Test Report issued under the responsibility of:

DEKRA

TEST REPORT	
Report Number. .....:	**6158066A.50**
Date of issue .....:	**2023-04-26**
Total number of pages.....:	**19**
DEKRA Branch .....:	**DEKRA Testing and Certification (Shanghai) Ltd.**
Applicant's name.....:	**Sunova Solar Technology Co., Ltd.**
Address .....:	**Building H, Phase II, Standard Workshop, Runzhou Road, Huishan Industrial Transformation and Agglomeration Area, 214100 Wuxi City Jiangsu, China**
Test specification:	
Standard .....:	IEC 61215-2:2016
Test procedure .....:	Client specified
Non-standard test method .....:	N/A
Test Report Form No. .....:	DEKRA Specified Test_1.0
Test Report Form(s) Originator ....:	DEKRA Testing and Certification (Shanghai) Ltd.
Master TRF.....:	2019-05-20

General disclaimer:

The test results presented in this report relate only to the object tested.
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This report does not entitle to carry any test mark.

Test item description..... :	Photovoltaic (PV) Module(s)
Trade Mark..... :	SUNOVA SOLAR Leading one Step Pv Supplier
Manufacturer ..... :	Sunova Solar Technology Co., Ltd.
Model/Type reference..... :	SS-550-72MDH SS-BG550-72MDH SS-410-54MDH SS-460-60MDH SS-BG565-72MDH(T)
Ratings..... :	Refer to Annex 1 for more detail

Testing procedure and testing location:

☒	**DEKRA Branch**	DEKRA Testing and Certification (Shanghai) Ltd.	
Testing location/ address ..... :		3F #250, Jiangchangsan Road, Building 16, Headquarter Economy Park Shibei Hi-Tech Park, Jing'an District, Shanghai, 200436, P.R. China	
☒	**Associated Testing Laboratory**	DEKRA Testing and Certification (Shanghai) Ltd. No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R. China	
Tested by (name, function, signature)..... :		Lee Huang	Lee Huang
Approved by (name, function, signature) .. :		Kevin Lu	Kevin Lu

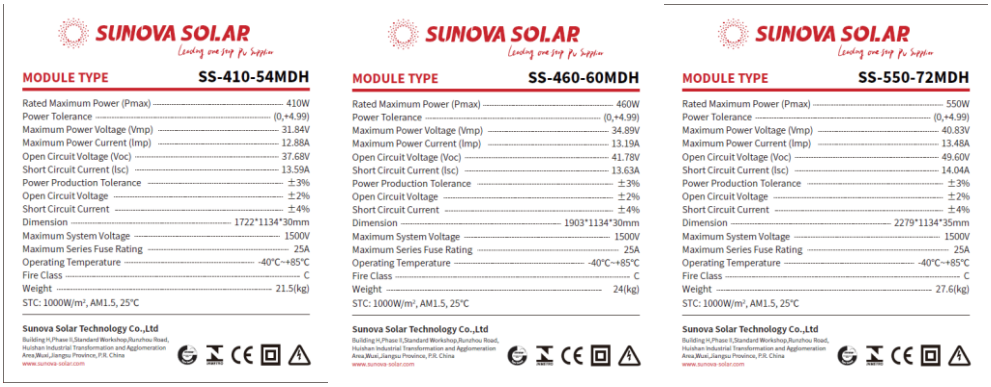
List of Attachments (including a total number of pages in each attachment):	
	attachment number / number of pages
Installation manual	
Drawings mechanical	
Circuit diagram	
Photographs	Annex 1 / 5 pages
IV Curve	
Electroluminescence image	
Component datasheets / certificates	
Others:	
List of test equipment used	Annex 2 / 1 page
IV curve for STC measurement	
EL image	
Statement of measurement uncertainty	Annex 3 / 1 page

Summary of testing:	
Tests performed (name of test and test clause): Visual inspection (MQT 01) Maximum power determination (MQT 02) Insulation test (MQT 03) Wet leakage current test (MQT 15) Hail impact test (MQT 17)	**Testing location:** DEKRA Testing and Certification (Shanghai) Ltd. No.16, Lane 1288, Luoning Road, Baoshan District, Shanghai, 200949, P.R. China

Copy of marking plate:

