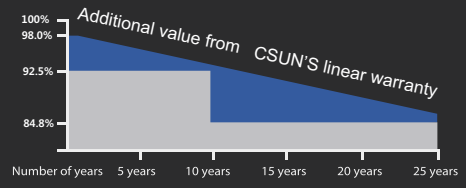
Mars Series
Half cell Modules

The power output shall not be less than 98.0% of the minimum power output stated in the product datasheet in the first year of the product's life cycle.
The loss of power output shall not exceed 0.55% per year thereafter, ending with 84.80%in the 25th year.

CSUN Standard warranty

CSUN's NEW linear performance warranty



Munich RE
Munich Re providing Re in surance

CSUN
energy for today

CSUN460-144M

High effciency PERC tech for esthetic applications

Module Fire Performance:Type 1 (UL 1703)
Fire Resistance Rating:Class C (IEC 61730)

CSUN425-144M	CSUN430-144M
CSUN435-144M	CSUN440-144M
CSUN445-144M	CSUN450-144M
CSUN455-144M	CSUN460-144M

21.16%
Module efficiency

460W
Highest power output

12 Year
Material& workmanship warranty

25 Year
Linear power output warranty

- Industry leading conversion efficiency
- Certificated to withstand wind (2400Pa) and snow load(5400Pa)
- Positive tolerance offer
- Excellent performance under weak light condition
- Passed salt mist & ammonia corrosion, blowing sand and hail testing
- Good temperature coefficient enables better output in hot climates

All information and data are subject to change without notice and are provided without liability.

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Electrical Characteristics at Standard Test Conditions (STC)

Module Type	CSUN425-144M	CSUN430-144M	CSUN435-144M	CSUN440-144M	CSUN445-144M	CSUN450-144M	CSUN455-144M	CSUN460-144M
Maximum Power(Pmpp)[W]	425	430	435	440	445	450	455	460
Positive Power Tolerance[W]	0~5	0~5	0~5	0~5	0~5	0~5	0~5	0~5
Open Circuit Voltage(Voc)[V]	48.3	48.5	48.7	48.9	49.1	49.3	49.5	49.7
Short Circuit Current(Isc) [A]	11.22	11.30	11.37	11.44	11.52	11.59	11.66	11.73
Maximum Power Voltage(Vmpp)[V]	40.4	40.6	40.8	41.0	41.2	41.4	41.6	41.8
Maximum Power Current(Impp)[A]	10.52	10.60	10.67	10.74	10.81	10.88	10.94	11.01
Module Efficiency	19.55%	19.78%	20.01%	20.24%	20.47%	20.70%	20.93%	21.16%

Electrical data relates to standard test conditions(STC): irradiance 1000W/m^2; AM1.5; cell temperature 25℃ measuring uncertainty of power is within ±3%. Certified in accordance with IEC61215,IEC61730-1/2 and UL1703.

Electrical Characteristics at Nominal Operating Cell Temperature(NOCT)

Module Type	CSUN425-144M	CSUN430-144M	CSUN435-144M	CSUN440-144M	CSUN445-144M	CSUN450-144M	CSUN455-144M	CSUN460-144M
Maximum Power(Pmpp)[W]	315	319	323	326	330	334	337	341
Open Circuit Voltage(Voc)[V]	45.0	45.2	45.3	45.5	45.7	45.9	46.1	46.3
Short Circuit Current(Isc) [A]	9.08	9.14	9.20	9.25	9.32	9.38	9.43	9.49
Maximum Power Voltage(Vmpp)[V]	37.4	37.6	37.7	37.9	38.1	38.3	38.5	38.7
Maximum Power Current(Impp)[A]	8.43	8.49	8.55	8.60	8.66	8.71	8.76	8.82

Electrical data relates to nominal operating cell temperature(NOCT): irradiance 800W/m^2;wind speed 1m/s; cell temperature 45℃ ambient temperature 20℃ measuring uncertainty of power is within ±3%.

Temperature Characteristics

Voltage Temperature Coefficient	-0.286%/℃
Current Temperature Coefficient	+0.057%/℃
Power Temperature Coefficient	-0.370%/℃

Maximum Ratings

Maximum System Voltage(V)	1000/1500
Series Fuse Rating(A)	25
Reverse Current Overload(A)	25

Mechanical Characteristics

Dimensions	2094×1038×35mm - frame thickness upon request
Weight	23.5kg
Frame	Anodized aluminum profile-black frame upon request
Front Glass	Toughened low iron glass,3.2mm
Cell Encapsulation	EVA(Ethylene-Vinyl-Acetate)
Back Sheet	Composite film-black back sheet upon request
Cell	144(6×24) monocrystalline solar semi-cells (166×83)
Junction Box	Rated current≥13A, IP≥65, TUV&UL
Cable	Length 300mm,1×4mm^2
Connector	MC4/compatible with MC4

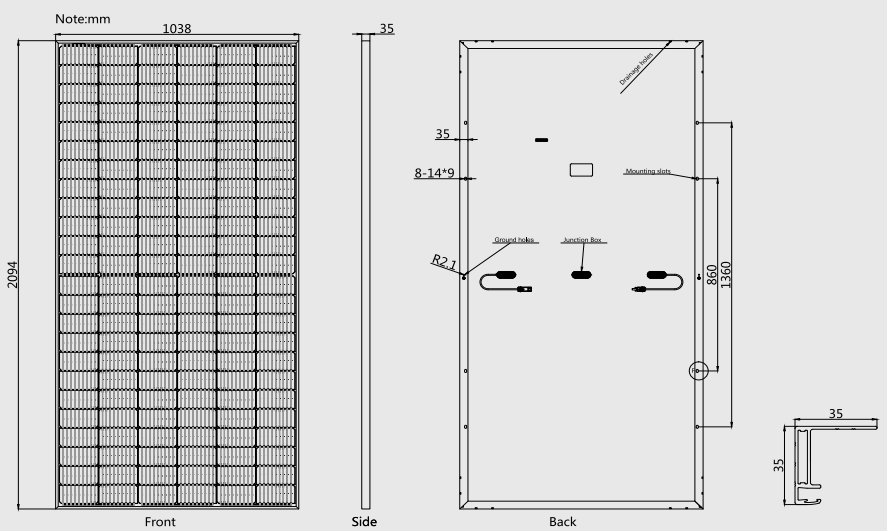
Packaging

Container 20'	180pcs.
Container 40'	396pcs.
Container 40'HC	737pcs.

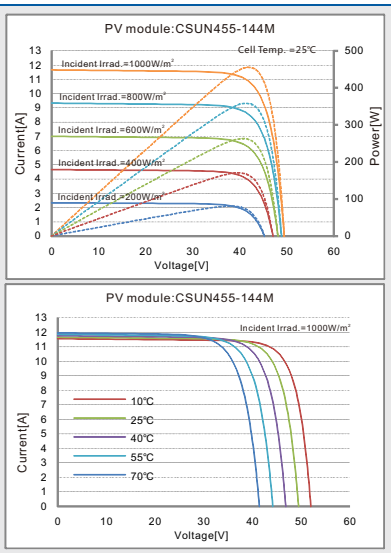
System Design

Temp.Range	-40°F to +185°F(-40℃ to +85℃)
Hail	Max. diameter of 0.98"(25mm)with impact speed of 51.2mph(23m/s)
Max.Capacity	Wind 2400Pa, snow 5400Pa-7200Pa upon request
Application Class	A
Safety Class	II

Dimensions



I-V Curves

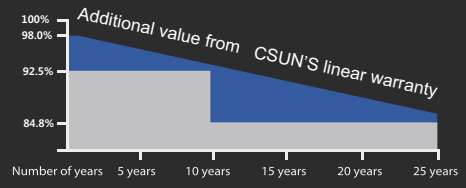


Mars Series
Half cell Modules

The power output shall not be less than 98.0% of the minimum power output stated in the product datasheet in the first year of the product's life cycle.
The loss of power output shall not exceed 0.55% per year thereafter, ending with 84.80%in the 25th year.

CSUN Standard warranty

CSUN's NEW linear performance warranty



Munich RE
Munich Re providing Re in surance

CSUN
energy for today

CSUN550-144M

High effciency PERC tech for esthetic applications

Module Fire Performance:Type 1 (UL 1703)
Fire Resistance Rating:Class C (IEC 61730)

CSUN535-144M CSUN540-144M
CSUN545-144M CSUN550-144M

21.28%
Module efficiency

550W
Highest power output

12 Year
Material& workmanship warranty

25 Year
Linear power output warranty

- Industry leading conversion efficiency
- Certificated to withstand wind (2400Pa) and snow load(5400Pa)
- Positive tolerance offer
- Excellent performance under weak light condition
- Passed salt mist & ammonia corrosion, blowing sand and hail testing
- Good temperature coefficient enables better output in hot climates

www.csunsolartech.com

Electrical Characteristics at Standard Test Conditions (STC)

Module Type	CSUN535-144M	CSUN540-144M	CSUN545-144M	CSUN550-144M
Maximum Power(Pmpp)[W]	535	540	545	550
Positive Power Tolerance[W]	0~5	0~5	0~5	0~5
Open Circuit Voltage(Voc)[V]	49.35	49.50	49.65	49.80
Short Circuit Current(Isc) [A]	13.78	13.85	13.92	13.98
Maximum Power Voltage(Vmpp)[V]	41.50	41.65	41.80	41.95
Maximum Power Current(Impp)[A]	12.90	12.97	13.04	13.12
Module Efficiency	20.70%	20.89%	21.09%	21.28%

Electrical data relates to standard test conditions(STC): irradiance 1000W/m^2; AM1.5; cell temperature 25℃ measuring uncertainty of power is within ±3%. Certified in accordance with IEC61215,IEC61730-1/2 and UL1703.

Electrical Characteristics at Nominal Operating Cell Temperature(NOCT)

Module Type	CSUN535-144M	CSUN540-144M	CSUN545-144M	CSUN550-144M
Maximum Power(Pmpp)[W]	399	403	406	410
Open Circuit Voltage(Voc)[V]	45.85	45.99	46.12	46.26
Short Circuit Current(Isc) [A]	11.13	11.19	11.25	11.30
Maximum Power Voltage(Vmpp)[V]	38.43	38.57	38.71	38.85
Maximum Power Current(Impp)[A]	10.38	10.44	10.50	10.56

Electrical data relates to nominal operating cell temperature(NOCT): irradiance 800W/m^2;wind speed 1m/s; cell temperature 45℃ ambient temperature 20℃ measuring uncertainty of power is within ±3%.

Temperature Characteristics

Voltage Temperature Coefficient	-0.28%/℃
Current Temperature Coefficient	+0.048%/℃
Power Temperature Coefficient	-0.35%/℃

Maximum Ratings

Maximum System Voltage(V)	1000/1500
Series Fuse Rating(A)	25
Reverse Current Overload(A)	25

Mechanical Characteristics

Dimensions	2279×1134×35mm - frame thickness upon request
Weight	29.1kg
Frame	Anodized aluminum profile-black frame upon request
Front Glass	Toughened low iron glass,3.2mm
Cell Encapsulation	EVA(Ethylene-Vinyl-Acetate)
Back Sheet	Composite film-black back sheet upon request
Cell	144(6×24) monocrystalline solar semi-cells (182×91)
Junction Box	Rated current≥25A, IP≥65, TUV&UL
Cable	Length 300mm,1×4mm^2
Connector	MC4/compatible with MC4

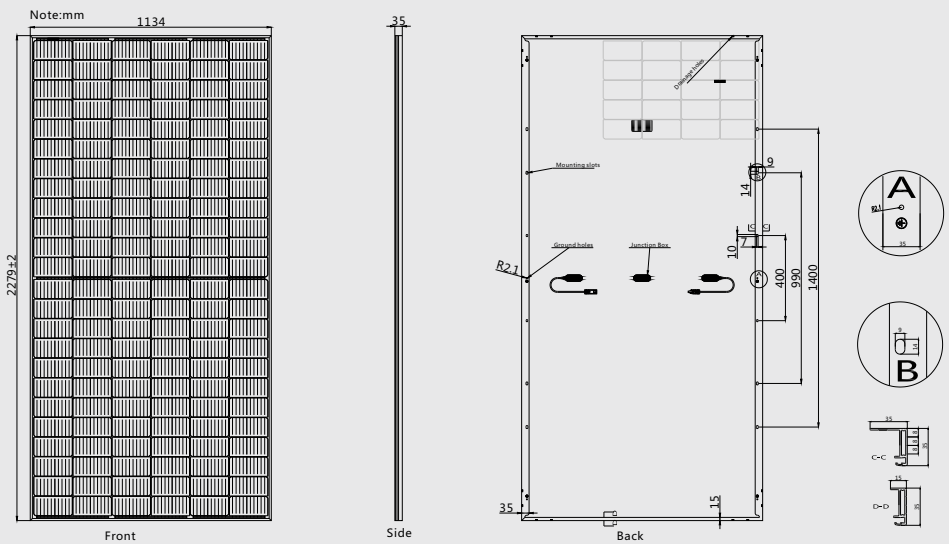
Packaging

Container 20'	180pcs.
Container 40'	360pcs.
Container 40'HC	620pcs.

