Product Service

Technical Report No.: 704062302120-02

Date: 2024-11-13

Client:

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. Xueshan Yang

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. Xueshan Yang

Factory:

1. Shanghai JA Solar Technology Co., Ltd. (072092)
No. 118, Lane 3111, West Huancheng Road, Fengxian District, 201401, Shanghai, PEOPLE'S REPUBLIC of CHINA

2. Hefei JA Solar Technology Co., Ltd (079395)
No. 999, Changning Road, Hi-tech Zone, 230088 Hefei City, Anhui Province, PEOPLE'S REPUBLIC of CHINA

3. JA Solar (Xingtai) Co., Ltd (095903)
No. 1688, Chang An Road, Xingtai Economic Development Area, 054000 Xingtai City, Hebei Province,PEOPLE'S REPUBLIC OF CHINA
4. JA Solar New Energy Yangzhou Co., Ltd. (108746)

No.1, Jianhua Road, Economic Development Zone, 225000 Yangzhou City, Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

5. Yiwu JA Solar Technology Co., Ltd. (109998)
No.165, Tongze Road, Yiting Town, 322000 Yiwu City, Zhejiang Province, PEOPLE'S REPUBLIC OF CHINA

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

7. JA Solar New Energy Yangzhou Co., Ltd. (Jingshan Park) (114922)

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

8. DongTai JA Solar Technology Co., Ltd. (121678)
No. 8 Zaofeng North Road, High-tech Zone, 224200 Dongtai City, Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

9. Inner Mongolia JA Solar PV Technology Co., Ltd. (123101)
No.21, Zhuangbei Avenue, Xin Guihua Area, Equipment Park, Qingshan District, 014000 Baotou, Inner Mongolia Autonomous Region, PEOPLE'S REPUBLIC OF CHINA

10. QuJing JA Solar Technology Co., Ltd. (123430)
North of Nanhai Avenue and East of Shaoxi Road, Qujing Economic and Technological Development Zone, 655000 Qujing City, Yunnan Province, PEOPLE'S REPUBLIC OF CHINA

11. Ordos JA Solar Technology Co., Ltd. (127131)
Room 2007, Office Builiding, High-tech Development Zone, Dongsheng District Equipment Manufacturing Base, 017000 Ordos City, Inner Mongolia, PEOPLE'S REPUBLIC OF CHINA

12. Inner Mongolia JA Naoer New Energy Co., Ltd. (128635)
Room 620, Office Building of the Management Committee, No. 1 Fuyuan Road, North Economic and Technological Development Zone, Bayannur City 015000, Inner Mongolia Autonomous Region, PEOPLE'S REPUBLIC OF CHINA

Test object:	Product: Photovoltaic modules Model: JAM72D42-620/LB
Test specification:	IEC 61853-1:2011 IEC 61853-2:2016 IEC 61215:2016 partial LID according to Client's requirements
Purpose of examination:	• Testing and evaluation (visual / partial) according to the test specification

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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

-

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.	Model serial No.	Remark
HA2023TL-0554-004X	2350108530365248	JAM72D42-620/LB
HA2023TL-0554-005X	2350108530365254	JAM72D42-620/LB
HA2023TL-0554-006X	2350108530365253	JAM72D42-620/LB
HA2023TL-0554-007X	—	Small sample
HA2024TL-0548-003X	2440107250007088	JAM66D45-615/LB*

Remarks: * JAMxxD42-xxx/LB & JAMxxD45-xxx/LB use the same cell JACMKTB-D, only different in cell cutting size.

2. Order

2.1 Date of Purchase Order, Customer's Reference

The order dated 2024-11-13

2.2 Test Sample(s)

- Reception date(s): N/A
- Location(s) of reception: N/A
- Condition of test sample(s): N/A

2.3 Testing

- Testing date(s): N/A
- Location(s) of testing: N/A

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

- N/A

3. Test Results

- “Decision rule according to IEC Guide 115:2023, clause 4.4.3 was applied.”