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

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



SUNOVA SOLAR

MODULE TYPE SS-410-54MDH

Rated Maximum Power (Pmax)	410W
Power Tolerance	(0,+4.99)
Maximum Power Voltage (Vmp)	31.84V
Maximum Power Current (Imp)	12.88A
Open Circuit Voltage (Voc)	37.68V
Short Circuit Current (Isc)	13.59A
Power Production Tolerance	±3%
Open Circuit Voltage	±2%
Short Circuit Current	±4%
Dimension	1722*1134*30mm
Maximum System Voltage	1500V
Maximum Series Fuse Rating	25A
Operating Temperature	-40°C~+85°C
Fire Class	C
Weight	21.5(kg)

STC: 1000W/m², AM1.5, 25°C

Sunova Solar Technology Co.,Ltd

SUNOVA SOLAR

MODULE TYPE SS-460-60MDH

Rated Maximum Power (Pmax)	460W
Power Tolerance	(0,+4.99)
Maximum Power Voltage (Vmp)	34.89V
Maximum Power Current (Imp)	13.19A
Open Circuit Voltage (Voc)	41.78V
Short Circuit Current (Isc)	13.63A
Power Production Tolerance	±3%
Open Circuit Voltage	±2%
Short Circuit Current	±4%
Dimension	1903*1134*30mm
Maximum System Voltage	1500V
Maximum Series Fuse Rating	25A
Operating Temperature	-40°C~+85°C
Fire Class	C
Weight	24(kg)

STC: 1000W/m², AM1.5, 25°C

Sunova Solar Technology Co.,Ltd

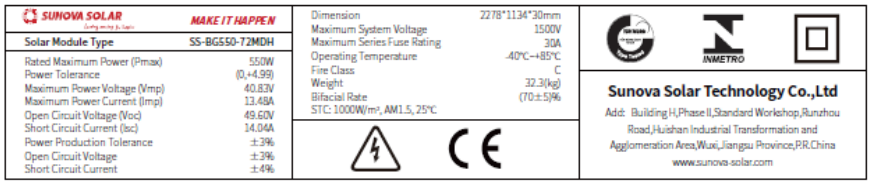
SUNOVA SOLAR

MODULE TYPE SS-550-72MDH

Rated Maximum Power (Pmax)	550W
Power Tolerance	(0,+4.99)
Maximum Power Voltage (Vmp)	40.83V
Maximum Power Current (Imp)	13.48A
Open Circuit Voltage (Voc)	49.60V
Short Circuit Current (Isc)	14.04A
Power Production Tolerance	±3%
Open Circuit Voltage	±2%
Short Circuit Current	±4%
Dimension	2279*1134*35mm
Maximum System Voltage	1500V
Maximum Series Fuse Rating	25A
Operating Temperature	-40°C~+85°C
Fire Class	C
Weight	27.6(kg)

STC: 1000W/m², AM1.5, 25°C

Sunova Solar Technology Co.,Ltd



SUNOVA SOLAR MAKE IT HAPPEN

Solar Module Type	SS-BG550-72MDH
Rated Maximum Power (Pmax)	550W
Power Tolerance	(0,+4.99)
Maximum Power Voltage (Vmp)	40.83V
Maximum Power Current (Imp)	13.48A
Open Circuit Voltage (Voc)	49.60V
Short Circuit Current (Isc)	14.04A
Power Production Tolerance	±3%
Open Circuit Voltage	±3%
Short Circuit Current	±4%
Dimension	2278*1134*30mm
Maximum System Voltage	1500V
Maximum Series Fuse Rating	30A
Operating Temperature	-40°C~+85°C
Fire Class	C
Weight	32.3(kg)
Bifacial Rate	(70±5)%

STC: 1000W/m², AM1.5, 25°C

INMETRO

Sunova Solar Technology Co.,Ltd

Add: Building H,Phase II,Standard Workshop,Runzhou Road,Huishan Industrial Transformation and Agglomeration Area,Wuxi,Jiangsu Province,P.R.China

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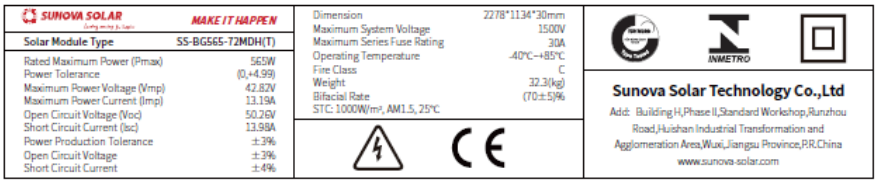

