

Technical Report No.: 704062302121-00

Date: 2023-06-05

- Client:** Shanghai JA Solar Technology Co., Ltd.
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201401 Shanghai, PEOPLE'S REPUBLIC of CHINA
Contact person: Ms. Wenli Gong
- Manufacturer:** Shanghai JA Solar Technology Co., Ltd.
No. 118, Lane 3111, West Huancheng Road, Fengxian District,
201401 Shanghai, PEOPLE'S REPUBLIC of CHINA
Contact person: Ms. Wenli Gong
- Factory:**
1. Shanghai JA Solar Technology Co., Ltd.
No. 118, Lane 3111, West Huancheng Road, Fengxian District,
201401 Shanghai, PEOPLE'S REPUBLIC of CHINA
Contact person: Ms. Wenli Gong
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Contact person: Mr. Shizhao Wang
 4. JA Solar New Energy Yangzhou Co., Ltd. (108746)
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 6. JA SOLAR VIET NAM COMPANY LIMITED (112017)

Lot G, Quang Chau Industrial Zone, Quang Chau Commune, Viet
Yen Dist, 236110 Bac Giang Province, VIETNAM

Contact person: Mr. Shuai Ma

7. JA Solar New Energy Yangzhou Co., Ltd.

(Jingshan Park) (114922)

No. 123, Jinshan Road, Economic Development Zone, 225127
Yangzhou City, Jiangsu Province, PEOPLE'S REPUBLIC OF
CHINA

Contact person: Ms. Xiaoqing Li

Test object: Product: Photovoltaic modules

Model: See clause 1.4

Test specification: IEC 61215-2:2016, Clause 4.1 Visual Inspection (MQT 01)
IEC 61215-2:2016, Clause 4.6 Performance at STC (MQT 06)
IEC 61215-2:2016, Clause 4.3 Insulation test (MQT 03)
IEC 61215-2:2016, Clause 4.15 Wet leakage current test (MQT 15)
IEC 61215-2:2016, Clause 4.17 Hail test (MQT 17)
IEC 61215-2:2016, Clause 4.18 Bypass diode functionality test
(MQT 18.2)
IEC 61215-2:2016, Clause 4.19 Stabilization (MQT 19.1)

Purpose of examination:

- Testing and evaluation (visual / partial) according to the test specification

Test result: The test results show that the presented product is in compliance with the above listed test specifications.

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1. Description of the test object

1.1 Picture(s)

N/A

1.2 Function

Manufacturer's specification for intended use:

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

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1.3 Consideration of the foreseeable use

☒ Not applicable

☐ Covered through the applied standard

☐ Covered by the following comment*

☐ Covered by attached risk analysis

*

1.4 Technical Data

Sample No.	Module serial No.	Model type	Remark/Constructional characteristics
Sample 1 (HA2023TL-0554-003X)	2350108530365250	JAM72D42-620/LB	2465 x 1134 x 35 mm, 34.6 ± 3% Kg
Sample 2 (HA2023TL-0554-001X)	2350108530365268	JAM72D42-620/LB	2465 x 1134 x 35 mm, 34.6 ± 3% Kg

Applicable Modules (due to same materials and similar construction):

JAM72D42-xxx/LB, xxx= 605 to 630 in steps of 5

xxx is standing for rated output power at STC

2. Order

2.1 Date of Purchase Order, Customer's Reference

The order dated 2023-05-18

2.2 Test Sample(s)

- Reception date(s): 2023-05-26
- Location(s) of reception: Changzhou HuaYang Inspection and Testing Technology Co., Ltd.
No.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, P.R. China
- Condition of test sample(s): In good condition

2.3 Testing

- Testing date(s): 2023-05-29 to 2023-06-02
- Location(s) of testing: Changzhou HuaYang Inspection and Testing Technology Co., Ltd.
No.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, P.R. China

2.4 Points of Non-Compliance or Exceptions of the Test Procedure

- N/A

3. Test Results

- "Decision rule according to IEC Guide 115:2021, clause 4.4.3, 4.5.1 was applied."
- "Decision rule (based on ILAC-G8) for an upper specification limit (A lower limit or specification with an up-per and a lower limit is treated similarly.):
 - Compliance with the requirement: If a specification limit is not breached by a measurement result plus the expanded uncertainty with a 95% coverage probability, then compliance with the specification will be stated (e. g. Pass).