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3.1 Positive Test Results

3.1.1 Flash Tests According to Table 2 of the IEC 61853-1

To determine the relationship between efficiency and irradiance & temperature, PV modules are tested across a matrix of operating conditions according to the standard IEC 61853-1:2011, ranging in irradiance from 100 W/m^2 to 1100 W/m^2 and ranging in temperature from 15 °C to 75 °C.
To determine the temperature coefficients, PV modules are tested according to IEC 60891:2009, under irradiance 1000W/m^2 and ranging in temperature from 15 °C to 50 °C.
Based on the laboratory measurement data, PAN file can be optimized, then match ability between the resulting efficiencies in PVsyst software and the lab data can be compared.

3.1.2 Testing raw date

Table 1: MQT 02 - Maximum power determination (Initial)(single side-front)						P
Test Date [YYYY-MM-DD]..... :			2023-06-01			—
Radiant Source..... :			☒ Solar simulator ☐ Natural Sunlight			—
Module temperature [°C] ..... :			25			—
Irradiance [W/m^2]..... :			1000			—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
HA2023TL-0554-004X	51.662	14.898	43.538	14.368	625.574	81.28
HA2023TL-0554-005X	51.626	14.895	43.402	14.413	625.550	81.35
HA2023TL-0554-006X	51.629	14.858	43.743	14.322	626.477	81.67
Supplementary information: N/A						

Table 1: MQT 02 - Maximum power determination (Initial)(single side-rear)		P
Test Date [YYYY-MM-DD]..... :	2023-06-01	—
Radiant Source..... :	☒ Solar simulator ☐ Natural Sunlight	—
Module temperature [°C] ..... :	25	—
Irradiance [W/m^2]..... :	1000	—

Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
HA2023TL-0554-004X	51.239	11.782	44.176	11.041	487.734	80.79
HA2023TL-0554-005X	51.244	11.861	44.483	10.968	487.870	80.27
HA2023TL-0554-006X	51.280	11.515	44.317	11.030	488.800	82.78
Supplementary information: N/A						

Table 2: Light exposure (60Kw·h)		P
Test Date [YYYY-MM-DD] start/end..... :	2023-06-01 / 2023-06-05	—
Radiant Source..... :	☒ Solar simulator ☐ Natural Sunlight	—
Sample # ..... :	HA2023TL-0554-004X HA2023TL-0554-005X HA2023TL-0554-006X	—
Total irradiation dosage [kWh/m^2] ..... :	60.0	—
Electrical load ..... :	☐Restive load ☒MPPT	—
Supplementary information: N/A		

Table 3: MQT 02 - Maximum power determination (after LID)(Single side-front)						P
Test Date [YYYY-MM-DD]..... :	2023-06-05					—
Radiant Source..... :	☒ Solar simulator ☐ Natural Sunlight					—
Module temperature [°C] ..... :	25					—
Irradiance [W/m^2]..... :	1000					—
Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
HA2023TL-0554-004X	51.645	14.874	43.460	14.324	622.529	81.04
HA2023TL-0554-005X	51.614	14.876	43.330	14.372	622.759	81.11
HA2023TL-0554-006X	51.607	14.847	43.705	14.259	623.172	81.33
Supplementary information: Power Degradation [%] -0.487 / -0.446 / -0.528						

Table 3: MQT 02 - Maximum power determination (after LID)(Single side-rear)		—
Test Date [YYYY-MM-DD].....:	2023-06-05	—
Radiant Source.....:	☒ Solar simulator ☐ Natural Sunlight	—
Module temperature [°C] .....:	25	—
Irradiance [W/m^2].....:	1000	—

Sample #	Voc [V]	Isc [A]	Vmp [V]	Imp [A]	Pmax [W]	FF [%]
HA2023TL-0554-004X	51.224	11.756	44.156	10.996	485.523	80.63
HA2023TL-0554-005X	51.224	11.836	44.457	10.928	485.845	80.13
HA2023TL-0554-006X	51.263	11.481	44.292	10.974	486.080	82.59

Supplementary information: Power Degradation [%] -0.453 / -0.415 / -0.556

ϕ = Min (ϕ_{Isc}, ϕ_{Pmax}) = 78.0%

$\phi_{Isc} = I_{scr} / I_{scf}$

$\phi_{Pmax} = P_{maxr} / P_{maxf}$

Table 4: Flash test data for each sample at the real irradiance and temperature conditions in table 2 of the IEC 61853-1