SUNOVA SOLAR MAKE IT HAPPEN

Solar Module Type	SS-BG565-72MDH(T)
Rated Maximum Power (Pmax)	565W
Power Tolerance	(0,+4.99)
Maximum Power Voltage (Vmp)	42.82V
Maximum Power Current (Imp)	13.19A
Open Circuit Voltage (Voc)	50.26V
Short Circuit Current (Isc)	13.98A
Power Production Tolerance	±3%
Open Circuit Voltage	±3%
Short Circuit Current	±4%
Dimension	2278*1134*30mm
Maximum System Voltage	1500V
Maximum Series Fuse Rating	30A
Operating Temperature	-40°C~+85°C
Fire Class	C
Weight	32.3(kg)
Bifacial Rate	(70±5)%

STC: 1000W/m², AM1.5, 25°C

INMETRO

Sunova Solar Technology Co.,Ltd

Add: Building H,Phase II,Standard Workshop,Runzhou Road,Huishan Industrial Transformation and Agglomeration Area,Wuxi,Jiangsu Province,P.R.China

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Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Abbreviations used in the report:	
Pmax – Maximum power	α – Current temperature coefficient
Vmp – Maximum power voltage	β – Voltage temperature coefficient
Imp – Maximum power current	δ – power temperature coefficient
Isc – Short circuit current	NMOT – Nominal Module Operating Temperature (20°C, 800 W/m²)
Voc – Open circuit voltage	VFMrated – Rated diode(s) forward voltage
FF – Fill factor	VFM – Measured diode(s) forward voltage
STC – Standard Test Conditions (25°C, 1 000 W/m²)	NP – Nameplate
t_1 – the manufacturer's rated lower production tolerance in % for Pmax	t_2 – the manufacturer's rated upper production tolerance in % for Voc
t_3– the manufacturer's rated upper production tolerance in % for Isc	r – Pmax measurement reproducibility
Testing Dates (YYYY-MM-DD)	
Date of first test item received ..... :	2023-04-03
Dates of tests (beginning/end)..... :	2023-04-17 / 2023-04-17

GENERAL REMARKS:	
According to the inquiry, test procedure was in accordance with IEC 61215-2:2016. Test procedure is according to client's requirements. Test results are documented within this test report. "(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) ..... :	Sunova Solar Technology Co., Ltd. Building H, Phase II, Standard Workshop, Runzhou Road, Huishan Industrial Transformation and Agglomeration Area, 214100 Wuxi City Jiangsu, China

PRODUCT ELECTRICAL RATINGS:

Module type	SS-550-72MDH	SS-460-60MDH	SS-410-54MDH	SS-BG550-72MDH	SS-BG565-72MDH(T)
Voc [V] /Tolerance	49.60±2%	41.78±2%	37.68±2%	49.60±3%	50.26±3%
Vmp [V]	40.83	34.89	31.84	40.83	42.82
Imp [Adc]	13.48	13.19	12.88	13.48	13.19
Isc [Adc] /Tolerance	14.04±4%	13.63±4%	13.59±4%	14.04±4%	13.98±4%
Pmp [W] /Tolerance	550±3%	460±3%	410±3%	550±3%	565±3%
Maximum system voltage [V]	1500	1500	1500	1500	1500
Maximum Over-Current Protection Rating [A]	25	25	25	30	30
Note: N/A					

MODULE GROUP ASSIGNMENT:

Sample #	Type/model	Sample S/N	Remark
1	SS-550-72MDH	M772W030323000001	HI
2	SS-BG550-72MDH	M772W050323000001	HI
3	SS-BG565-72MDH(T)	M772W060323000001	HI
4	SS-460-60MDH	M760W020323000001	HI
5	SS-410-54MDH	M754W010323000001	HI
Supplementary information: N/A			

4. TESTING OVERVIEW			
		All modules	
4.1	Visual inspetion (MQT 01)	See Table 01	P
4.2	Maximum power determination (MQT 02)	See Table 02	—
4.3	Insulation test (MQT 03)	See Table 03	P
4.15	Wet leakage current test (MQT 15)	See Table 04	P
4.17	Hail impact test (MQT 17)	See Table 05	P
4.1	Visual inspetion (MQT 01)	See Table 05.1	P
4.3	Insulation test (MQT 03)	See Table 05.2	P
4.15	Wet leakage current test (MQT 15)	See Table 05.3	P
4.2	Maximum power determination (MQT 02)	See Table 05.4	P