3.1 Positive Test Results

- See below details

TABLE 01: MQT 01 Visual inspection		P
Test Date [YYYY-MM-DD]..... :	2023-05-29	—
Sample No.	Nature and position of initial findings – comments or attach photos	—
1	No major visual defects found	P
2	No major visual defects found	P
Supplementary information: N/A		

TABLE 02: MQT 19.1 ini: Initial stabilization							P
TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization (single-side front)							
Test Date [YYYY-MM-DD]..... :	2023-05-29						—
Test method..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
1	14.772	51.623	14.317	43.515	623.017	81.70	—
2	14.774	51.631	14.328	43.594	624.618	81.88	—
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 (single-side rear)							
Test Date [YYYY-MM-DD]..... :	2023-05-29						—
Test method..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
1	11.658	51.194	10.811	44.255	478.450	80.17	—
2	11.612	51.202	10.836	44.056	477.381	80.29	—
Supplementary information: N/A							

TABLE 02.2: MQT 19.1 ini: Initial Stabilization procedure	P
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Light exposure method..... :					☒ Simulator ☐ Natural sunlight		
Abbreviation: Regarding light source "S" for Solar simulator and "N" for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x					1		
Sample #	1	Test Date (YYYY-MM-DD) start/end..... :			2023-05-29 / 2023-06-01		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	623.017	—	—
1	5	800~1000	50 ± 10	3.0 Ω	621.324	—	—
2	5	800~1000	50 ± 10	3.0 Ω	620.621	0.39	Yes
Initial (R)					478.450		
1	5	800~1000	50 ± 10	4.1 Ω	477.032	—	—
2	5	800~1000	50 ± 10	4.1 Ω	476.665	0.37	Yes
Sample #	2	Test Date (YYYY-MM-DD) start/end..... :			2023-05-29 / 2023-06-01		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial (F)	—	—	—	—	624.618	—	—
1	5	800~1000	50 ± 10	3.0 Ω	622.746	—	—
2	5	800~1000	50 ± 10	3.0 Ω	621.798	0.45	Yes
Initial (R)					477.381		
1	5	800~1000	50 ± 10	4.2 Ω	475.705	—	—
2	5	800~1000	50 ± 10	4.2 Ω	475.127	0.47	Yes
Supplementary information: N/A							
☐ Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end						

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

TABLE 03: MQT 06.1 ini: Performance at STC after initial stabilization (single-side front)										P
Test Date [YYYY-MM-DD]					2023-06-01					—
Pmax(lab) lower limit (W)					See table below: Pmax [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					606.891					—
Voc(lab) upper limit (V)					See table below: Voc [V] Max. calc.					—
Isc (lab) upper limit (A)					See table below: Isc [A] Max. calc.					—
Test method					☒ Simulator ☐ Natural sunlight					—
Sample #	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	Pmax [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
1	14.741	15.214	51.600	52.887	14.269	43.493	620.621	588.684	81.59	P
2	14.753	15.214	51.618	52.887	14.271	43.572	621.798	588.684	81.65	P
Average	—						621.210	606.891	—	P
Supplementary information: The limit values are calculated considering manufacturer's tolerances t of rated nameplate values and laboratory measurement uncertainties m .										

TABLE 03: MQT 06.1 ini: Performance at STC after initial stabilization (single-side rear)										P
Test Date [YYYY-MM-DD]					2023-06-01					—
Pmax(lab) lower limit (W)					See table below: Pmax [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					-					—
Voc(lab) upper limit (V)					See table below: Voc [V] Max. calc.					—
Isc (lab) upper limit (A)					See table below: Isc [A] Max. calc.					—
Test method					☒ Simulator ☐ Natural sunlight					—
	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	Pmax [W]		FF [%]	Result

Sample #	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
1	11.639	-	51.175	-	10.775	44.239	476.665	-	80.03	—
2	11.586	-	51.185	-	10.791	44.031	475.127	-	80.12	—
Average	—						475.896	-	—	—
Supplementary information: The limit values are calculated considering manufacturer's tolerances <i>t</i> of rated nameplate values and laboratory measurement uncertainties <i>m</i> .										