Test Date [YYYY-MM-DD] ..... :	2023-06-09
Radiant Source ..... :	☒ Solar simulator ☐ Natural Sunlight
Sample # ..... :	HA2023TL-0554-004X

T_{TARGET} [ºC]	IRR_{TARGET} [W/m²]	TACHIVED [ºC]	IRRACHIVED [W/m²]	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
15	100	14.9	100.5	47.600	42.155	1.480	1.436	60.531	85.94
15	200	15.2	200.3	49.535	43.092	3.023	2.931	126.289	84.33
15	400	15.1	399.1	50.811	44.053	6.049	5.842	257.350	83.73
15	600	15.1	599.9	51.864	44.136	8.969	8.753	386.334	83.05
15	800	14.9	797.7	52.597	44.319	11.868	11.621	515.025	82.51
15	1000	15.5	998.9	53.022	44.405	14.819	14.462	642.189	81.73
25	100	25.2	100.3	47.280	41.856	1.462	1.406	58.844	85.13
25	200	24.9	200.8	48.710	41.950	2.973	2.925	122.716	84.73
25	400	25.1	400.7	49.954	43.079	5.945	5.786	249.261	83.94
25	600	25.1	600.2	50.726	43.254	8.897	8.662	374.683	83.02
25	800	24.8	801.3	51.245	43.471	11.765	11.490	499.460	82.84
25	1000	25.0	1001.6	51.645	43.460	14.884	14.333	622.929	81.04
25	1100	24.9	1102.3	51.840	43.536	16.358	15.693	683.221	80.57
50	400	50.1	399.4	46.924	39.829	6.107	5.844	232.743	81.22
50	600	50.2	598.9	47.661	39.882	9.138	8.766	349.593	80.27

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50	800	49.9	799.1	48.217	40.028	12.145	11.640	465.905	79.56
50	1000	50.1	997.5	48.866	40.047	15.137	14.490	580.277	78.45
50	1100	50.1	1098.7	48.782	40.204	16.687	15.847	637.129	78.27
75	600	74.9	600.3	44.462	36.444	9.173	8.730	318.160	78.01
75	800	75.2	802.1	45.081	36.457	12.181	11.636	424.208	77.25
75	1000	75.0	997.5	45.497	36.561	15.262	14.470	529.058	76.19
75	1100	75.1	1095.4	45.628	36.757	16.802	15.787	580.285	75.69
Supplementary information: N/A									

Table 4: Flash test data for each sample at the real irradiance and temperature conditions in table 2 of the IEC 61853-1

Test Date [YYYY-MM-DD] ..... :	2023-06-10
Radiant Source ..... :	☒ Solar simulator ☐ Natural Sunlight
Sample # ..... :	HA2023TL-0554-005X

T_{TARGET} [ºC]	IRR_{TARGET} [W/m²]	TACHIVED [ºC]	IRRACHIVED [W/m²]	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
15	100	15.2	100.3	48.294	42.477	1.458	1.422	60.417	85.78
15	200	15.1	201.4	49.531	43.086	3.027	2.932	126.334	84.25
15	400	15.0	400.6	50.818	43.632	6.056	5.885	256.777	83.44
15	600	15.1	600.0	51.567	44.141	9.037	8.728	385.250	82.67
15	800	14.8	798.0	52.099	44.304	12.045	11.609	514.317	81.96
15	1000	15.2	998.4	52.505	44.394	15.027	14.449	641.453	81.30
25	100	25.0	100.1	47.449	41.631	1.453	1.412	58.788	85.28
25	200	25.0	199.6	48.693	42.244	2.967	2.902	122.611	84.86
25	400	24.8	400.0	49.933	42.612	5.957	5.854	249.466	83.87
25	600	24.8	599.2	50.755	42.854	8.882	8.748	374.873	83.16
25	800	25.0	798.1	51.267	43.062	11.883	11.606	499.784	82.04
25	1000	25.0	998.2	51.614	43.330	14.885	14.382	623.159	81.11
25	1100	24.9	1097.4	51.811	43.484	16.379	15.731	684.050	80.61
50	400	49.8	400.0	46.909	39.865	6.108	5.832	232.493	81.15
50	600	50.1	598.1	47.626	39.895	9.153	8.761	349.532	80.18