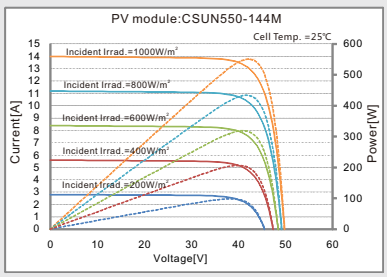
System Design

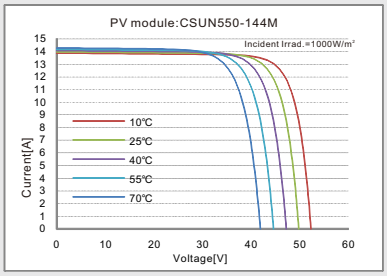
Temp.Range	-40°F to +185°F(-40℃ to +85℃)
Hail	Max. diameter of 0.98"(25mm)with impact speed of 51.2mph(23m/s)
Max.Capacity	Wind 2400Pa, snow 5400Pa-7200Pa upon request
Application Class	A
Safety Class	II

Dimensions



I-V Curves



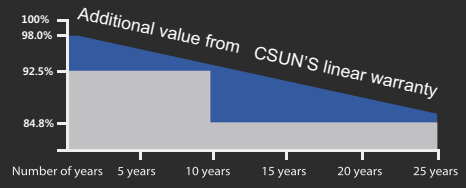


Mars Series
Half cell Modules

The power output shall not be less than 98.0% of the minimum power output stated in the product datasheet in the first year of the product's life cycle.
The loss of power output shall not exceed 0.55% per year thereafter, ending with 84.80%in the 25th year.

CSUN Standard warranty

CSUN's NEW linear performance warranty



CSUN670-132M

High effciency PERC tech for esthetic applications

Module Fire Performance:Type 1 (UL 1703)
Fire Resistance Rating:Class C (IEC 61730)

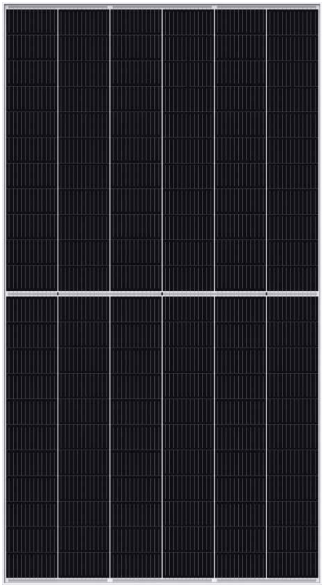
CSUN645-132M CSUN650-132M
CSUN655-132M CSUN660-132M
CSUN665-132M CSUN670-132M

21.60%
Module efficiency

670W
Highest power output

12 Year
Material& workmanship warranty

25 Year
Linear power output warranty



- Industry leading conversion efficiency
- Certificated to withstand wind (2400Pa) and snow load(5400Pa)
- Positive tolerance offer
- Excellent performance under weak light condition
- Passed salt mist & ammonia corrosion, blowing sand and hail testing
- Good temperature coefficient enables better output in hot climates

All information and data are subject to change without notice and are provided without liability.

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Electrical Characteristics at Standard Test Conditions (STC)

Module Type	CSUN645-132M	CSUN650-132M	CSUN655-132M	CSUN660-132M	CSUN665-132M	CSUN670-132M
Maximum Power(Pmpp)[W]	645	650	655	660	665	670
Positive Power Tolerance[W]	0~5	0~5	0~5	0~5	0~5	0~5
Open Circuit Voltage(Voc)[V]	45.08	45.27	45.46	45.65	45.84	46.00
Short Circuit Current(Isc) [A]	18.38	18.43	18.46	18.50	18.55	18.65
Maximum Power Voltage(Vmpp)[V]	37.24	37.42	37.61	37.80	37.98	38.40
Maximum Power Current(Impp)[A]	17.32	17.37	17.42	17.46	17.51	17.45
Module Efficiency	20.76%	20.92%	21.09%	21.25%	21.41%	21.60%

Electrical data relates to standard test conditions(STC): irradiance 1000W/m^2; AM1.5; cell temperature 25℃ measuring uncertainty of power is within ±3%. Certified in accordance with IEC61215,IEC61730-1/2 and UL1703.

Electrical Characteristics at Nominal Operating Cell Temperature(NOCT)

Module Type	CSUN645-132M	CSUN650-132M	CSUN655-132M	CSUN660-132M	CSUN665-132M	CSUN670-132M
Maximum Power(Pmpp)[W]	486	490	494	498	501	504
Open Circuit Voltage(Voc)[V]	42.38	42.55	42.73	42.91	43.09	43.27
Short Circuit Current(Isc) [A]	14.81	14.85	14.88	14.91	14.95	14.99
Maximum Power Voltage(Vmpp)[V]	34.71	34.88	35.05	35.23	35.40	35.57
Maximum Power Current(Impp)[A]	14.01	14.05	14.09	14.13	14.17	14.21

Electrical data relates to nominal operating cell temperature(NOCT): irradiance 800W/m^2;wind speed 1m/s; cell temperature 45℃ ambient temperature 20℃ measuring uncertainty of power is within ±3%.

Temperature Characteristics

Voltage Temperature Coefficient	-0.28%/℃
Current Temperature Coefficient	+0.048%/℃
Power Temperature Coefficient	-0.35%/℃

Maximum Ratings

Maximum System Voltage(V)	1000/1500
Series Fuse Rating(A)	30
Reverse Current Overload(A)	30

Mechanical Characteristics

Dimensions	2384×1303×35mm - frame thickness upon request
Weight	34kg
Frame	Anodized aluminum profile-black frame upon request
Front Glass	Toughened low iron glass,3.2mm
Cell Encapsulation	EVA(Ethylene-Vinyl-Acetate)
Back Sheet	Composite film-black back sheet upon request
Cell	132(6×22) monocrystalline solar semi-cells (210×105)
Junction Box	Rated current≥30A, IP≥65, TUV&UL
Cable	Length 300mm,1×4mm^2
Connector	MC4/compatible with MC4

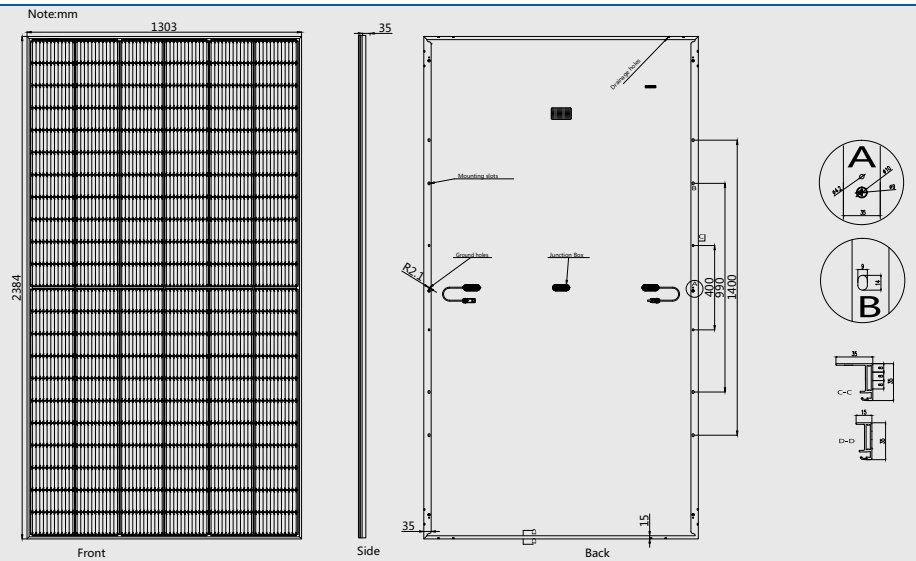
Packaging

Container 40'HC	558pcs.

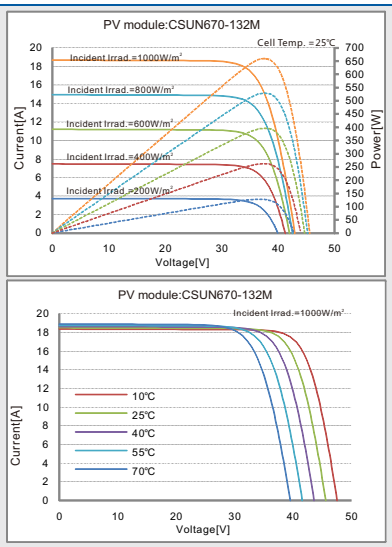
System Design

Temp.Range	-40°F to +185°F(-40℃ to +85℃)
Hail	Max. diameter of 0.98"(25mm)with impact speed of 51.2mph(23m/s)
Max.Capacity	Wind 2400Pa, snow 5400Pa-7200Pa upon request
Application Class	A
Safety Class	II

Dimensions



I-V Curves



List of contents

History of certification	
File no. .....:	N/A
Certificate no.....:	PV 50466969 issued by TÜV Rheinland
Date of issue ....:	10/18/2021
Report no. .....:	60367022 005
Module type(s) .:	**System voltage of 1000V** **PV Modules with 6" Poly-crystalline Silicon Solar Cells:** 72 cells: CSUNxxx-72P (xxx=320-345, in increment of 5) 60 cells: CSUNxxx-60P (xxx=260-285, in increment of 5) **PV Modules with 6" Mono-crystalline Silicon Solar Cells:** 72 cells: CSUNxxx-72M (xxx=325-370, in increment of 5) 60 cells: CSUNxxx-60M (xxx=280-305, in increment of 5) 72 cells: CSUNxxx-72M (xxx=390-410, in increment of 5) 72 cells: CSUNxxx-72M-BB (xxx=390-410, in increment of 5) 60 cells: CSUNxxx-60M (xxx=325-335, in increment of 5) 60 cells: CSUNxxx-60M-BB (xxx=325-330, in increment of 5) **PV Modules with 6" Mono-crystalline Half-cut Silicon Solar Cells:** 144 cells: CSUNxxx-144M (xxx=390-420, in increment of 5) 144 cells: CSUNxxx-144M-BB (xxx=385-400, in increment of 5) 144 cells: CSUNxxx-144M (xxx=425-460, in increment of 5) 144 cells: CSUNxxx-144M-BB (xxx=415-440, in increment of 5) 120 cells: CSUNxxx-120M (xxx=355-380, in increment of 5) 120 cells: CSUNxxx-120M-BB (xxx=355-365, in increment of 5) 120 cells: CSUNxxx-120M (xxx=325-340, in increment of 5) 120 cells: CSUNxxx-120M-BB (xxx=320-330, in increment of 5) **System voltage of 1500V** **PV Modules with 6" Poly-crystalline Silicon Solar Cells:** 72 cells: CSUNxxx-72PH (xxx=320-345, in increment of 5) 60 cells: CSUNxxx-60PH (xxx=260-285, in increment of 5) **PV Modules with 6" Mono-crystalline Silicon Solar Cells:** 72 cells: CSUNxxx-72MH (xxx=325-370, in increment of 5) 60 cells: CSUNxxx-60MH (xxx=280-305, in increment of 5) 72 cells: CSUNxxx-72MH (xxx=390-410, in increment of 5) 72 cells: CSUNxxx-72MH-BB (xxx=390-410, in increment of 5) 60 cells: CSUNxxx-60MH (xxx=325-335, in increment of 5) 60 cells: CSUNxxx-60MH-BB (xxx=325-330, in increment of 5) **PV Modules with 6" Mono-crystalline Half-cut Silicon Solar Cells:** 144 cells: CSUNxxx-144MH (xxx=425-460, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=415-440, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=390-420, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=385-400, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=355-380, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=355-365, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=325-340, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=320-330, in increment of 5)

Description: ..... :	Basic qualification
Supplementary information: N/A	
File no. ..... :	PVP07070/21P-01
Certificate no.... :	44 780 21 406749 -258
Date of issue .... :	11/25/2021
Report no. ..... :	492011836.001
Module type(s) . :	**PV Modules with 6" Mono-crystalline Half-cut Silicon Solar Cells:** 144 cells: CSUNxxx-144MH (xxx=425-460, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=415-440, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=390-420, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=385-400, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=355-380, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=355-365, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=325-340, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=320-330, in increment of 5) **PV Modules with 7" Mono-crystalline Half-cut Silicon Solar Cells:** 156 cells: CSUNxxx-156MH (xxx=580-600, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=535-550, in increment of 5) 132 cells: CSUNxxx-132MH (xxx=490-505, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=445-460, in increment of 5)
Description: ..... :	According to the enquiry of the applicant, based on the certificate no. PV 50466969 and test report no. CN21GBC3 001 and CN21TBIV 001 issued by TÜV Rheinland, extend to raw materials and related module types, requiring no additional tests, details refer to CDF no. 492011836.001, according to IEC 61215-1:2016, IEC 61215-2:2016, IEC 61215-1-1:2016, IEC 61730-1:2016 and IEC 61730-2:2016. - In addition, extend to new raw materials and new module types as below: (1) New 7” mono solar cell: PM1011BF1B1, manufactured by JIANGSU RUNERGY YUEDA PV TECHNOLOGY CO., LTD (2) New internal wiring (for interconnection cell-to-cell busbar): 6.0 x 0.4mm, coper belt with tin plated, manufactured by Wuxi Sveck Technology Co., Ltd. (3) New junction box set 2: FT50xy (x= 4, y=B, D or F), manufactured by Zhejiang Renhe Photovoltaic Technology Co., Ltd. - Increase fuse rating from 20A to 25A. - New related module types: **PV Modules with 7" Mono-crystalline Half-cut Silicon Solar Cells:** 156 cells: CSUNxxx-156MH (xxx=580-600, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=535-550, in increment of 5) 132 cells: CSUNxxx-132MH (xxx=490-505, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=445-460, in increment of 5) CSUN590-156MH was selected as representative test samples and conducted with all the related tests. CSUN580-156MH and CSUN600-156MH were tested to determine the lowest and highest end of power range.
Supplementary information: N/A	

Summary of testing
According to the enquiry of the applicant, based on the certificate no. 44 780 21 406749 - 258 and test report no. 492011836.001, extend to raw materials and module types according to IEC 61215-1:2016, IEC 61215-2:2016, IEC 61215-1-1:2016, IEC 61730-1:2016 and IEC 61730-2:2016. - List of raw materials: New 8” mono solar cell: M21012BPERCBP SE, manufactured by Tongwei Solar (Meishan) Co., Ltd. - New related module types: **PV Modules with 8" Mono-crystalline Half-cut Silicon Solar Cells:** 132 cells: CSUNxxx-132MH (xxx=645-670, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=585-610, in increment of 5) CSUN660-132MH was selected as representative test samples and conducted with all the related tests. CSUN645-132MH and CSUN670-132MH were tested to determine the lowest and highest end of power range. All tests were successfully completed. And factory inspection was performed. Therefore, from the result of testing and factory inspection, it is recommended that certification should be granted.
Detailed product information are to be found in the CDF (constructional data form) in Annex 1 of this report.