TABLE 04: MQT 03 ini: Initial Insulation test				P
Test Date [YYYY-MM-DD].....:		2023-06-01		—
Test Voltage applied [V]		8000/1500		—
Size of module [m²].....:		2.795		—
Required Resistance [MΩ].....:		14.311		—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	>10000	No dielectric breakdown	x	P
2	>10000	No dielectric breakdown	x	P
Supplementary information: the maximum measuring limit of the equipment is 10000MΩ.				

TABLE 05: MQT 15 ini: Initial Wet leakage current test				P
Test Date [YYYY-MM-DD]		2023-06-01		—
Test Voltage applied [V]		1500		—
Solution temperature [°C].....		22 ± 2		—
Size of module [m²].....		2.795		—
Sample #	Required Resistance [MΩ]		Measured [MΩ]	Result
1	14.311		3970	P
2	14.311		4520	P
Supplementary information: Solution resistivity [Ω·cm] 2442				

TABLE 06: MQT 17 - Hail impact test								P
Test Date [YYYY-MM-DD].....:		2023-06-02						—
Sample #		2						—
Ice ball size [mm]		1	2	3	4	5	6	—

	34.8	35.1	35.2	34.5	35.2	35.0	
	7	8	9	10	11	/	
	35.1	35.0	35.0	35.2	35.1		
Ice ball weight [g]	1	2	3	4	5	6	—
	20.8	20.2	20.4	20.2	20.8	20.7	
	7	8	9	10	11	/	
	20.5	20.2	20.9	21.3	20.2		
Ice ball velocity [m/s].....	1	2	3	4	5	6	—
	26.2	25.9	26.1	25.4	26.0	26.2	
	7	8	9	10	11	/	
	26.1	25.5	26.4	25.4	26.1		
Number of impact locations	11						—

Supplementary information: (impact location descriptions)

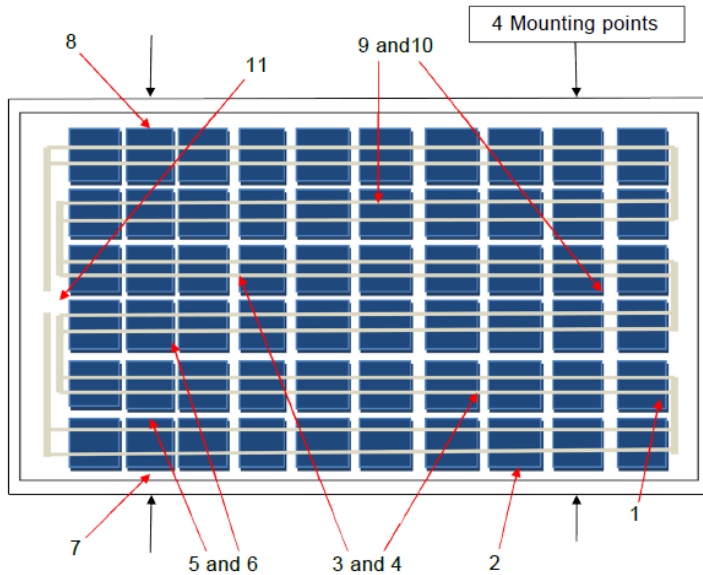


TABLE 07: MQT 01 - Visual inspection after hail impact test		P
Test Date [YYYY-MM-DD].....	2023-06-02	—
Sample No.	Nature and position of initial findings – comments or attach photos	—
2	No major visual defects found	P

Supplementary information: N/A

TABLE 08: MQT 03 - Insulation test after hail impact test				P
Test Date [YYYY-MM-DD].....:	2023-06-02			—
Test Voltage applied [V]	8000/1500			—
Size of module [m²].....:	2.795			—
Required Resistance [MΩ].....:	14.311			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	>10000	No dielectric breakdown	x	P
2	>10000	No dielectric breakdown	x	P
Supplementary information: the maximum measuring limit of the equipment is 10000MΩ.				