50	800	50.2	798.4	48.194	39.916	12.162	11.685	466.404	79.57
50	1000	50.2	1000.0	48.669	40.019	15.132	14.509	580.637	78.84
50	1100	49.9	1100.5	48.824	40.162	16.673	15.872	637.462	78.31
75	600	75.1	599.9	44.569	36.229	9.177	8.804	318.944	77.98
75	800	74.8	799.2	45.266	36.478	12.143	11.657	425.239	77.36
75	1000	75.0	996.6	45.606	36.767	15.200	14.424	530.324	76.50
75	1100	74.8	1097.5	45.745	36.850	16.779	15.816	582.819	75.93
Supplementary information: N/A									

Table 4: Flash test data for each sample at the real irradiance and temperature conditions in table 2 of the IEC 61853-1

Test Date [YYYY-MM-DD] ..... :	2023-06-11
Radiant Source ..... :	☒ Solar simulator ☐ Natural Sunlight
Sample # ..... :	HA2023TL-0554-006X

T_{TARGET} [ºC]	IRR_{TARGET} [W/m²]	TACHIVED [ºC]	IRRACHIVED [W/m²]	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
15	100	15.1	99.8	48.779	42.410	1.446	1.427	60.510	85.77
15	200	15.2	200.1	49.534	43.196	3.023	2.930	126.557	84.52
15	400	15.0	401.0	50.831	43.890	6.063	5.860	257.189	83.45
15	600	14.8	599.0	51.571	44.145	9.057	8.741	385.866	82.61
15	800	15.1	800.2	52.101	44.307	12.050	11.613	514.545	81.96
15	1000	15.1	1000.5	52.501	44.393	15.018	14.470	642.356	81.47
25	100	25.0	99.8	47.550	41.583	1.441	1.414	58.808	85.82
25	200	24.9	201.3	48.823	42.480	2.962	2.886	122.602	84.78
25	400	25.0	399.4	49.967	43.140	5.966	5.793	249.890	83.83
25	600	25.2	596.9	50.721	43.383	8.912	8.644	375.025	82.97
25	800	24.9	797.8	51.315	43.573	11.875	11.480	500.229	82.09
25	1000	25.1	998.3	51.607	43.705	14.855	14.265	623.472	81.33
25	1100	25.1	1099.1	51.751	43.885	16.352	15.594	684.329	80.87
50	400	49.9	399.9	46.878	39.838	6.133	5.857	233.340	81.16
50	600	50.2	598.7	47.689	40.001	9.157	8.761	350.432	80.25

50	800	49.8	799.8	48.162	39.891	12.212	11.720	467.507	79.49
50	1000	50.1	998.5	48.707	40.108	15.173	14.506	581.826	78.73
50	1100	50.2	1099.7	48.859	40.221	16.713	15.892	639.206	78.28
75	600	75.1	598.3	44.659	36.324	9.167	8.806	319.880	78.14
75	800	75.3	802.3	45.194	36.537	12.197	11.677	426.660	77.4
75	1000	74.8	1001.1	45.711	36.762	15.205	14.469	531.909	76.53
75	1100	74.9	1098.6	45.851	36.824	16.767	15.864	584.178	75.99
Supplementary information: N/A									