TABLE 01: MQT 01 – Initial Visual inspection		P
Test Date [YYYY-MM-DD]..... :	2023-04-17	—
Sample #	Nature and position of initial findings – comments or attach photos	—
1	No visual defects found	P
2	No visual defects found	P
3	No visual defects found	P
4	No visual defects found	P
5	No visual defects found	P
Supplementary information: N/A		

TABLE 02: MQT 02 - Maximum power determination						
Test Date [YYYY-MM-DD]..... :			2023-04-17			—
Irradiance (W/m²) ..... :			1000			—
Module temperature (°C) ..... :			25			—
Test method ..... :			☑ Simulator ☐ Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]
1	14.029	49.288	12.790	42.639	545.353	78.87
2	13.961	49.546	13.374	40.823	545.969	78.93
3	13.996	51.698	12.814	43.920	562.787	77.78
4	13.622	42.457	13.449	34.106	458.691	79.31
5	13.596	37.873	13.401	30.443	407.968	79.23
Supplementary information: N/A						

TABLE 03: MQT 03 ini: Initial Insulation test				
Test Date [YYYY-MM-DD]..... :	2023-04-17			—
Test Voltage applied [V] ..... :	8000/1500			—
Size of module [m²] ..... :	2.58 / 2.16 / 1.95			—
Required Resistance [MΩ]..... :	15.50 / 18.52 / 20.21			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	>5000	-	No	P
2	>5000	-	No	P
3	>5000	-	No	P
4	>5000	-	No	P
5	>5000	-	No	P
Supplementary information: The insulation tester can measure up to 5000MΩ.				

TABLE 04: MQT 15 ini: Initial Wet leakage current test				
Test Date [YYYY-MM-DD] .....:	2023-04-17			—
Test Voltage applied [V] .....:	1500			—
Solution temperature [°C].....:	23.5			—
Solution resistivity [Ω cm] .....:	2048			—
Size of module [m²] .....:	2.58 / 2.16 / 1.95			—
Sample #	Required Resistance [MΩ]	Measured [MΩ]		Result
1	15.50	>5000		P
2	15.50	>5000		P
3	15.50	>5000		P
4	18.52	>5000		P
5	20.51	>5000		P
Supplementary information: The insulation tester can measure up to 5000MΩ.				

TABLE 05: MQT 17 - Hail impact test							
Test Date [YYYY-MM-DD]..... :	2023-04-17						—
Sample #	1						—
Ice ball size [mm] .....:	1	2	3	4	5	6	—
	25.1	25.0	25.2	25.3	25.1	25.2	
	7	8	9	10	11	—	
	25.0	25.2	25.1	25.4	25.1	—	
Ice ball weight [g] .....:	1	2	3	4	5	6	—
	7.49	7.54	7.52	7.50	7.56	7.46	
	7	8	9	10	11	—	
	7.58	7.47	7.52	7.51	7.54	—	
Ice ball velocity [m/s].....:	1	2	3	4	5	6	—
	23.4	23.3	23.6	23.0	23.2	22.9	
	7	8	9	10	11	—	
	23.1	22.9	22.8	23.5	22.8	—	
Number of impact locations .....:	11						—
Supplementary information: N/A							

TABLE 05: MQT 17 - Hail impact test							
Test Date [YYYY-MM-DD] ..... :	2023-04-17						—
Sample #	2						—
Ice ball size [mm] ..... :	1	2	3	4	5	6	—
	25.2	25.0	25.3	25.4	25.3	25.0	
	7	8	9	10	11	—	
	25.2	25.2	25.3	25.1	25.1	—	
Ice ball weight [g] ..... :	1	2	3	4	5	6	—
	7.53	7.51	7.55	7.50	7.53	7.54	
	7	8	9	10	11	—	
	7.56	7.55	7.52	7.51	7.53	—	
Ice ball velocity [m/s] ..... :	1	2	3	4	5	6	—
	23.1	23.6	23.2	23.3	23.1	23.0	
	7	8	9	10	11	—	
	22.9	23.5	23.8	23.6	23.4	—	
Number of impact locations ..... :	11						—
Supplementary information: N/A							

