color: White		
Potting material	Jiangsu Tianchen New Materials CO., LTD.	HT-6360 A/B	Color: White		

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