Table 5: Temperature Coefficients Measurement Data at 1000 W/m²

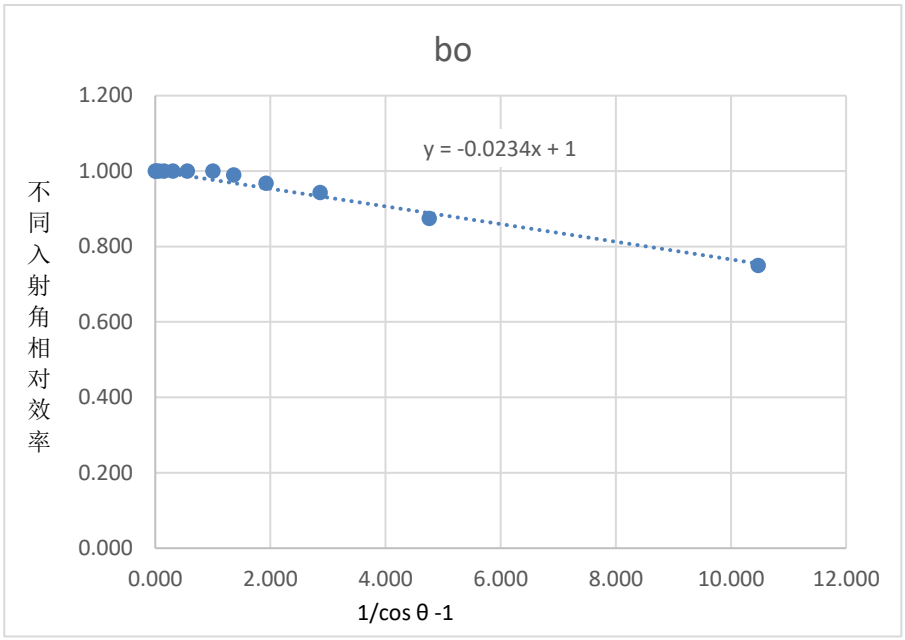
Test Date [YYYY-MM-DD] ..... :	2024-04-24
Radiant Source ..... :	☒ Solar simulator ☐ Natural Sunlight
Sample # ..... :	HA2024TL-0548-003X

Coefficients Determined by Laboratory Results

Serial Number	Alpha (α) ISC [%]	Beta (β) VOC [%]	Gamma (γ) PMAX [%]
HA2024TL-0548-003X	0.044	-0.242	-0.290

Table 6: Measurement of incidence angle effects

Test Date [YYYY-MM-DD] .....:	2023-06-15						
Radiant Source .....:	☒ Solar simulator ☐ Natural Sunlight						
Sample # .....:	HA2023TL-0554-007X						
Isc_80°/A:	1.088						—
Isc_-80°/A:	1.074						—
Isc_0°/A:	7.168						—
m=(Isc_80°/Isc_0°)/ cos 80°	0.874						—
n=(Isc_-80°/Isc_0°)/ cos 80°	0.863						—
DeviationΔ=|(m-n)/(m+n)|×100% ≤2%	0.6						P
Module Angle	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	IAM value according to IEC61853-2
0	—	—	7.168	—	—	—	1.000
10	—	—	7.082	—	—	—	1.000
20	—	—	6.742	—	—	—	1.000

30	—	—	6.228	—	—	—	1.000
40	—	—	5.497	—	—	—	1.000
50	—	—	4.607	—	—	—	1.000
60	—	—	3.595	—	—	—	1.000
65	—	—	2.998	—	—	—	0.990
70	—	—	2.374	—	—	—	0.968
75	—	—	1.750	—	—	—	0.943
80	—	—	1.088	—	—	—	0.874
85	—	—	0.468	—	—	—	0.750
Fitted curve (bo)							

3.1.3 Testing data analysis

Table 7: Average PMAX Determined by Laboratory Results according to the IEC 61853-1 based on Table 2

Irradiance [W/m²]	Module Temperature			
	15 °C	25 °C	50 °C	75 °C
100	60.486	58.813	-	-
200	126.393	122.643	-	-
400	257.105	249.539	232.859	-
600	385.817	374.860	349.852	318.995

800	514.629	499.824	466.605	425.369
1000	641.999	623.187	580.913	530.430
1100	-	683.867	637.932	582.427

Table 8: PMAX Determined by Laboratory Results Scaled to Nameplate Power at STC				
Irradiance [W/m²]	**Module Temperature**			
	15 °C	**25 °C**	**50 °C**	**75 °C**
100	60.177	58.512	-	-
200	125.747	122.016	-	-
400	255.790	248.263	231.668	-
600	383.844	372.943	348.063	317.364
800	511.997	497.268	464.219	423.194
1000	638.716	620.000	577.942	527.717
1100	-	680.370	634.670	579.448