General remarks

Test item particulars:	
Accessories and detachable parts included in the evaluation .....:	N/A
Options included.....:	N/A
Abbreviations used in the report:	
HF - Humidity Freeze	TC - Temperature Cycling
DH - Damp Heat	Vmpp - Maximum power voltage
Impp - Maximum power current	Voc - Open circuit voltage
Isc - Short circuit current	FF - Fill Factor
Pmpp - Maximum power	α - Current temperature coefficient
NMOT - Nominal Module Operating Temperature	β - Voltage temperature coefficient
STC - Standard Test Conditions	γ - Power temperature coefficient
CTI - Comparative Tracking Index	PTI - Proof Tracking Index
RTI - Relative Temperature Index	RTE - Relative Thermal Endurance index
TI - Temperature Index	DTI - Distance through insulation
Cl - Clearances	Cr - Creepage distances
PD - Pollution Degree	MG - Material Groups
Possible test case verdicts:	
Test case does not apply to the test object.....:	Not Applicable (N/A)
Test object does meet the requirement.....:	Pass (P)
Test object does not meet the requirement.....:	Fail (F)
Other remarks:	
The test verdicts 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 issuing testing laboratory. “(see Annex #)” refers to additional information appended to the report. “(see Table #)” refers to a table appended to the report. Power degradation data expressed in negative value indicates a reduction of maximum power output. Power degradation data expressed in positive value indicates an increment of maximum power output. Throughout this report, a point is used as the decimal separator.	

General product information

Module type: CSUN660-132MH

Product Electrical Ratings at STC:	
Nominal maximum power (Pmax) [W] with tolerance .....:	660 ± 3%
Nominal open circuit voltage at (Voc) [V] with tolerance...:	45.65 ± 3%
Nominal maximum power voltage (Vmpp) [V].....:	37.80
Nominal short circuit current at (Isc) [A] with tolerance.....:	18.50 ± 3.5%
Nominal maximum power current (Impp) [A].....:	17.46
Product Safety Ratings:	
Maximum system voltage [V].....:	1500
Fuse rating [A] .....:	30
Safety class in accordance with IEC 61140 .....:	Class II
Fire safety class.....:	Class C
Recommended maximum series module configurations ..:	Written in installation manual
Recommended maximum parallel module configurations :	Written in installation manual

Module type: CSUN645-132MH (lower end)

Product Electrical Ratings at STC:	
Nominal maximum power (Pmax) [W] with tolerance .....:	645 ± 3%
Nominal open circuit voltage at (Voc) [V] with tolerance...:	45.08 ± 3%
Nominal maximum power voltage (Vmpp) [V].....:	37.24
Nominal short circuit current at (Isc) [A] with tolerance.....:	18.38 ± 3.5%
Nominal maximum power current (Impp) [A].....:	17.32
Product Safety Ratings:	
Maximum system voltage [V].....:	1500
Fuse rating [A] .....:	30
Safety class in accordance with IEC 61140 .....:	Class II
Fire safety class.....:	Class C
Recommended maximum series module configurations ..:	Written in installation manual
Recommended maximum parallel module configurations :	Written in installation manual

Module type: CSUN670-132MH (higher end)

Product Electrical Ratings at STC:	
Nominal maximum power (Pmax) [W] with tolerance .....:	670 ± 3%
Nominal open circuit voltage at (Voc) [V] with tolerance...:	46.00 ±3%
Nominal maximum power voltage (Vmpp) [V].....:	38.40
Nominal short circuit current at (Isc) [A] with tolerance.....:	18.65 ± 3.5%
Nominal maximum power current (Impp) [A].....:	17.45
Product Safety Ratings:	
Maximum system voltage [V].....:	1500
Fuse rating [A] .....:	30
Safety class in accordance with IEC 61140 .....:	Class II
Fire safety class.....:	Class C
Recommended maximum series module configurations ..:	Written in installation manual
Recommended maximum parallel module configurations :	Written in installation manual

Testing procedure

Module type: CSUN660-132MH

☐	Random sampling from production
☒	Prototype submitted by client
☐	New module type
☒	Modifications (if yes, please choose the applicable modification according to the Retesting Guideline)
☐	Modification to frontsheet
☐	Modification to encapsulation system
☒	Modification to cell technology
☐	Modification to cell and string interconnect material or technique
☐	Modification to backsheet
☐	Modification to electrical termination
☐	Modification to bypass diode
☐	Modification to electrical circuitry
☐	Modification to edge sealing
☐	Modification to frame and/or mounting structure
☐	Change in PV module size
☐	Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process
☒	Increase of over-current protection rating
☐	Increase of system voltage
☐	Change in cell fixing tape
☐	Others
☐	Others

Description of similarity (differences) between the applied model and the previously tested model:

- New 8” mono solar cell: M21012BPERCBP SE, manufactured by Tongwei Solar (Meishan) Co., Ltd.

Module type: CSUN645-132MH (lower end)

☐	Random sampling from production
☒	Prototype submitted by client
☐	New module type
☐	Modifications (if yes, please choose the applicable modification according to the Retesting Guideline)
	☐ Modification to frontsheet
	☐ Modification to encapsulation system
	☐ Modification to cell technology
	☐ Modification to cell and string interconnect material or technique
	☐ Modification to backsheet
	☐ Modification to electrical termination
	☐ Modification to bypass diode
	☐ Modification to electrical circuitry
	☐ Modification to edge sealing
	☐ Modification to frame and/or mounting structure
	☐ Change in PV module size
	☐ Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process
	☐ Increase of over-current protection rating
	☐ Increase of system voltage
	☐ Change in cell fixing tape
	☐ Others
☒	Others

Description of similarity (differences) between the applied model and the previously tested model:

- To determine the lower end of power range

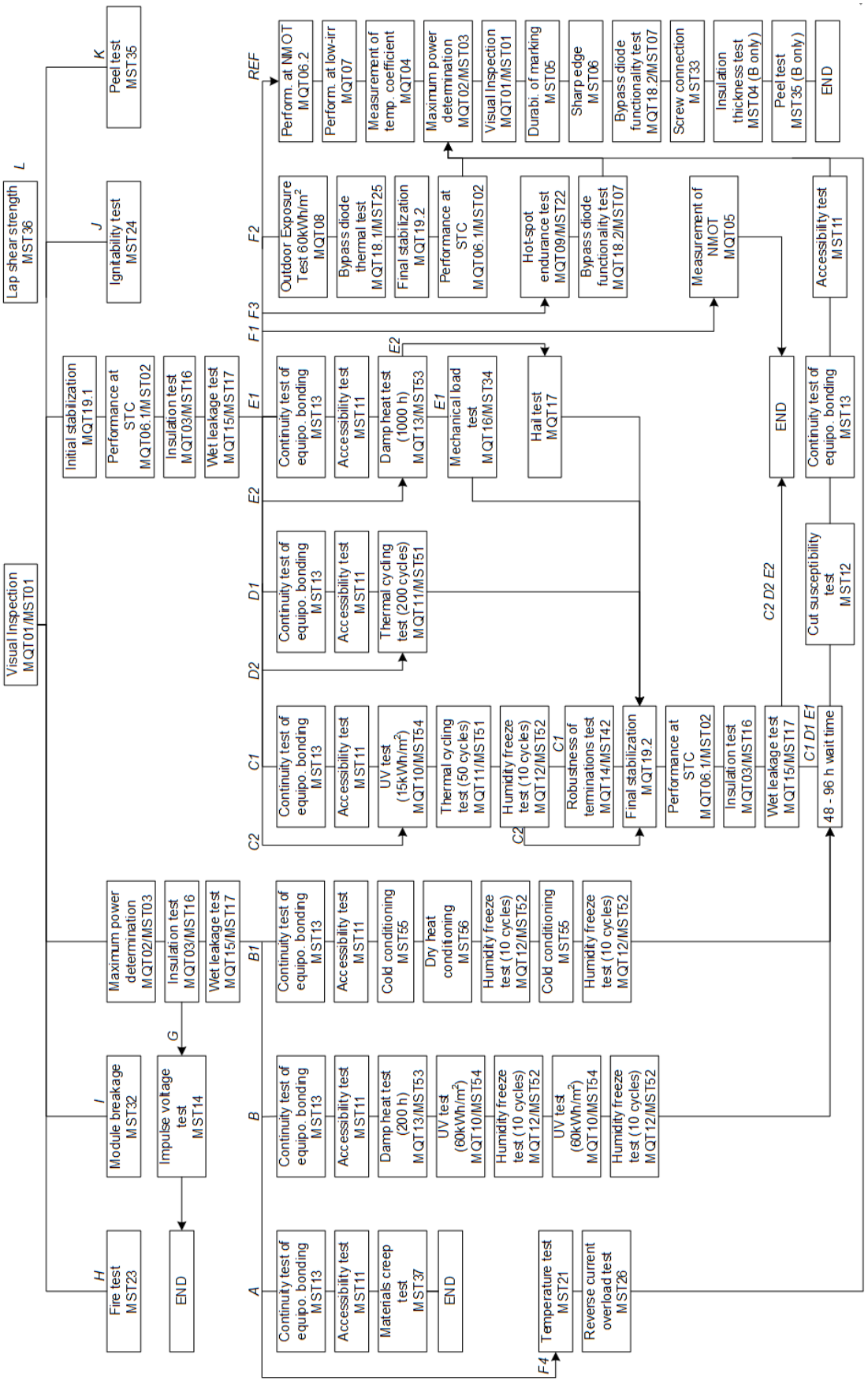
Module type: CSUN670-132MH (higher end)

☐	Random sampling from production
☒	Prototype submitted by client
☐	New module type
☐	Modifications (if yes, please choose the applicable modification according to the Retesting Guideline)
	☐ Modification to frontsheet
	☐ Modification to encapsulation system
	☐ Modification to cell technology
	☐ Modification to cell and string interconnect material or technique
	☐ Modification to backsheet
	☐ Modification to electrical termination
	☐ Modification to bypass diode
	☐ Modification to electrical circuitry
	☐ Modification to edge sealing
	☐ Modification to frame and/or mounting structure
	☐ Change in PV module size
	☐ Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process
	☐ Increase of over-current protection rating
	☐ Increase of system voltage
	☐ Change in cell fixing tape
	☐ Others
☒	Others

Description of similarity (differences) between the applied model and the previously tested model:

- To determine the higher end of power range

Test sequence



Module group assignment

Module type: CSUN660-132MH

Sample #	Serial number	Dimension (l x w x h) [mm]	Remark
1	C21I01ME00031A	2384 x 1303 x 35	REF
2	C21I01ME00032A	2384 x 1303 x 35	F3
3	C21I01ME00033A	2384 x 1303 x 35	D1
4	C21I01ME00034A	2384 x 1303 x 35	D2
5	C21I01ME00035A	2384 x 1303 x 35	E1
6	C21I01ME00036A	2384 x 1303 x 35	E2
7	C21I01ME00037A	2384 x 1303 x 35	F4

Module type: CSUN645-132MH (lower end)

Sample #	Serial number	Dimension (l x w x h) [mm]	Remark
8	C21I01ME00039A	2384 x 1303 x 35	Lower end power
9	C21I01ME00040A	2384 x 1303 x 35	Lower end power

Module type: CSUN670-132MH (higher end)

Sample #	Serial number	Dimension (l x w x h) [mm]	Remark
10	C21I01ME00041A	2384 x 1303 x 35	Higher end power
11	C21I01ME00042A	2384 x 1303 x 35	Higher end power