TABLE 05: MQT 17 - Hail impact test							
Test Date [YYYY-MM-DD] ..... :	2023-04-17						—
Sample #	3						—
Ice ball size [mm] ..... :	1	2	3	4	5	6	—
	25.3	25.4	25.5	25.0	25.3	25.2	
	7	8	9	10	11	—	
	25.2	25.0	25.3	25.0	25.4	—	
Ice ball weight [g] ..... :	1	2	3	4	5	6	—
	7.53	7.56	7.52	7.54	7.54	7.48	
	7	8	9	10	11	—	
	7.52	7.55	7.52	7.58	7.49	—	
Ice ball velocity [m/s] ..... :	1	2	3	4	5	6	—
	22.9	23.2	23.4	23.7	23.1	22.8	
	7	8	9	10	11	—	
	23.6	23.4	23.5	23.3	22.9	—	
Number of impact locations ..... :	11						—
Supplementary information: N/A							

TABLE 05: MQT 17 - Hail impact test							
Test Date [YYYY-MM-DD] ..... :	2023-04-17						—
Sample #	4						—
Ice ball size [mm] ..... :	1	2	3	4	5	6	—
	25.0	25.2	25.3	25.1	25.4	25.2	
	7	8	9	10	11	—	
	25.1	25.3	65.6	65.0	65.2	—	
Ice ball weight [g] ..... :	1	2	3	4	5	6	—
	7.53	7.54	7.49	7.54	7.53	7.56	
	7	8	9	10	11	—	
	7.52	7.55	7.51	7.51	7.56	—	
Ice ball velocity [m/s] ..... :	1	2	3	4	5	6	—
	22.9	23.1	23.2	22.8	23.4	23.3	
	7	8	9	10	11	—	
	23.5	23.0	23.5	23.4	23.6	—	
Number of impact locations ..... :	11						—
Supplementary information: N/A							

TABLE 05: MQT 17 - Hail impact test							
Test Date [YYYY-MM-DD] ..... :	2023-04-17						—
Sample #	5						—
Ice ball size [mm] ..... :	1	2	3	4	5	6	—
	25.2	25.4	25.1	25.1	25.3	25.4	
	7	8	9	10	11	—	
	25.2	25.2	25.5	25.0	25.1	—	
Ice ball weight [g] ..... :	1	2	3	4	5	6	—
	7.58	7.51	7.55	7.52	7.56	7.53	
	7	8	9	10	11	—	
	7.53	7.52	7.58	7.57	7.53	—	
Ice ball velocity [m/s] ..... :	1	2	3	4	5	6	—
	22.8	23.1	23.5	23.2	23.6	23.3	
	7	8	9	10	11	—	
	23.3	23.2	23.5	23.0	23.3	—	
Number of impact locations ..... :	11						—
Supplementary information: N/A							

TABLE 05.1: MQT 01 - Visual inspection after hail impact test		
Test Date [YYYY-MM-DD].....:	2023-04-17	—
Sample #	Nature and position of initial findings – comments or attach photos	—
1	No visual defects found	P
2	No visual defects found	P
3	No visual defects found	P
4	No visual defects found	P
5	No visual defects found	P
Supplementary information: N/A		

TABLE 05.2: MQT 03 Insulation test after hail impact test				
Test Date [YYYY-MM-DD].....:	2023-04-17			—
Test Voltage applied [V] .....:	8000/1500			—
Size of module [m²] .....:	2.58 / 2.16 / 1.95			—
Required Resistance [MΩ].....:	15.50 / 18.52 / 20.51			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	>5000	-	No	P
2	>5000	-	No	P
3	>5000	-	No	P
4	>5000	-	No	P
5	>5000	-	No	P
Supplementary information: The insulation tester can measure up to 5000MΩ.				

TABLE 05.3: MQT 15: Wet leakage current test after hail impact test			
Test Date [YYYY-MM-DD] .....:	2023-04-17		—
Test Voltage applied [V].....:	1500		—
Solution temperature [°C].....:	22.8		—
Solution resistivity [Ω cm] .....:	2251		—
Size of module [m²] .....:	2.58 / 2.16 / 1.95		—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
1	15.50	>5000	P
2	15.50	>5000	P
3	15.50	>5000	P
4	18.52	>5000	P
5	20.51	>5000	P
Supplementary information: The insulation tester can measure up to 5000MΩ.			