Table 9: Relative Efficiency by Laboratory Results Scaled to Nameplate vs. Irradiance at 25°C							
Serial Number	**Irradiance [W/m²]**						
	100	200	400	600	800	1000	1100
HA2023TL-0554-004X	94.46%	98.50%	100.04%	100.25%	100.22%	100.00%	99.71%
HA2023TL-0554-005X	94.34%	98.38%	100.08%	100.26%	100.25%	100.00%	99.79%
HA2023TL-0554-006X	94.32%	98.32%	100.20%	100.25%	100.29%	100.00%	99.78%
Average	94.38%	98.40%	100.11%	100.25%	100.26%	100.00%	99.76%

3.1.4 PAN File Creation

3.1.4.1. PAN File Creation Method

The PAN file contains a number of model parameters organized in different tabs within PVsyst. The parameters which affect the model results in forward bias (normal operation) are located in the tabs labeled “Basic Data” and “Model Parameters”. TUV-SUD’s approach to PAN file creation is as following:

1. Enter manufacturer specifications on the “Basic Data” tab.
2. Enter the relative efficiency test results in **Table 9** under different irradiance at 25°C into “Additional Data/Low-light data”, and optimized the Rserie; It is mentioned that the relative efficiency is calculated after scale the average measured PMAX lab data from **Table 7** to the manufacturer’s nameplate power. The scaled data is shown in **Table 8** and **Table 9**.
3. Define the Rsh, Rsh0 and Rexp (on the “Model parameters” tab) for default values.
4. Enter the Pmax, Isc, Voc temperature coefficient in **Table 5** into “Model parameters” tab.

3.1.4.2. Optimized PAN File Results

PVsyst V7.4.6

TUV SUD Certification and Testing Co., Ltd Shanghai Branch (China)

PV module - JAM72D42-620/LB

Manufacturer	JA Solar	**Commercial data**	
Model	JAM72D42-620/LB	Availability :	Prod. Since 2023
		Data source :	TÜV SÜD
Pnom STC power (manufacturer)	620 Wp	Technology	Si-mono
Module size (W x L)	1.134 x 2.465 m²	Rough module area (Amodule)	2.80 m²
Number of cells	2 x 72	Sensitive area (cells) (Acells)	2.62 m²

Specifications for the model (manufacturer or measurement data)

Reference temperature (TRef)	25 °C	Reference irradiance (GRef)	1000 W/m²
Open circuit voltage (Voc)	52.1 V	Short-circuit current (Isc)	15.11 A
Max. power point voltage (Vmpp)	43.5 V	Max. power point current (Impp)	14.25 A
=> maximum power (Pmpp)	620.0 W	Isc temperature coefficient (muIsc)	6.7 mA/°C

One-diode model parameters

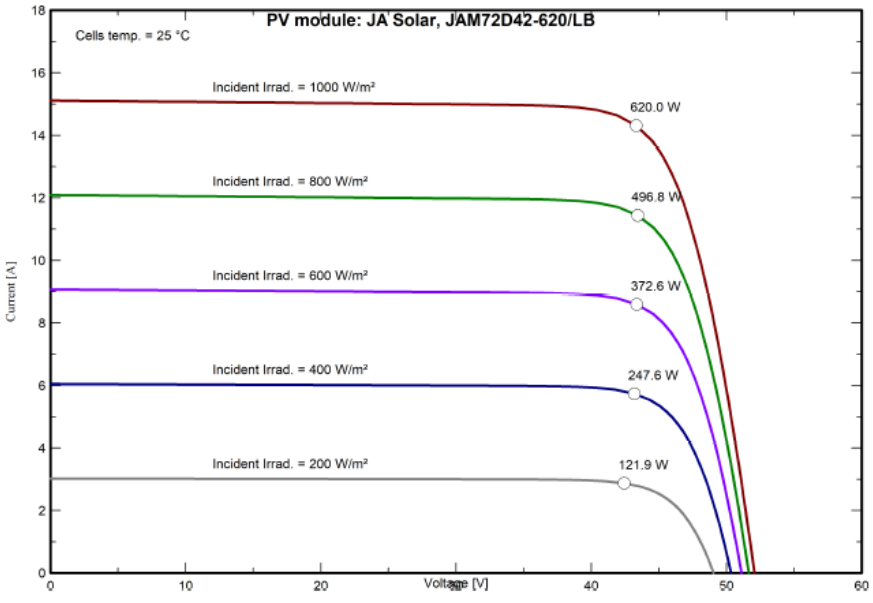
Shunt resistance (Rshunt)	250 Ω	Diode saturation current (IoRef)	0.016 nA
Serie resistance (Rserie)	0.19 Ω	Voc temp. coefficient (MuVoc)	-125 mV/°C
Specified Pmax temper. coeff. (muPMaxR)	-0.29 %/°C	Diode quality factor (Gamma)	1.02
		Diode factor temper. coeff. (muGamma)	0.000 1/°C