Clause	Requirement + Test	Result - Remark	Verdict

Test result overview

5 Marking and documentation			**-**
5.1 Name Plate			**-**
The module include the following clear and indelible markings:			-
a)	Name, registered trade name or registered trade mark of manufacturer	Yes	P
b)	Type or model number designation	Yes	P
c)	Serial number (unless marked on other part of product)	Laminated inside	N/A
d)	Date and place of manufacture; alternatively serial number allowing to trace the date and place of manufacture	Traceable by SN	P
e)	Maximum system voltage	Yes	P
f)	Class of protection against electrical shock	Yes	P
g)	Voltage at open-circuit or Voc including tolerances.	Yes	P
h)	Current at short-circuit or Isc including tolerances	Yes	P
i)	Module maximum power or Pmax including tolerances	Yes	P
-	All electrical data is shown as relative to standard test conditions (1000W/m^2, 25°C, AM1.5 according to IEC TS 61836).	Yes	P
-	International symbols are used where applicable.	Yes	P
5.2 Documentation			-
5.2.1 Minimum requirements			-
-	Modules are supplied with documentation describing the methods of electrical and mechanical installation as well as the electrical ratings of the module	Yes	P
-	The documentation states the class of protection against electrical shock under which the module has been qualified and any specific limitations required for that class.	Yes	P
-	The documentation assures that installers and operators receive appropriate and sufficient documentation for safe installation, use, and maintenance of the PV modules.	Yes	P
5.2.2 Information to be given in the documentation			-
a)	All information required under 5.1 e) to i)	Yes	P
b)	Reversed current rating in accordance to IEC / EN 61730-2		-
-	Overcurrent protection device type and rating are e.g. given in IEC 60269-6.	Yes	P

Clause	Requirement + Test	Result - Remark	Verdict
-	Maximum series / parallel module configurations is recommended	Yes	P
c)	Manufacturer's stated tolerance for Voc, Isc and maximum power output under standard test conditions	Yes	P
d)	Temperature coefficient for voltage at open-circuit	Yes	P
e)	Temperature coefficient for maximum power	Yes	P
f)	Temperature coefficient for short-circuit current	Yes	P
-	All electrical data mentioned above is shown as relative to standard test conditions (1000W/m^2, 25°C, AM1.5 according to IEC TS 61836).	Yes	P
g)	Nominal module operating temperature (NMOT) is specified	Yes	P
h)	Performance at NMOT (MQT 06.2) is specified	Yes	P
i)	Performance at low irradiance (MQT 07) is specified	Yes	P
-	International symbols are used where applicable	Yes	P
-	Compliance is checked by inspection and MQT 04 through MQT 07.	Yes	P
The electrical documentation include a detailed description of the electrical installation wiring method to be used, including:			-
j)	The minimum cable diameters for modules intended for field wiring	Yes	P
k)	Any limitations on wiring methods and wire management that apply to the wiring compartment or box;	Yes	P
l)	The size, type, material and temperature rating of the conductors to be used	Yes	P
m)	Type of terminals for field wiring	Yes	P
n)	Specific PV connector model/types and manufacturer to which the module connectors are mated	Yes	P
o)	The bonding method(s) to be used (if applicable); all provided or specified hardware is identified in the documentation	Yes	P
p)	The type and ratings of bypass diode to be used (if applicable)	Yes	P
q)	limitations to the mounting situation (e.g., slope, orientation, mounting means, cooling)	Yes	P
r)	A statement indicating the fire rating(s) and the applied standard as well as the limitations to that rating (e.g., installation slope, sub structure or other applicable installation information)	Yes	P

Clause	Requirement + Test	Result - Remark	Verdict
s)	A statement indicating the design load per each mechanical means for securing the module as evaluated during the static mechanical load test according to MQT 16. At discretion of the manufacturer the test load and/or the safety factor γm may be noted, too	Yes	P
-	The installation instructions include relevant parameters specified by manufacturer or the following statement or the equivalent: *"Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of ISC and VOC marked on this module should be multiplied by a factor of 1,25 when determining component voltage ratings, conductor current ratings, and size of controls connected to the PV output."*	Yes	P
5.2.3 Assembly instructions			-
-	These are provided with a product shipped in subassemblies, and are detailed and adequate to the degree required to facilitate complete and safe assembly of the product	Yes	P
Supplementary information: N/A			

Clause	Requirement + Test	Result - Remark	Verdict
7 Pass criteria			**-**
7.1 General			**-**
-	If two or more modules fail to meet the following test criteria, the design is deemed not to have met the qualification requirements	No	P
-	Should one module fail any test, two additional modules meeting the requirements of Clause 4 is subjected to the entire series of tests of the respective test sequence. If one or both of these modules also fail, the design is deemed not to have met the qualification requirements. If, however, both modules pass the test sequence, the design is judged to have met the qualification requirements.	No	P
-	A module design is judged to have passed the qualification tests and therefore to be approved according to this standard, if each test sample meets all of the following criteria.	Yes	P
7.2 Power output and electric circuitry			**-**
7.2.1 Verification of rated label values (Gate No. 1)			-
-	After stabilization, each individual module meets: $P_{max}(Lab) \cdot \left(1 + \frac{\lvert m_1 \rvert [\%]}{100}\right) \geq P_{max}(NP) \cdot \left(1 - \frac{\lvert t_1 \rvert [\%]}{100}\right)$	Yes	P
-	After stabilization: $\bar{P}_{max}(Lab) \cdot \left(1 + \frac{\lvert m_1 \rvert [\%]}{100}\right) \geq P_{max}(\mathrm{NP})$	Yes	P
-	After stabilization, each individual module meets: $V_{OC}(Lab) \cdot \left(1 + \frac{\lvert m_2 \rvert [\%]}{100}\right) \leq V_{oc}\,(NP) \cdot \left(1 + \frac{\lvert t_2 \rvert [\%]}{100}\right)$	Yes	P
-	After stabilization, each individual module meets: $I_{SC}(Lab) \cdot \left(1 + \frac{\lvert m_3 \rvert [\%]}{100}\right) \leq I_{SC}\,(NP) \cdot \left(1 + \frac{\lvert t_3 \rvert [\%]}{100}\right)$	Yes	P
7.2.2 Maximum power degradation during type approval testing (Gate No. 2)			-
-	At the end of each test sequence or for sequence B after bypass diode test, each test sample meets: $P_{max}(\mathrm{Lab\_Gate\#2}) \geq 0.95 \times P_{max}(\mathrm{Lab\_Gate\#1}) \cdot \left(1 - \frac{r[\%]}{100}\right)$	Yes	P
7.2.3 Electrical circuitry			-
-	Samples are not permitted to exhibit an open-circuit during the tests	No open-circuit observed.	P

Clause	Requirement + Test	Result - Remark	Verdict
7.3 Visual defects			**-**
-	There is no visual evidence of a major defect.	Yes	P
7.4 Electrical safety			**-**
-	The insulation test (MQT 03) requirements are met after the tests	Yes	P
-	The wet leakage current test (MQT 15) requirements are met at the beginning and the end of each sequence.	Yes	P
-	Specific requirements (IEC 61215-1-1) of the individual tests are met.	Yes	P
Supplementary information: N/A			

Clause	Requirement + Test	Result - Remark	Verdict

Module type: CSUN660-132MH

Initial examinations			-
MQT19.1	Initial stabilization ..... :	Performed by testing lab, see table 4.19.5	-
MQT01/MST01	Visual inspection ..... :	See table 4.1 & 10.2	P
MQT06.1/MST02	Performance at STC (Gate #1) ..... :	See table 4.6.1	P
MQT03/MST16	Insulation test ..... :	See table 4.3 & 10.13	P
MQT15/MST17	Wet leakage current test ..... :	See table 4.15 & 10.14	P
MQT02/MST03	Maximum power determination ..... :	See table 10.4	P
MST13	Continuity test for equipotential bonding ..... :	N/A	N/A
MST11	Accessibility test ..... :	N/A	N/A

Sample 2#			**-**
MQT09/MST22	Hot spot endurance test ..... :	See table 4.9	P
MQT18.2/MST07	Bypass diode functionality test ..... :	See table 4.18.2	P
MQT18.1/MST25	Bypass diode thermal test ..... :	See table 4.18.1	P

Sample 3#			**-**
MQT11/MST 51	Thermal cycling test (200 cycles) ..... :	See table 4.11	P
MST12	Cut susceptibility test ..... :	N/A	N/A

Sample 4#			**-**
MQT11/MST 51	Thermal cycling test (200 cycles) ..... :	See table 4.11	P

Sample 5#			**-**
MQT13/MST53	Damp heat test (1000h) ..... :	See table 4.13	P
MQT16/MST34	Static mechanical load test ..... :	N/A	N/A
MQT19.3	Stress-Specific Stabilization - BO LID ..... :	N/A	N/A
MST12	Cut susceptibility test ..... :	N/A	N/A

Sample 6#			**-**
MQT13/MST53	Damp heat test (1000h) ..... :	See table 4.13	P
MQT17	Hail test ..... :	N/A	N/A
MQT19.3	Stress-Specific Stabilization - BO LID ..... :	N/A	N/A

Clause	Requirement + Test	Result - Remark	Verdict
Sample 7#			**-**
MST21	Temperature test ..... :	See table 10.15	P
MST26	Reverse current overload test ..... :	See table 10.20	P

Final examinations			-
MQT06.1/MST02	Performance at STC (Gate #2)..... :	See table 4.6.1	P
MQT03/MST16	Insulation test..... :	See table 4.3	P
MQT15/MST17	Wet leakage current test..... :	See table 4.15	P
MST13	Continuity test for equipotential bonding ..... :	See table 10.11	P
MST11	Accessibility test..... :	N/A	N/A
-	48-96h wait time	-	-
MQT02/MST03	Maximum power determination..... :	See table 10.4	P
MQT01/MST01	Visual inspection ..... :	See table 10.2	P
MST05	Durability of markings ..... :	See table 10.6	P
MST06	Sharp edge test..... :	See table 10.7	P
MQT18.2/MST07	Bypass diode functionality test ..... :	See table 10.19	P
MST33	Screw connections test..... :	N/A	N/A
MST04	Insulation thickness test ..... :	N/A	N/A
MST35	Peel test..... :	N/A	N/A

Module type: CSUN645-132MH (lower end)

Initial examinations			-
MQT19.1	Initial stabilization..... :	Performed by testing lab, see table 4.19.5	-
MQT01/MST01	Visual inspection ..... :	See table 4.1	P
MQT06.1/MST02	Performance at STC (Gate #1)..... :	See table 4.6.1	P
MQT03/MST16	Insulation test..... :	See table 4.3 & 10.13	P
MQT15/MST17	Wet leakage current test..... :	See table 4.15 & 10.14	P
MST13	Continuity test for equipotential bonding ..... :	N/A	N/A
MST11	Accessibility test..... :	N/A	N/A

Clause	Requirement + Test	Result - Remark	Verdict

Module type: CSUN670-132MH (higher end)

Initial examination			-
MQT19.1	Initial stabilization ..... :	Performed by testing lab, see table 4.19.5	-
MQT01/MST01	Visual inspection ..... :	See table 4.1	P
MQT06.1/MST02	Performance at STC (Gate #1) ..... :	See table 4.6.1	P
MQT03/MST16	Insulation test ..... :	See table 4.3 & 10.13	P
MQT15/MST17	Wet leakage current test ..... :	See table 4.15 & 10.14	P
MST13	Continuity test for equipotential bonding ..... :	N/A	N/A
MST11	Accessibility test ..... :	N/A	N/A

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

Test results of IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2

Module type: CSUN660-132MH

4.1 Visual inspection (initial) - MQT01/MST01		-
Test date [MM/DD/YYYY].....:	10/04/2021	-
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
Supplementary information: N/A		

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.19.5 Stabilization (initial) - MQT19.1							-
Sample #.....:			1				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	656.6	-	-
1(P2)	5.0	994	50±10	N/A	657.4	-	-
2(P3)	5.0	998	50±10	N/A	655.2	0.34	Yes
Sample #.....:			2				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	657.5	-	-
1(P2)	5.0	994	50±10	N/A	656.8	-	-
2(P3)	5.0	998	50±10	N/A	655.6	0.29	Yes
Sample #.....:			3				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	656.5	-	-
1(P2)	5.0	994	50±10	N/A	655.8	-	-
2(P3)	5.0	998	50±10	N/A	655.6	0.14	Yes
Sample #.....:			4				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	656.8	-	-
1(P2)	5.0	994	50±10	N/A	657.1	-	-
2(P3)	5.0	998	50±10	N/A	655.3	0.27	Yes