TABLE 05.4: MQT 02 Maximum power determination after hail impact test								
Test Date [YYYY-MM-DD] ..... :	2023-02-03							—
Irradiance [W/m^2] ..... :	1000							—
Module temperature [°C] ..... :	Corrected to 25							—
Test method ..... :	☒ Solar simulator ☐ Natural sunlight							—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Degradation [%]	Result
1	14.023	49.174	12.787	42.619	544.964	79.03	-0.07%	P
2	13.961	49.525	13.376	40.774	545.394	78.88	-0.11%	P
3	13.992	51.323	12.818	43.889	562.563	78.34	-0.04%	P
4	13.626	42.511	13.441	34.119	458.591	79.17	-0.02%	P
5	13.574	37.875	13.411	30.384	407.483	79.26	-0.12%	P
Supplementary information: N/A								

Annex 1: Photographs

Module Type: SS-410-54MDH

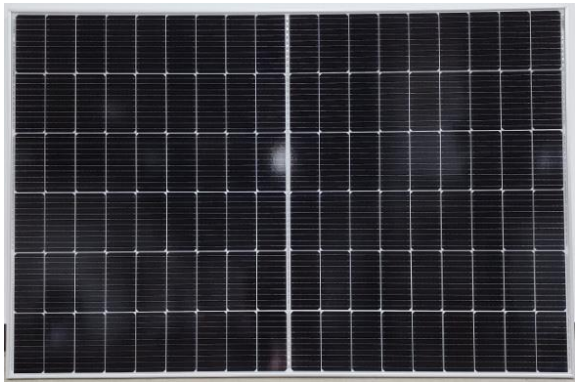

Fig. 01: front view of test sample

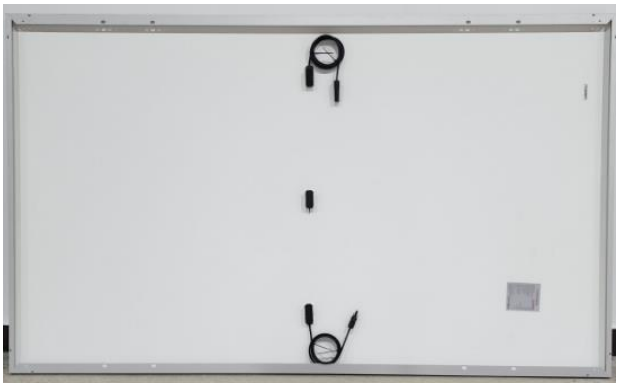

Fig. 02: rear view of test sample

Module Type: SS-460-60MDH

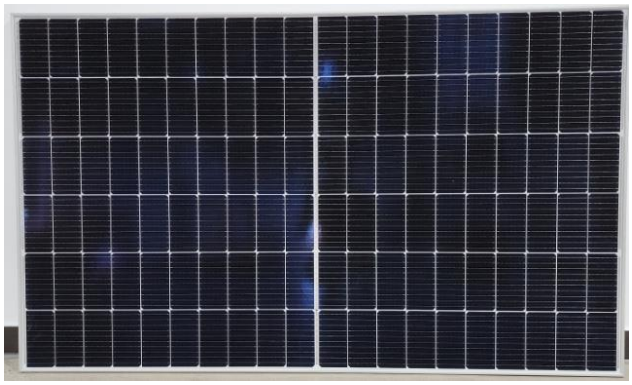

Fig. 03: front view of test sample

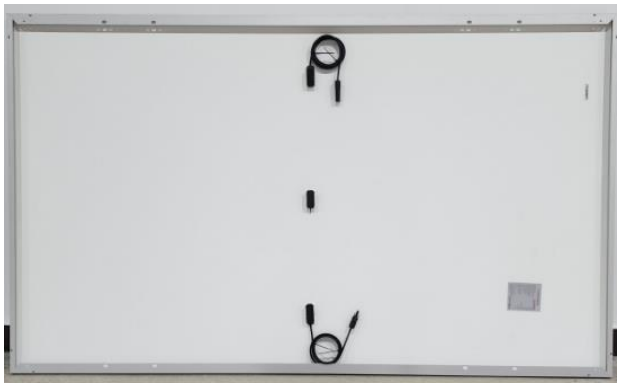

Fig. 04: rear view of test sample

Module Type: SS-550-72MDH

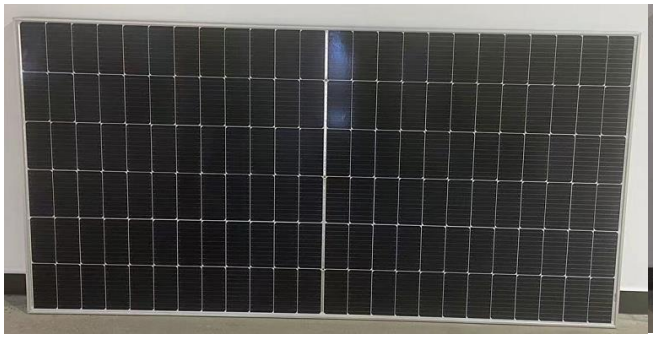

Fig. 05: front view of test sample 3

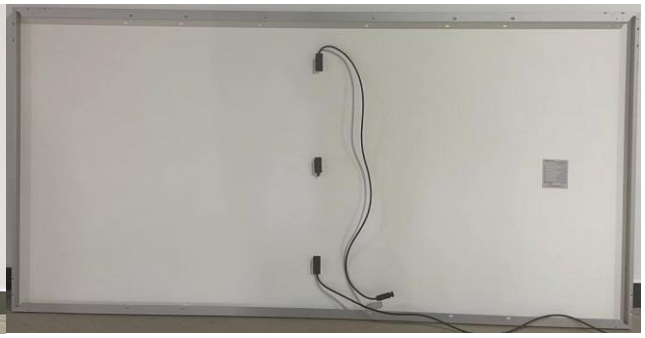

Fig. 06: rear view of test sample 3

Module Type: SS-BG550-72MDH

Fig. 07: front view of test sample 5

Fig. 08: rear view of test sample 5

Module Type: SS-BG565-72MDH(T)

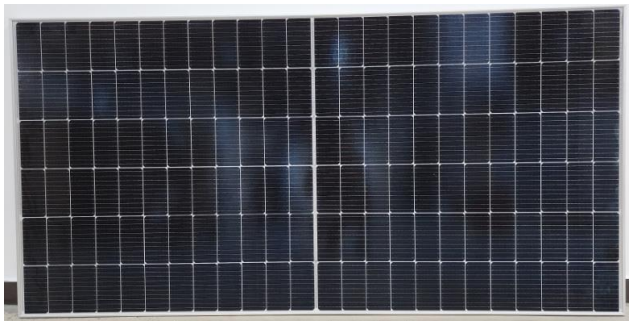