Reverse Bias Parameters, for use in behaviour of PV arrays under partial shadings or mismatch

Reverse characteristics (dark) (BRev)	3.20 mA/V²	(quadratic factor (per cell))	
Number of by-pass diodes per module	3	Direct voltage of by-pass diodes	-0.7 V

Model results for standard conditions (STC: T=25 ° C, G=1000 W/m² , AM=1.5)

Max. power point voltage (Vmpp)	43.3 V	Max. power point current (Impp)	14.36 A
Maximum power (Pmpp)	620.0 Wp	Power temper. coefficient (muPmpp)	-0.29 %/°C
Efficiency(/ Module area) (Eff_mod)	22.2 %	Fill factor (FF)	0.788
Efficiency(/ Cells area) (Eff_cells)	23.7 %		



3.1.4.3. PAN File Result Verification

After creating the PAN file, a quality check is implemented in order to compare the PAN file model consistence with measurements from the laboratory. The laboratory test results scaled are plotted as efficiency vs. irradiance curves for each temperature of the IEC61853-1 test matrix, as shown in **Table 10**. Similarly, efficiency vs. irradiance curves are generated using PVsyst and the newly created PAN file, as shown in **Table 11**. Comparison between the model and the measurements is represented with the following graph and table, and the RMSE (Root Mean Square Error) of the optimized PAN file is reported, as shown in **Table 12 and Figure 4.**

Table 10: Efficiency Determined by Laboratory Results Scaled to Nameplate Power at STC

Irradiance [W/m²]	Module Temperature			
	15 °C	25 °C	50 °C	75 °C
100	21.53%	20.93%	-	-
200	22.49%	21.83%	-	-
400	22.88%	22.20%	20.72%	-
600	22.89%	22.24%	20.75%	18.92%
800	22.90%	22.24%	20.76%	18.92%
1000	22.85%	22.18%	20.68%	18.88%
1100	-	22.13%	20.64%	18.84%

Table 11: Efficiency Generated Using PVsyst and the Newly Created PAN file

Irradiance [W/m²]	Module Temperature			
	15 °C	25 °C	50 °C	75 °C
100	21.93%	21.21%	-	-
200	22.48%	21.80%	-	-
400	22.82%	22.15%	20.44%	-
600	22.87%	22.22%	20.53%	18.76%
800	22.86%	22.22%	20.55%	18.79%
1000	22.82%	22.18%	20.52%	18.77%
1100	-	22.15%	20.49%	18.75%

Table 12: Comparison Result Between the Optimized PVsyst Model and the Measurements