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

Sample #.....:			5				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	658.4	-	-
1(P2)	5.0	994	50±10	N/A	656.7	-	-
2(P3)	5.0	998	50±10	N/A	656.9	0.26	Yes
Sample #.....:			6				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	656.8	-	-
1(P2)	5.0	994	50±10	N/A	656.8	-	-
2(P3)	5.0	998	50±10	N/A	655.1	0.26	Yes
Supplementary information: N/A							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.6.1 Performance at STC (after initial stabilization, Gate #1) - MQT06.1/MST02							-
Test date [MM/DD/YYYY]..... :			10/09/2021				-
Test method ..... :			☒ Simulator / ☐ Natural sunlight				-
Irradiance [W/m^2]..... :			1000				-
Module temperature [°C] ..... :			25.0				-
$P_{max}(lab)$ lower limit [W] ..... :			624.7				-
$\overline{P}_{max}(lab)$ lower limit [W] ..... :			644.0				-
$V_{OC}(lab)$ upper limit [V] ..... :			46.60				-
$I_{SC}(lab)$ upper limit [A] ..... :			18.69				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
1	45.64	38.10	17.99	17.20	655.2	79.79	P
2	45.57	38.09	17.99	17.21	655.6	79.97	P
3	45.55	38.12	17.99	17.20	655.6	80.02	P
4	45.55	38.09	17.97	17.20	655.3	80.07	P
5	45.57	38.11	18.02	17.24	656.9	80.01	P
6	45.55	38.10	17.98	17.20	655.1	79.98	P
Average	-	-	-	-	655.6	-	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.3 Insulation test (initial) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		10/09/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 4000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
1	12.9	>1000	No	P
2	12.9	>1000	No	P
3	12.9	>1000	No	P
4	12.9	>1000	No	P
5	12.9	>1000	No	P
6	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (initial) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		10/09/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2063	-
Solution temperature [°C] / 22±2 .....:		23.5	-
Sample #	Required [MΩ]	Measured [MΩ]	-
1	12.9	>1000	P
2	12.9	>1000	P
3	12.9	>1000	P
4	12.9	>1000	P
5	12.9	>1000	P
6	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.9 Hot-spot endurance test - MQT09/MST22		-
Sample #.....:	2	-
Test date [MM/DD/YYYY] / start - end..:	12/14/2021	-
Cell interconnection circuit.....:	☐ S / ☐ SP / ☒ SPS	-
Irradiance during each cycle [W/m^2].....:	998	-
Test duration for each cycle [hour].....:	1	-
Module temperature at thermal equilibrium in each cycle [°C].....:	51.2	-
Maximum measured cell temperature of cell with lowest shunt resistance adjacent to the edge [°C].....:	B6: 146.3	-
Shading rate of cell with lowest shunt resistance [%].....:	B6:57	-
Maximum measured cell temperature of other 2 cells with lowest shunt resistance[°C].....:	X3: 162.2 C5: 113.6	-
Shading rate of the other 2 cells with lowest shunt resistance [%].....:	X3: 54.1 C5: 52.2	-
Maximum measured cell temperature of cell with highest shunt resistance [°C].:	V2: 112.6	-
Shading rate of cell with highest shunt resistance [%].....:	V2: 44.1	-

Supplementary information: Position of solar cells (front side view):

	A	B	C	⋯	J	K	L	⋯	S	T	U	V
1												
2						Junction Box						
3												
4						Junction Box						
5												
6						Junction Box						

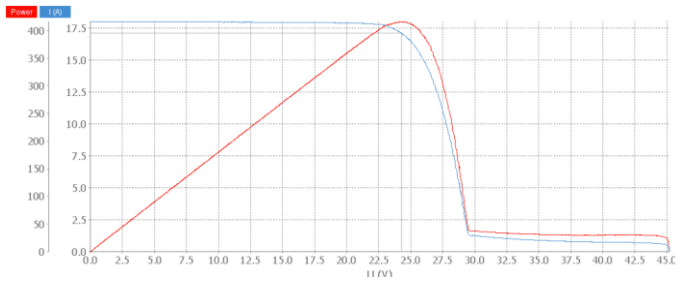
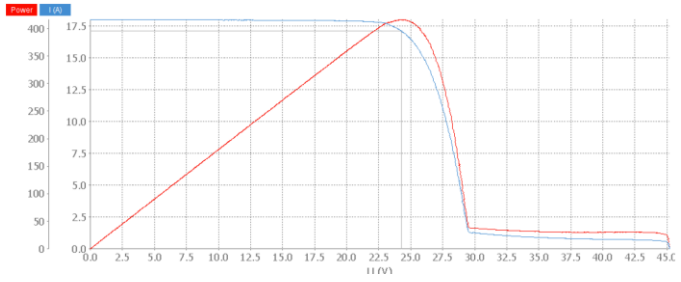
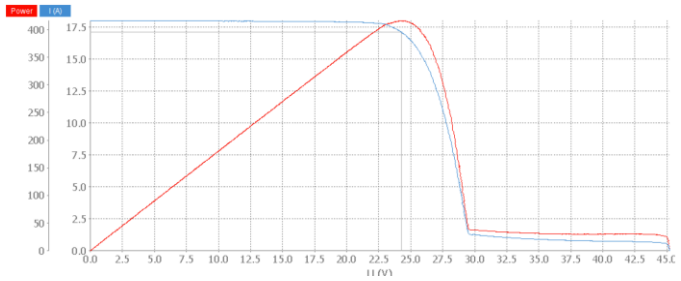
4.1 Visual inspection (after hot-spot endurance test) - MQT01/MST01		-
Test date [MM/DD/YYYY].....:	12/14/2021	-
Sample #	Nature and position of initial findings - comments or attach photos	-
2	No visual defects	P

Supplementary information: N/A

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.2 Maximum power determination (after hot-spot endurance test) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Ambient temperature [°C].....:			Corrected to 25.0				-
Irradiance [W/m²].....:			Corrected to 1000				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
2	45.31	37.77	18.03	17.26	652.0	79.56	-
Supplementary information: N/A							
4.3 Insulation test (after hot-spot endurance test) - MQT03/MST16							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Test voltage applied [V].....:			2 minutes of 1500 and 1 minute of 8000				-
Sample #	Required [MΩ]		Measured [MΩ]		Dielectric breakdown?		-
2	12.9		>1000		No		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m². Area of the module is 3.10m².							
4.15 Wet leakage current test (after hot-spot endurance test) - MQT15/MST17							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Test voltage applied [V].....:			2 minutes of 1500				-
Solution resistivity [Ω/cm] / <3500 .....:			2341				-
Solution temperature [°C] / 22±2 .....:			21.1				-
Sample #	Required [MΩ]		Measured [MΩ]				-
2	12.9		>1000				P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m². Area of the module is 3.10m².							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.18.2 Bypass diode functionality test (after hot-spot endurance test) - MQT18.2/MST07		-
Sample #.....:	2	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A] .....:	N/A	-
$V_{FMrated}$ [V] .....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading the string	P
1		P
2		P
3		P
Supplementary information: N/A		

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.18.1 Bypass diode thermal test - MQT18.1/MST25					-
Sample #.....:	2				-
Test date [MM/DD/YYYY].....:	12/14/2021				-
Module temperature [°C] .....:	75				-
Number of diodes in junction box .....:	3				-
Diode manufacturer.....:	Zhejiang Renhe Photovoltaic Technology Co., Ltd.				-
Diode type designation.....:	FMK5040D				-
Max. permissible junction temperature T_{jmax} [°C].....:	200 (according to datasheet)				-
Step 1, determination of V_D versus Tj characteristic					-
Diode #.....:	1				-
Temperature [°C].....:	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	-
Ambient temperature of the junction box [°C].....:	30	50	70	90	-
Pulsed current [A] .....:	18.03	18.03	18.03	18.03	-
Voltage drop [V] .....:	0.3923	0.3637	0.3420	0.3249	-
V_D versus Tj characteristic.....:	$V_D=0.4274-1.2*10^{-3}\ T_J$				-
Diode #.....:	2				-
Temperature [°C].....:	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	-
Ambient temperature of the junction box [°C].....:	30	50	70	90	-
Pulsed current [A] .....:	18.03	18.03	18.03	18.03	-
Voltage drop [V] .....:	0.4453	0.4216	0.4113	0.3949	-
V_D versus Tj characteristic.....:	$V_D=0.4707-0.8*10^{-3}\ T_J$				-
Diode #.....:	3				-
Temperature [°C].....:	30 ± 2 °C	50 ± 2 °C	70 ± 2 °C	90 ± 2 °C	-
Ambient temperature of the junction box [°C].....:	30	50	70	90	-
Pulsed current [A] .....:	18.03	18.03	18.03	18.03	-
Voltage drop [V] .....:	0.4541	0.4382	0.4221	0.4341	-
V_D versus Tj characteristic.....:	$V_D=0.4816-0.9*10^{-3}\ T_J$				-

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

Step 2, bypass diode thermal test				-
Diode #.....:	1	2	3	-
Current flow applied [A] .....:	18.03	18.03	18.03	-
Voltage drop [V] after 1h.....:	0.2725	0.3386	0.3537	-
Calculated max. junction temperature Tj_{calc} [°C].....:	125.5	166.1	141.7	-
Tj_{calc} < Tj_{max}? .....:	Yes	Yes	Yes	P
Current flow (1.25 x Isc) [A].....:	22.53	22.53	22.53	-
Bypass diode remains functional?.....:	Yes	Yes	Yes	P
Supplementary information: N/A				

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.1 Visual inspection (after bypass diode thermal test) - MQT01/MST01							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Sample #	Nature and position of initial findings - comments or attach photos						-
2	No visual defects						P
Supplementary information: N/A							
4.2 Maximum power determination (after bypass diode thermal test) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Ambient temperature [°C].....:			Corrected to 25.0				-
Irradiance [W/m^2].....:			Corrected to 1000				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
2	45.29	37.76	18.02	17.22	651.6	79.44	-
Supplementary information: N/A							
4.3 Insulation test (after bypass diode thermal test) - MQT03/MST16							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Test voltage applied [V].....:			2 minutes of 1500 and 1 minute of 8000				-
Sample #	Required [MΩ]		Measured [MΩ]		Dielectric breakdown?		-
2	12.9		>1000		No		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.							
4.15 Wet leakage current test (after bypass diode thermal test) - MQT15/MST17							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Test voltage applied [V].....:			2 minutes of 1500				-
Solution resistivity [Ω/cm] / <3500 .....:			2051				-
Solution temperature [°C] / 22±2 .....:			22.8				-
Sample #	Required [MΩ]		Measured [MΩ]				-
2	12.9		>1000				P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.11 Thermal cycling 200 test - MQT11/MST51							-
Test date [MM/DD/YYYY] / start - end..:			10/25/2021 - 11/25/2021				-
Total cycles .....:			200				-
Current applied [A] .....:			17.2 during the heat up stage from -40°C to 80°C 0.05 during others				-
Sample #	Open circuits?						-
3	No						P
4	No						P
Supplementary information: N/A							
4.1 Visual inspection (after thermal cycling 200 test) - MQT01/MST01							-
Test date [MM/DD/YYYY].....:			11/25/2021				-
Sample #	Nature and position of initial findings - comments or attach photos						-
3	No visual defects						P
4	No visual defects						P
Supplementary information: N/A							
4.2 Maximum power determination (after thermal cycling 200 test) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:			11/25/2021				-
Ambient temperature [°C].....:			Corrected to 25.0				-
Irradiance [W/m^2].....:			Corrected to 1000				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
3	45.41	37.82	17.98	17.22	651.7	79.80	-
4	45.41	37.84	18.05	17.28	653.6	79.76	-
Supplementary information: N/A							
4.3 Insulation test (after thermal cycling 200 test) - MQT03/MST16							-
Test date [MM/DD/YYYY].....:			11/25/2021				-
Test voltage applied [V].....:			2 minutes of 1500 and 1 minute of 8000				-
Sample #	Required [MΩ]		Measured [MΩ]		Dielectric breakdown?		-
3	12.9		>1000		No		P
4	12.9		>1000		No		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (after thermal cycling 200 test) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		11/25/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2442	-
Solution temperature [°C] / 22±2 .....:		23.1	-
Sample #	Required [MΩ]	Measured [MΩ]	-
3	12.9	>1000	P
4	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.13 Damp heat 1000 test - MQT13/MST53							-
Sample #.....:		5, 6					-
Test date [MM/DD/YYYY] / start - end..:		10/18/2021 - 12/06/2021					-
Total hours [hours] .....:		1000					-
Supplementary information: N/A							
4.1 Visual inspection (after damp heat 1000 test) - MQT01/MST01							-
Test date [MM/DD/YYYY].....:		12/06/2021					-
Sample #	Nature and position of initial findings - comments or attach photos						-
5	No visual defects						P
6	No visual defects						P
Supplementary information: N/A							
4.2 Maximum power determination (after damp heat 1000 test) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:		12/06/2021					-
Ambient temperature [°C].....:		Corrected to 25.0					-
Irradiance [W/m^2].....:		Corrected to 1000					-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
5	45.40	37.77	17.66	16.88	637.7	79.53	-
6	45.39	37.73	17.66	16.88	637.0	79.48	-
Supplementary information: N/A							
4.3 Insulation test (after damp heat 1000 test) - MQT03/MST16							-
Test date [MM/DD/YYYY].....:		12/06/2021					-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000					-
Sample #	Required [MΩ]		Measured [MΩ]		Dielectric breakdown?		-
5	12.9		>1000		No		P
6	12.9		>1000		No		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (after damp heat 1000 test) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		12/06/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2682	-
Solution temperature [°C] / 22±2 .....:		23.6	-
Sample #	Required [MΩ]	Measured [MΩ]	-
5	12.9	>1000	P
6	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.6 Performance at STC (final, Gate #2) - MQT06.1/MST02							-
Test method .....:			☒ Simulator / ☐ Natural sunlight				-
Irradiance [W/m²].....:			1000				-
Module temperature [°C] .....:			25.0				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
3	45.41	37.82	17.98	17.22	651.7	79.80	-
4	45.41	37.84	18.05	17.28	653.6	79.76	-
5	45.54	37.85	17.64	16.85	637.9	79.41	-
6	45.39	37.73	17.66	16.88	637.0	79.48	-