Fig. 09: front view of test sample 6

Fig. 10: rear view of test sample 6

Annex 2: List of measurement equipment

List of Measurement Equipment:				
Measurement / testing	**Testing / measuring equipment / material used, (Equipment ID)**	**Range used**	**Last Calibration date**	**Calibration due date**
Visual inspection	Visual inspection bench BS-PV 010	-	-	-
	Illumination photometer BS-PV 036	2000lx	2022-03-03	2023-03-02
Maximum power determination	Solar Simulator BS-PV 057-01	A+AA+	2022-08-18	2023-08-17
	Electronic Load BS-PV 057-02	-15 V~420 V -50 A~50 A	2022-08-18	2023-08-17
	WPVS reference cell BS-PV 057-03	-	2021-10-25	2023-10-24
Insulation test	Insulation tester BS-PV 090	Test voltage: 0~10kV Result range: 0~50000MΩ	2022-06-06	2023-06-05
Wet leakage current	Water Tank BS-PV 047-01	22°C	2022-06-06	2023-06-05
	Insulation resistance tester BS-PV 090	Test voltage: 0~10kV Result range: 0~50000MΩ	2022-06-06	2023-06-05
	Conductivity meter BS-PV 047-02	0~1999μs/cm, 10.0~40.0°C	2022-06-06	2023-06-05
Hail test	Hail tester BS-PV 050-01	-	2022-08-23	2023-08-22
	Electrical balance BS-PV 050-02	220g/0.01g	2022-06-06	2023-06-05
	Digital Caliper BS-PV 050-03	0-150mm	2022-06-06	2023-06-05

Annex 3: Statement of test uncertainty

The total measuring uncertainty of Pmpp is ≤ 2.40%
The total measuring uncertainty of Isc is ≤ 2.28%
The total measuring uncertainty of Voc is ≤ 0.82%