RMSE	NRMSE(Average)
0.0015556	0.0073065

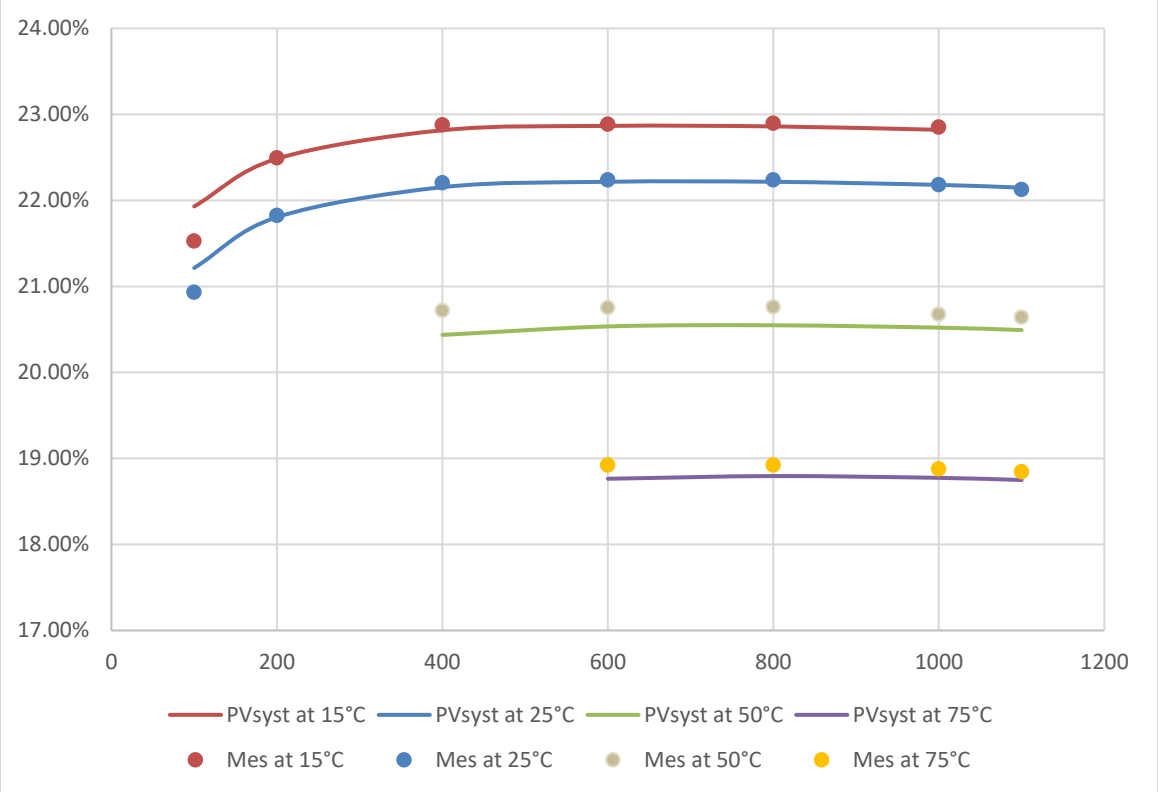


Figure 4:Comparison of PVsyst Model, Using the Optimized PAN file, to the Laboratory Testing Results

3.2 Points of Non-Compliance according to the test specification

- None

4. Test History

704062302120-00, issued on 2023-07-12
704062302120-01, issued on 2024-04-30

5. Remarks

5.1 General

Based on previous project 704062302120-01, added PAN files for following similar models JAM72D42-645/LB, JAM72D42-650/LB & JAM72D42-655/LB.

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

Description	Equipment ID	Date of calibration
Module pulse simulator	HYJC-YS-021	2023-01-05 2024-01-24
Reference cell	HYJC-YS-097	2022-07-26 2023-09-28

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

The measurement uncertainty is U(Pmax)=2.16%, U(Voc)=1.00%, U(Isc)=2.40% (K=2).

The measurement uncertainty of Isc is (K=2):

Aoi	0°	10°	20°	30°	40°	50°	60°	65°	70°	75°	80°	85°
Uc	2.40 %	2.53 %	2.64 %	2.84 %	2.98 %	3.11 %	3.17 %	3.27 %	3.42 %	3.80 %	4.44 %	5.27 %

7. Summary

Below parameters are measured on three representative PV modules:

- The relative efficiency test results under different irradiance at 25°C
- Performance at the real irradiance and temperature conditions in table 2 of the IEC 61853-1

Based on the test results, PANFILE are optimized in Pvsyst. Efficiency vs. irradiance curves are generated using PVsyst and the newly created PAN file, which is highly matched with the test results in lab.

According to the customer's requirements, the PAN Files of JAM72D42-610/LB, JAM72D42-615/LB, JAM72D42-625/LB, JAM72D42-630/LB, JAM72D42-635/LB, JAM72D42-640/LB, JAM72D42-645/LB, JAM72D42-650/LB & JAM72D42-655/LB were extended based on the measured parameter model of JAM72D42-620/LB.

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