TABLE 09: MQT 15 - Wet leakage current test after hail impact test				P
Test Date [YYYY-MM-DD].....:		2023-06-02		—
Test Voltage applied [V].....:		1500		—
Solution temperature [°C].....:		22.9		—
Size of module [m²].....:		2.795		—
Sample #	Required Resistance [MΩ]		Measured [MΩ]	Result
1	14.311		4010	P
2	14.311		3810	P
Supplementary information: Solution resistivity [Ω·cm] 2775				

TABLE 10.1: MQT 06.1 - Final Performance at STC (single-side front)									P
Test Date [YYYY-MM-DD].....:	2023-06-02								—
Test method.....:	☒ Simulator ☐ Natural sunlight								—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab _GateNo.1)	Power Degradation [%]	Result
1	14.738	51.594	14.267	43.486	620.404	81.59	620.621	-0.03	P
2	14.764	51.601	14.253	43.559	620.831	81.49	621.798	-0.16	P
Supplementary information: The IV curves didn't show any additional kinks or other unusual characteristics as compared to the initial IV curve.									

TABLE 10.1: MQT 06.1 - Final Performance at STC (single-side rear)									P
Test Date [YYYY-MM-DD].....:					2023-06-02				—
Test method.....:					☒ Simulator ☐ Natural sunlight				—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Pmax [W] (Lab_GateNo.1)	Power Degradation [%]	Result
1	11.637	51.168	10.772	44.235	476.482	80.02	476.665	-0.04	P
2	11.588	51.174	10.783	44.020	474.658	80.04	475.127	-0.10	P
Supplementary information: The IV curves didn't show any additional kinks or other unusual characteristics as compared to the initial IV curve.									

TABLE 13.7: MQT 18.2 - Bypass diode functionality test					P
Test Date [YYYY-MM-DD].....:			2023-06-02		—
☐ Method A					—
Ambient temperature [°C]					—
Current flow applied [A]					—
Sample #	VFM	VFMrated	VFM = (N × VFMrated) ± 10 %		Result
			☐ Yes ☐ No		—
Supplementary information:					
☒ Method B					—
	IV curve after shading				Result
Diode 1	Turn on				P
Diode 2	Turn on				P
Diode 3	Turn on				P
Supplementary information: performed on sample 1, 2.					

3.2 Points of Non-Compliance according to the test specification

- None

4. Test History

N/A

5. Remarks

5.1 General

N/A

5.2 Factory surveillance cycle

Your production facility is currently on the following surveillance cycle.

- ☐ Annual (12 month)
- ☐ Bi-Annual (6 month)
- ☐ Quarterly (3 month)
- ☒ N/A

5.3 Additional information for routine tests to be performed by the factory(ies)

Routine tests for electrical appliances / equipment:

N/A

6. Documentation

Appendix 1: List of measurement equipment

No.	Test Item	Main testing Equipment	Calibrate until
1	Visual inspection	Illumination photometer HYJC-YS-070	2024-03-06
2	Performance at STC	Reference cell HYJC-YS-097	2023-08-04
3	Performance at STC Bypass diode functionality test	Module pulse simulator HYJC-YS-021	2024-03-06
4	Insulation test Wet leakage current test	Programmable control voltage insulation meter HYJC-YS-155	2023-08-22
5	Wet leakage current test	Conductance meter HYJC-YS-171	2023-08-22
6	Hail test	Hail tester HYJC-YS-036	2024-04-06
7	Stabilization	level C steady state simulator HYJC-YS-006	2023-06-26
All equipment used for tests having a significant effect on the accuracy or validity of the result of the test is calibrated before being put into service.			

Appendix 2: Statement of the estimated uncertainty of the test results

The measurement uncertainty is $U(P_{max})=2.16\%$, $U(V_{oc})=1.00\%$, $U(I_{sc})=2.40\%$ ($K=2$).

7. Summary

“The test specifications are met”

TÜV SÜD Certification and Testing (China)Co., Ltd. Shanghai Branch

Tested by: Rongwei Jing *Ting Rongwei*
printed name, function & signature

Approved by: Guangxia Fu
printed name, function & signature