Power degradation of each module after each test sequences						-
Sample #	Pmp (initial) [W]	Pmp (final) [W]	Reproducibility *r* [%]	Power degradation [%]	Maximum allowed degradation [%]	-
3	655.6	651.7	0.02	-0.35	-5.02	P
4	655.3	653.6	0.02	-0.26	-5.02	P
5	656.9	637.9	0.02	-2.89	-5.02	P
6	655.1	637.0	0.02	-2.76	-5.02	P

Supplementary information: According to Gate #2, Maximum allowed degradation [%] = -(5 + 0.95 x *r*)

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.3 Insulation test (final) - MQT03/MST16				-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
3	12.9	>1000	No	P
4	12.9	>1000	No	P
5	12.9	>1000	No	P
6	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (final) - MQT15/MST17			-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		<3500	-
Solution temperature [°C] / 22±2 .....:		22±2	-
Sample #	Required [MΩ]	Measured [MΩ]	-
3	12.9	>1000	P
4	12.9	>1000	P
5	12.9	>1000	P
6	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

Module type: CSUN645-132MH (lower end)

4.1 Visual inspection (initial) - MQT01/MST01		-
Test date [MM/DD/YYYY].....:	10/04/2021	-
Sample #	Nature and position of initial findings - comments or attach photos	-
9	No visual defects	P
10	No visual defects	P
Supplementary information: N/A		

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.19.5 Stabilization (initial) - MQT19.1							-
Sample #.....:			9				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	656.1	-	-
1(P2)	5.0	994	50±10	N/A	655.8	-	-
2(P3)	5.0	998	50±10	N/A	654.4	0.26	Yes
Sample #.....:			10				-
Light exposure method.....:			☒ Solar simulator / ☒ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start - end .:			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} - P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	654.2	-	-
1(P2)	5.0	994	50±10	N/A	654.8	-	-
2(P3)	5.0	998	50±10	N/A	653.9	0.14	Yes
Supplementary information: N/A							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.6.1 Performance at STC (after initial stabilization, Gate #1) - MQT06.1/MST02							-
Test date [MM/DD/YYYY]..... :			10/09/2021				-
Test method ..... :			☒ Simulator / ☐ Natural sunlight				-
Irradiance [W/m^2]..... :			1000				-
Module temperature [°C] ..... :			25.0				-
$P_{max}(lab)$ lower limit [W] ..... :			610.5				-
$\overline{P}_{max}(lab)$ lower limit [W] ..... :			629.4				-
$V_{OC}(lab)$ upper limit [V] ..... :			46.02				-
$I_{SC}(lab)$ upper limit [A] ..... :			18.57				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
9	45.45	38.01	18.00	17.22	654.4	79.99	P
10	45.48	38.02	17.99	17.20	653.9	79.92	P
Average	-	-	-	-	654.2	-	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.3 Insulation test (initial) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		10/09/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
9	12.9	>1000	No	P
10	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (initial) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		10/09/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2428	-
Solution temperature [°C] / 22±2 .....:		22.2	-
Sample #	Required [MΩ]	Measured [MΩ]	-
9	12.9	>1000	P
10	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

Module type: CSUN670-132MH (higher end)

4.1 Visual inspection (initial) - MQT01/MST01		-
Test date [MM/DD/YYYY].....:	10/04/2021	-
Sample #	Nature and position of initial findings – comments or attach photos	-
11	No visual defects	P
12	No visual defects	P
Supplementary information: N/A		

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.19.5 Stabilization (initial) – MQT19.1							-
Sample #.....:			11				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start – end :			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} – P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	657.8	-	-
1(P2)	5.0	994	50±10	N/A	656.9	-	-
2(P3)	5.0	998	50±10	N/A	656.6	0.18	Yes
Sample #.....:			12				-
Light exposure method.....:			☒ Solar simulator / ☐ Natural sunlight / ☐ Others				-
Test date [MM/DD/YYYY] / start – end :			10/04/2021 - 10/09/2021				-
Test cycle	Integrated irradiation [kWh/m²]	Irradiance [W/m²]	Module temperature [°C]	Resistive load [Ω]	Pmpp at the end of cycle [W]	(P_{max} – P_{min}) / $P_{average}$ [%]	Stable? [Y / N]
Initial(P1)	N/A	N/A	N/A	N/A	659.0	-	-
1(P2)	5.0	994	50±10	N/A	657.9	-	-
2(P3)	5.0	998	50±10	N/A	657.7	0.20	Yes
Supplementary information: N/A							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.6.1 Performance at STC (after initial stabilization, Gate #1) - MQT06.1/MST02							-
Test date [MM/DD/YYYY]..... :			10/09/2021				-
Test method ..... :			☒ Simulator / ☐ Natural sunlight				-
Irradiance [W/m^2]..... :			1000				-
Module temperature [°C] ..... :			25.0				-
$P_{max}(lab)$ lower limit [W] ..... :			634.2				-
$\overline{P}_{max}(lab)$ lower limit [W] ..... :			653.8				-
$V_{OC}(lab)$ upper limit [V] ..... :			46.96				-
$I_{SC}(lab)$ upper limit [A] ..... :			18.84				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
11	45.66	38.15	18.02	17.21	656.6	79.81	P
12	45.67	38.13	18.06	17.25	657.7	79.77	P
Average	-	-	-	-	657.2	-	P
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.3 Insulation test (initial) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		10/09/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
11	12.9	>1000	No	P
12	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61215-1, IEC / EN 61215-1-1 & IEC / EN 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.15 Wet leakage current test (initial) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		10/09/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2024	-
Solution temperature [°C] / 22±2 .....:		22.6	-
Sample #	Required [MΩ]	Measured [MΩ]	-
11	12.9	>1000	P
12	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict

Test results of IEC / EN 61730-1

4 Classification, application and intended use			**-**
4.1 General			-
-	The module has been evaluated for the following Class (IEC 61140) ..... :	II	-
4.5 Intended use			-
PV modules are installed in the following special applications:			-
a)	Building attached PV (BAPV)	N/A	-
b)	Building integrated PV (BIPV)	N/A	-
c)	Applications in areas where snow and / or wind load exceeding loads as tested in IEC 61730-2 are expected	N/A	-
d)	Applications at environmental temperature exceeding the limits indicated in 5.1 of IEC 61730-1	N/A	-
e) - j)	Other (e to j as listed in 4.5 of IEC 61730-1, please specify)	N/A	-
Supplementary information: N/A			-

Remark:

Classification as in IEC 61730-1:

Class 0: Modules rated for use in this classification have individual and/or system level electrical outputs at hazardous levels of voltage, current and power. Class 0 PV modules are intended for use in restricted access areas that are protected from public access by fences or other measures of the location that prevent general access.

Class II: Modules rated for use in this classification II have individual and/or system level electrical outputs at hazardous levels of voltage, current and power. These PV modules are intended for installation where general user access and contact to insulated live parts is anticipated.

Class III: Modules rated for use in this classification shall not have electrical ratings greater than 240W where the open-circuit voltage does not exceed 35VDC and the short-circuit current does not exceed 8 A when tested under standard test conditions. These PV modules are intended for installation where general user access and contact to uninsulated live parts is anticipated.

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5 Requirements for design and construction			**-**
5.1 General			**-**
-	All PV modules shall be suitable for operation in outdoor non-weather protected locations, exposed to direct and indirect (albedo) solar radiation, in an environmental temperature range of at least -40°C to +40°C and up to 100 % relative humidity as well as rain.	IEC 61215 and IEC 61730-2, all tests were passed.	P
-	A PV module can either be completely assembled when shipped from the factory, or be provided in subassemblies. The provided assemblies of the product shall not involve any action that is likely to affect compliance with the requirements of the IEC 61730 series. Incorporation of a PV module into the final assembly shall not require any alteration of the PV module from its originally evaluated form.	No assembly part is present.	N/A
-	The construction of a PV module shall be such that equipotential bonding continuity, if applicable, is not interrupted by installation	IEC 61730-2, MST 13 was passed	P
-	Any adjustable or movable structural part shall be provided with a locking device to reduce the likelihood of unintentional movement, if any such movement may result in a risk of fire, electric shock, or injury to persons.	No such part	N/A
-	PV modules shall not have accessible burrs, sharp edges or sharp points that can cause injury to users or service persons. Edges and points that appear to be sharp by inspection, shall comply with the sharp edge test (MST 06).	IEC 61730-2, MST06 test was passed.	P
-	Parts shall be prevented from loosening or turning if such loosening or turning may result in a risk of fire, electric shock, or injury to persons. Compliance for components is verified by specific tests described in the relevant standards or screw connection test (MST 33).	No such part	N/A

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.2 Marking and documentation			**-**
5.2.1 General			-
-	Instructions related to safety shall be in an official language of the country where the equipment is to be installed.	Installation manual with English.	P
5.2.2 Marking			-
5.2.2.1 General			-
Each PV module includes the following clear and indelible markings:			-
a)	Name, registered trade name, or registered trade mark of manufacturer	Written on the nameplate.	P
b)	Type or model number designation	Written on the nameplate.	P
c)	Serial number	Stuck beside the string connectors.	P
d)	Date and place of manufacture; alternatively serial number assuring traceability of date and place of manufacture	Traceable from serial number.	P
e)	Polarity of terminals or leads	Polarized by color / tag.	P
f)	“Maximum system voltage” or ”V_{sys}”	Written on the nameplate.	P
g)	Class of protection against electrical shock, in accordance with Clause 4 of IEC 61730-1:2016	Written on the nameplate.	P
h)	“Voltage at open-circuit” or “V_{oc}” including manufacturing tolerances	Written on the nameplate.	P
i)	“Current at short-circuit” or “I_{sc}” including manufacturing tolerances	Written on the nameplate.	P
j)	“PV module maximum power” or “P_{max}” including manufacturing tolerances	Written on the nameplate.	P
k)	“Maximum overcurrent protection rating” (compliance is verified by reverse current overload test (MST 26))	Written on the nameplate.	P
-	All electrical data shall be shown as relative to standard test conditions (STC: 1000W/m^2, 25±2°C, AM 1.5 according to IEC 60904-3).	Written on the nameplate.	P
-	International symbols shall be used where applicable.	Written on the nameplate.	P
-	PV connectors or wiring shall be marked in accordance to IEC 62852 with a symbol „Do not disconnect under load“, as given in Annex A. Symbol or warning notice shall be imprinted or labelled close to connector.	“Do not disconnect under load” is written on the connector.	P
-	PV connectors shall be clearly marked indicating the terminal polarity.	The terminal polarity is marked on the PV connectors.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
-	For Class II and Class 0 PV modules, the folowing (IEC 60417-6042: Caution, risk of electric shock) symbol shall be applied near the PV module electrical connection means. 	Written on the nameplate.	P
-	PV modules shall be marked to indicate the class according to IEC 61730-I: 2016.	Written on the nameplate.	P
-	PV modules provided with a functional earth connection shall be provided with a symbol according to 5.2.2.2.2, Figure 3.	No functional earth connection	N/A
-	PV modules provided with terminals for field wiring rated only for use with copper wire shall be marked, at or adjacent to the terminals, with the statement "Use copper wire only", "Cu only", or the equivalent.	Not required	N/A
-	PV modules provided with terminals for field wiring rated only for use with a different specific wiring material shall be marked with a similar statement referring to the rated material.	Not required	N/A
5.2.2.2 Symbols			-
5.2.2.2.1 Equipotential bonding			-
-	A wiring terminal or bonding location of a PV module intended to accommodate a field installed bonding conductor for equipotential bonding is identified with the appropriate symbol IEC 60417-5021 (DB:2002-10) (Figure 2)). Alternatively IEC 60417-5017 (Figure 1) can be used. No other terminal or location shall be identified in this manner.	Printed on the frame	N/A
5.2.2.2.2 Functional earthing			-
-	A wiring terminal or bonding location of a PV module intended to accommodate a field installed functional earthing conductor is identified with the appropriate symbol (IEC 60417-5018 (DB: 2002-10) (Figure 3).	No Functional earthing	N/A
5.2.3 Documentation			-
-	PV modules shall be supplied with documentation describing the methods of electrical and mechanical installation as well as the electrical ratings of the PV module.	Written in installation manual.	P
-	The documentation shall state the Class under which the PV module was qualified and any specific limitations required for that Class.	Written in installation manual.	P
-	The documentation shall state the environmental conditions to which the module has been qualified which by default includes a temperature range of -40°C to +40°C.	Written in installation manual.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
-	The documentation shall state the environmental conditions to which the module has been qualified which by default includes wind / snow load including safety factor.	Written in installation manual.	P
-	It shall be ensured that appropriate documentation for safe installation, use, and maintenance is available to installers and operators.	Written in installation manual.	P
The documentation shall contain the following information:			-
-	All information required by 5.2.2.1 with exception of c), d) and e)	See above	P
-	Recommended maximum series / parallel PV module configurations	Written in installation manual.	P
-	The current rating of overcurrent protection, as determined in MST 26	Written on the nameplate.	P
-	Manufacturer's stated tolerance for V_{oc}, I_{sc} and maximum power output P_{max} under standard test conditions	Written on the nameplate.	P
-	Temperature coefficient for voltage at open-circuit.	Written in installation manual.	P
-	Temperature coefficient for maximum power.	Written in installation manual.	P
-	Temperature coefficient for short-circuit current.	Written in installation manual.	P
-	All electrical data shall be shown as relative to standard test conditions (1000 W/m^2, (25 $\pm$ 2)°C, AM 1.5 according to IEC 60904-3).	Written on the nameplate.	P
-	International symbols shall be used where applicable.	Written on the nameplate.	P
The electrical documentation shall include a detailed description of the electrical installation wiring method to be used. This description shall include:			-
-	The minimum cable diameters for PV modules intended for field wiring	Written in installation manual.	P
-	Any limitations on wiring methods and wire management that apply to the junction box for the PV module	Written in installation manual.	P
-	The size, type, material, and temperature rating of the conductors to be used	Written in installation manual.	P
-	Type of terminals for field wiring	Written in installation manual.	P
-	Specific PV connector model / types and manufacturer to which the PV module connectors can be mated	Written in installation manual.	P
-	The bonding method(s) to be used (if applicable) shall be specified. All provided or specified hardware shall be identified in the documentation.	Written in installation manual.	P
-	The type and ratings of bypass diode to be used (if applicable)	Written in installation manual.	P
-	Limitations to the mounting situation (e.g. slope,	Written in installation manual.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
	mounting means, cooling)		
-	A statement indicating the fire rating(s) and the applied standard, or a statement that resistance to external fire sources was not evaluated, as well as the limitations to that rating (e.g. installation slope, sub structure or other applicable installation information)	Written in installation manual.	P
-	A statement indicating the minimum mechanical means for securing the PV module (as evaluated during the mechanical load test (MST 34))	Written in installation manual.	P
-	A statement indicating the maximum altitude the PV module is designed for. De-ratings can be applied.	Written in installation manual.	P
The documentation for roof mounting shall include:			-
-	A statement indicating the minimum mechanical means for securing the PV module to the roof (as evaluated during the mechanical load test according (MST 34)	Written in installation manual.	P
-	Details of the specific parameter(s) when the fire rating is dependent on a specific mounting structure, specific spacing, or specific means of attachment to the roof or structure.	Written in installation manual.	P
-	The documentation shall include a statement advising that external or otherwise artificially concentrated sunlight shall not be directed onto the front or back face of the PV module (if not qualified for).	Written in installation manual.	P
-	Assembly instructions shall be provided with a product shipped in subassemblies, and shall be detailed and adequate to the degree required to facilitate complete and safe assembly of the product to specifications set forth in the IEC 61730 standard series.	Not applicable	N/A
-	To facilitate proper system sizing the manufacturer shall include relevant parameters in the installation instructions that allow system layout based not only on STC values given in the documentation. For example a safety factor for V_{oc} and I_{sc} of 1.25 is recommended since irradiance is often higher then 1000 W/m^2 and temperature below 25°C may raise V_{oc}. A statement as suggested in IEC 61730:2016 is recommended.	Written in installation manual.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.3 Electrical components and insulation			-
5.3.2 Internal wiring			-
-	Internal wiring shall have sufficient current carrying capacity for the relevant application.	Cable was certified according to EN 50618 / IEC 62930	P
5.3.4 Connectors			-
-	External DC connectors shall fulfil the requirements of IEC 62852.	Connector was certified according to IEC 62852.	P
5.3.5 Junction boxes for PV modules			-
-	Junction boxes for PV modules shall fulfil the requirements of IEC 62790.	Junction box was certified according to IEC 62790.	P
5.3.6 Frontsheets and backsheets			-
-	Polymeric frontsheets and backsheets shall meet relevant requirements of section 5.5.2	Relevant test of IEC 61730-2 was passed.	P
-	If these sheets are used as relied upon insulation they shall fulfil requirements of 5.6.4.3 and 5.5.2.3 for insulation in thin layers	Relevant test of IEC 61730-2 was passed.	P
5.3.7 Insulation barriers			-
-	A polymeric insulation barrier shall meet the relevant requirements of 5.5.2	Relevant test of IEC 61730-2 was passed.	P
5.3.8 Electrical connections			-
5.3.8.1 General			-
-	External wires and cables shall fulfil the requirements of EN 50618 or IEC 62930.	Cable was certified according to EN 50618 / IEC 62930	P
-	External DC connectors shall fulfil the requirements of IEC 62852.	Connectors was certified according to IEC 62852.	P
-	Junction boxes for PV modules shall fulfil the requirements of IEC 62790.	Junction box is certified according to IEC 62790.	P
-	Prevention shall be taken that connections do not become loose, e.g. by using a washer.	No such terminal.	N/A
-	Precautions shall be taken that under operation clamping units or other terminations are prevented from thermal and mechanical stress which might impair electrical conductivity.	No such terminal.	N/A
5.3.8.2 Terminals for external cables and PV connector ribbons			-
-	Terminals for electrical connections shall be suitable for the type and range of conductor cross-sectional areas according to specification of the manufacturer. They shall meet the requirements of IEC 62790.	Junction box is certified according to IEC 62790.	P
-	Insulated terminals shall be designed in a manner where a possible displacement that may result in a reduction of clearances and creepage distances is prevented.	Junction box is certified according to IEC 62790.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.3.8.3 Splices and connections inside a PV module			-
-	Splices and connections inside a PV module other than those for terminals of external cables and PV connector ribbons shall be mechanically secured and shall provide electrical continuity. Electrical connections shall be soldered, welded, conductively adhered, crimped, or otherwise securely connected. A soldered or conductively adhered joint shall be additionally mechanically secured.	No splice. Electrical connections is soldered.	P
5.3.9 Encapsulants			-
a)	The rated operating temperature range of the encapsulant shall include the temperature range of the intended application.	Relevant test of IEC 61730-2 was passed.	P
b)	The material group, the insulation resistance and the dielectric strength of the encapsulant shall be suitable for the intended application.	Relevant test of IEC 61730-2 was passed.	P
5.3.10 Bypass diodes			-
-	Bypass diodes shall be rated to withstand the current and voltage for their intended use.	IEC 61730-2, MST25 test was passed.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.4 Mechanical and electromechanical connections			-
5.4.1 General			-
-	Mechanical connections shall be able to durably withstand the thermal, mechanical, and environmental stresses occurring in the application without decreasing the integrity of the connection below safe levels.	Connections are mechanically secure.	P
-	Parts intended to be removed shall only be detachable with the aid of tools.	No such part.	N/A
-	For mechanical connections friction between surfaces, such as simple spring pressure, is not acceptable as the sole means to inhibit the turning or loosening of a part.	No such part.	N/A
5.4.2 Screw connections			-
-	Screws and mechanical connections, the failure of which might cause the PV module to become unsafe, shall withstand the mechanical stresses occurring in normal use. Screws shall not be made of a material which is soft or liable to creep.	No screw is used.	N/A
-	Screws used to provide mechanical stability and continuity for equipotential bonding, e.g. fixing screws in frames and other components, shall withstand the mechanical stresses occurring in normal use. At least one screw per electrical- mechanical connection shall ensure the electrical connection between the metallic components.	No screw is used.	N/A
-	Screws used for mechanical and electrical connections with a nominal diameter of less than 3 mm shall screw into metal.	No screw is used.	N/A
-	For screws used for mechanical and electrical connections two full threads shall engage into the metal.	No screw is used.	N/A
-	Screwed and other fixed connections between different parts of the PV module shall be made in such a way that they do not come loose through torsion, bending stresses, vibration, etc., as may occur in normal use.	No screw is used.	N/A
5.4.3 Rivets			-
-	Rivets which serve as electrical as well as mechanical connections are locked against loosening. A noncircular shank or an appropriate notch may be sufficient.	No rivets is used.	N/A

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.4.4 Thread-cutting screws			-
-	Thread-cutting screws and self-tapping screws shall not be used for the interconnection of current-carrying parts made of metal which is soft or liable to creep, such as zinc or aluminium.	No screw is used.	N/A
	Thread-forming screws (sheet metal screws) shall not be used for the connection of cur3rent-carrying part, unless they clamp these parts directly in contact with each other, and are provided with suitable locking means.	No screw is used.	N/A
	Thread-cutting (self-tapping) screws shall not be used for the connection of current-carrying parts unless they generate a full form standard machine screw thread. However, screws of the latter type shall not be used if they are likely to be operated by the user or installer	No screw is used.	N/A
	Threat-cutting and threat-forming screws, used to provide continuity for equipotential bonding, shall be such that it is not necessary to disturb the connection in normal use.	No screw is used.	N/A
	For equipotential bonding one screw is permitted if two full threads engaged the metal.	No screw is used.	N/A
5.4.5 Form/press / tight fit			-
-	Form/press/tight fits of metallic components not separately equipotential bonded need to be electrically connected.	No such part	N/A
5.4.6 Connections by adhesives			-
-	Adhesion of a polymer relied upon for insulation to another insulating layer shall be appropriate for the application.	No such part	N/A
-	If the connection by adhesive should be considered as cemented joint the requirements according to 5.6.4.2 shall be applied.	No such part	N/A
5.4.7 Other connections			-
-	Other connections such as, for example, welded or soldered, were investigated by visual inspection (MST 01). Other connections which are relied upon for equipotential bonding were checked with test of continuity of equipotential bonding (MST 13). Materials and processes for creating the connections shall be appropriate for the intended use.	No such part	N/A

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.5 Materials			-
5.5.2 Polymeric materials			-
5.5.2.1 General			-
-	Polymeric parts which ensure either the electrical or mechanical safety of the PV module, or both, shall be resistant to electrical and mechanical property degradation and shall apply with the requirement of the materials creep test (MST37) depending on their constructive function in the PV module.	Relevant tests of IEC 61730-2 were passed.	P
5.5.2.3 Polymeric materials used as electrical insulation			-
5.5.2.3.3 Endurance to thermal stress - RTE(RTI) or TI (mechanical / electrical)			-
-	Materials used as relied upon insulation shall have a minimum relative thermal endurance, relative thermal index or temperature index (RTE/RTI or TI) in accordance with IEC 60216-5 or IEC 60216-1 equal to or greater than the maximum normalized operating temperature of the material as measured in the particular mounting situation (e.g. roof mounted) during the temperature test (MST 21), or 90 °C, whichever is higher.	RTE/RTI or TI of backsheet is above the test values during the temperature test (MST 21), or above 90 °C, whichever is higher.	P
5.5.2.3.4 Polymeric insulating materials used as external parts			-
External polymeric parts of the PV module whose deterioration could impair the safety shall meet the following additional requirements:			-
a)	Flammability class minimum V-1 according to IEC 60695-11-10 (not applicable to insulation in thin layers; those are covered only by MST 24)	Not applicable.	N/A
b)	Ball pressure test according to IEC 60695-10-2 with a temperature of 75 °C (not applicable to insulation in thin layers)	Not applicable.	N/A
c)	Ignitability test (MST 24) in final application (laminated or the PV module)	IEC 61730-2 MST24 was passed.	P
d)	Peel test for proof of cemented joints according to IEC 61730-2 (MST 35), where applicable.	Not applicable.	N/A
e)	Lap shear strength test (MST 36), where applicable.	Not applicable.	N/A
5.5.2.3.5 Polymeric insulating parts supporting live parts			-
-	External parts of non-metallic material, parts of insulating material supporting live parts including connections, and parts of polymeric material providing supplementary insulation or reinforced insulation, shall be sufficiently resistant to heat if their deterioration could cause the PV module to fail to comply with this standard.	Yes	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.5.2.4 Polymeric materials used for mechanical functions			-
-	Materials used for mechanical functions shall have a minimum mechanical relative thermal endurance, relative thermal index or temperature index (RTE/RTI or TI) equal or greater than the max. normalized operating temperature of the material as measured in the particular mounting situation during temperature test (MST21), or 90°C, whichever is higher.	Yes	P
5.5.3 Metallic materials			-
5.5.3.1 General			-
-	In accordance with IEC 60950-1 metal parts designed for applications in climates with wet or humid ambient conditions shall not be in contact to metal parts that have a difference of their electrochemical potentials of more than 600 mV. Larger electrochemical potential differences are permissible if the contact points of these materials are designed to remain dry.	The frame is Anodized aluminum alloy. Relevant tests of IEC 61730-2 were passed.	P
-	Iron or mild steel as a part of the product shall be plated, painted, or enamelled for protection against corrosion. The corrosion protection at a minimum shall be at least equivalent to a zinc coating of 0.015 mm thickness.	Relevant tests of IEC 61730-2 were passed.	P
5.5.3.2 Current carrying parts			-
-	Under normal operation current-carrying parts shall have a sufficient mechanical strength and electrical conductivity. If environmental conditions may cause corrosion current-carrying materials (metal, polymeric based, etc.) shall be protected against corrosion, e.g. by coating.	Relevant tests of IEC 61730-2 were passed.	P
-	In case of current-carrying parts consisting of corrosion protective coated metal the coating shall be capable of preventing corrosion according to either one of ISO 1456, ISO 1461, ISO 2081 or ISO 2093. If the current-carrying parts may be stressed by abrasion, coated metal parts are not allowed.	Relevant tests of IEC 61730-2 were passed.	P
5.5.4 Adhesives			-
-	Adhesives shall be appropriate for the application. Compliance is checked by relevant tests of IEC 61730-2, including lap shear strength test (MST 36), peel test (MST 35), robustness of terminations test (MST 42), mechanical load test (MST 34), and visual inspection (MST 01), accessibility test (MST 11), wet leakage current test (MST 17) pre- and post-test sequences, where applicable.	Relevant tests of IEC 61730-2 were passed.	P
-	Additionally, if an adhesive is part of the relied upon electrical insulation it has to meet the requirements of 5.5.2.3.3.	Relevant tests of IEC 61730-2 were passed.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.6 Protection against electric shock			-
5.6.1 General			-
-	PV modules shall be provided with adequate protection against contact with hazardous live parts and shall pose no risk of electric shock.	Relevant tests of IEC 61730-2 were passed.	P
5.6.2 Protection against accessibility to hazardous live parts			-
5.6.2.1 General			-
-	PV modules shall be constructed to provide adequate protection against accessibility to hazardous live parts (>35V DC).	Relevant tests of IEC 61730-2 were passed.	P
-	For Class 0 PV modules, accessible parts shall be separated from hazardous live parts by at least basic insulation. Compliance is checked by visual inspection (MST 01) and by accessibility test (MST 11).	Not applicable.	N/A
-	Class II PV modules shall be so constructed and enclosed that only parts separated from hazardous live parts by double or reinforced insulation are accessible. Compliance is checked by visual inspection (MST 01) and by accessibility test (MST 11).	Class II, compliance is checked by visual inspection (MST 01) and by accessibility test (MST 11).	P
-	In Class III PV modules live parts are not considered as hazardous, so a separation from accessible parts is not needed. To ensure sufficient functionality and protection against hazardous lighting arc, live parts of different polarity shall be separated by at least functional insulation. Compliance is checked by visual inspection (MST 01) and by accessibility test (MST 11).	Not applicable.	N/A
-	Materials used for realizing protection against accessibility of hazardous live parts by means of enclosure, insulation barrier or relied upon insulation shall comply with the requirements of 5.5.2 due to their application.	Relevant tests of IEC 61730-2 were passed.	P
5.6.2.2 Protection by means of enclosures and insulation barriers			-
-	Enclosures or insulation barriers shall be so designed that, after mounting, the live parts are not accessible.	Relevant tests of IEC 61730-2 were passed.	P
5.6.2.3 Protection by means of insulation of live parts			-
-	An insulation material providing the sole insulation between a live part and an accessible metal part, or between uninsulated live parts not of the same potential, shall be of adequate thickness and of a material appropriate for the application.	Relevant tests of IEC 61730-2 were passed.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
5.6.3 Insulation coordination			-
5.6.3.1 General			-
-	Position	Edge of module	-
5.6.3.2 Pollution degree			-
-	Pollution degree	1	-
5.6.3.3 Material group			-
-	Material group	I	-
5.6.3.4 Clearances (cl) and creepage distances (cr)			-
-	Min. determined creepage distance	15.0 mm	P
-	The module type has been evaluated for the following system voltage .....:	Vsys = 1500V	-
-	The modules are intended for a maximum operating altitude (meters above sea level) of [m] .....:	2000	-
5.6.4 Distance through insulation (dti)			-
5.6.4.1 General			-
-	The solid insulation properties of polymeric materials were verified through the tests outlined in IEC 61730-2.	Relevant tests of IEC 61730-2 were passed.	P
-	The distances through insulation (dti) are required for supplementary, double or reinforced insulation only as shown in lines 4 of Table 3 and 4 of IEC 61730-1	N/A	N/A
-	Polymeric materials for cemented insulation parts and insulation in thin layers shall withstand environmental, thermal, electrical and mechanical stresses as far as they occur. They shall comply with requirements according to 5.5.2 The insulation shall fulfil the material classification as given in IEC 60216-1, IEC 60216-2 and IEC 60216-5 (RTI/RTE/TI).	Relevant tests of IEC 61730-2 were passed.	P
5.6.4.2 Cemented joints			-
-	Cemented joints were considered	No	N/A
5.6.4.3 Insulation in thin layers			-
-	Thickness of relied upon insulation was checked by insulation thickness test (MST 04) in final application.	Relevant tests of IEC 61730-2 were passed.	P

IEC / EN 61730-1			
Clause	Requirement + Test	Result - Remark	Verdict
a)	Single-layer sheet - Minimum thickness according to lines 1b) of Table 3 and Table 4, as applicable depending on class (see table 1). Exception: The minimum thickness for a single layer is 30µm, even for system voltages < 600 V, since pinholes may be present. For thicknesses < 30µm a multilayer concept shall be adopted to mitigate risk. - RTI / RTE / TI as defined in 5.5.2.3.3. - Dielectric strength for reinforced insulation.	No such part	N/A
b)	Multi-layer sheets - The sum of thickness of all layers providing relied upon insulation shall be in compliance with values according to lines 1b) of Table 3 and Table 4, as applicable depending on class (see table 1). Each layer of a multi-layer (e.g. 2 layers, see Figure 4, example b1) and b2)) sheet providing relied upon insulation shall meet the following requirements: - RTI / RTE / TI as defined in 5.5.2.3.3. - Dielectric strength for basic insulation. If single layers are not characterized individually the following applies: The combined thickness of all layers (more and including 2 layers, see Figure 4, example b1), b2) and c)) providing relied upon insulation shall be in compliance with values according to Table 3 and Table 4 as applicable depending on class (see Table 1). RTI / RTE / TI shall be determined in the full layer stack or each layer providing relied upon insulation shall meet RTI / RTE / TI as defined in 5.5.2.3.3. Any changes in the stack or application require a new RTI / RTE / TI evaluation. Dielectric strength of entire multi-layer sheet providing relied upon insulation shall fulfill requirements for reinforced insulation.	Relevant tests of IEC 61730-2 were passed.	P
Supplementary information: N/A			

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

Test results of IEC / EN 61730-2

Module type: CSUN660-132MH

10.2 Visual inspection (initial) - MQT01/MST01		-
Test date [MM/DD/YYYY].....:	10/04/2021	-
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
5	No visual defects	P
7	No visual defects	P
Supplementary information: N/A		

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.4 Maximum power determination (initial) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:			10/09/2021				-
Ambient temperature [°C].....:			Corrected to 25.0				-
Irradiance [W/m^2].....:			Corrected to 1000				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
2	45.57	38.09	17.99	17.21	655.6	79.97	-
3	45.55	38.12	17.99	17.20	655.6	80.02	-
5	45.57	38.11	18.02	17.24	656.9	80.01	-
7	45.58	38.12	18.00	17.22	656.3	79.99	-
Supplementary information: N/A							

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.13 Insulation test (initial) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		10/09/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
2	12.9	>1000	No	P
3	12.9	>1000	No	P
5	12.9	>1000	No	P
7	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.14 Wet leakage current test (initial) - MQT15/MST17			-
Test date [MM/DD/YYYY].....:		10/09/2021	-
Test voltage applied [V].....:		2 minutes of 1500	-
Solution resistivity [Ω/cm] / <3500 .....:		2347	-
Solution temperature [°C] / 22±2 .....:		22.5	-
Sample #	Required [MΩ]	Measured [MΩ]	-
2	12.9	>1000	P
3	12.9	>1000	P
5	12.9	>1000	P
7	12.9	>1000	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.			

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.15 Temperature test - MST21				-
Sample #.....:		7		-
Test date [MM/DD/YYYY].....:		12/13/2021		-
Reference solar irradiance [W/m²].....:		974		-
Reference ambient temperature [°C]....:		40.0		-
Spacing between module and black test platform [cm] .....:		0		-
Measuring location.....:		A: Module superstrate above the center cell B: Module substrate below the center cell C: Terminal enclosure interior surface D: Terminal enclosure interior air space E: Field wiring terminals F: Insulation of the field wiring leads G: External connector bodies H: Diode bodies I: The boundary between frame and silica gel J: Ambient temperature		-
Measuring location	Component temperature limit [°C]	Component temperature T_{OBS} [°C]	Normalized temperature T_{CON} [°C]	-
A	N/A	67.2	67.2	N/A
B	105	70.7	70.7	P
C	N/A	N/A	N/A	N/A
D	N/A	N/A	N/A	N/A
E	120	60.2	60.2	P
F	120	53.4	53.4	P
G	110	52.1	52.1	P
H	N/A	N/A	N/A	N/A
I	N/A	65.8	65.8	N/A
J	20 - 55	40	40.0	P
Supplementary information: $T_{CON} = T_{OBS} + (40\ °C - T_{ENV})$, Solar simulator method used.				
10.2 Visual inspection (after temperature test) - MQT01/MST01				-
Test date [MM/DD/YYYY].....:		12/13/2021		-
Sample #	Nature and position of initial findings - comments or attach photos			-
7	No visual defects			P
Supplementary information: N/A				

IEC / EN 61730-2				
Clause	Requirement + Test	Result - Remark		Verdict
10.13 Insulation test (after temperature test) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		12/13/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
7	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m2. Area of the module is 3.10m^2.				
10.14 Wet leakage current test (after temperature test) - MQT15/MST17				-
Test date [MM/DD/YYYY].....:		12/13/2021		-
Test voltage applied [V].....:		2 minutes of 1500		-
Solution resistivity [Ω/cm] / <3500 .....:		2212		-
Solution temperature [°C] / 22±2 .....:		21.8		-
Sample #	Required [MΩ]	Measured [MΩ]		-
7	12.9	>1000		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.20 Reverse current overload test - MST26				-
Test date [MM/DD/YYYY].....:		12/14/2021		-
Module over-current protection rating [A] .....:		30		-
Current applied[A] .....:		40.5		-
Voltage applied[V] / high - low .....:		62.8 - 55.3		-
Test duration [hour] .....:		2		-
Sample #	Requirements			-
7	☒ No flaming of the module ☒ No flaming or charring of the tissue paper			P
Supplementary information: N/A				
10.2 Visual inspection (after reverse current overload test) - MQT01/MST01				-
Test date [MM/DD/YYYY].....:		12/14/2021		-
Sample #	Nature and position of initial findings - comments or attach photos			-
7	No visual defects			P
Supplementary information: N/A				
10.13 Insulation test (after reverse current overload test) - MQT03/MST16				-
Test date [MM/DD/YYYY].....:		12/14/2021		-
Test voltage applied [V].....:		2 minutes of 1500 and 1 minute of 8000		-
Sample #	Required [MΩ]	Measured [MΩ]	Dielectric breakdown?	-
7	12.9	>1000	No	P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m2. Area of the module is 3.10m^2.				
10.14 Wet leakage current test (after reverse current overload test) - MQT15/MST17				-
Test date [MM/DD/YYYY].....:		12/14/2021		-
Test voltage applied [V].....:		2 minutes of 1500		-
Solution resistivity [Ω/cm] / <3500 .....:		2074		-
Solution temperature [°C] / 22±2 .....:		22.6		-
Sample #	Required [MΩ]	Measured [MΩ]		-
7	12.9	>1000		P
Supplementary information: Minimum requirement according to the standard is 40MΩ·m^2. Area of the module is 3.10m^2.				

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict
10.2 Visual inspection (final, after 48-96h wait time) - MQT01/MST01			-
Sample #	Nature and position of initial findings - comments or attach photos		-
3	No visual defects		P
5	No visual defects		P
Supplementary information: N/A			

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.11 Continuity test of equipotential bonding (final) - MST13				-
Test date [MM/DD/YYYY].....:		12/14/2021		-
Current applied [A] .....:		75		-
Location of designated grounding point:		The ground hole of one longer side		-
Location of second contacting point .....:		A: The center of another longer side B: Adjacent shorter side with greatest distance from the grounding point C: The center of the other shorter side		-
Sample #	Required resistance [Ω]	Measured voltage [V]	Calculated resistance [Ω]	-
5	<0.1	N/A	A: 0.005 B: 0.005 C: 0.004	P
Supplementary information: N/A				

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.4 Maximum power determination (final) - MQT02/MST03							-
Test date [MM/DD/YYYY].....:			12/14/2021				-
Ambient temperature [°C].....:			Corrected to 25.0				-
Irradiance [W/m^2].....:			Corrected to 1000				-
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]	-
2	45.31	37.77	18.03	17.26	652.0	79.56	P
3	45.41	37.82	17.98	17.22	651.7	79.80	P
5	45.54	37.85	17.64	16.85	637.9	79.41	P
7	45.44	37.79	18.04	17.26	652.3	79.58	P
Supplementary information: The IV curve show no additional kinks or other unusual characteristics as compared to the initial IV curve.							

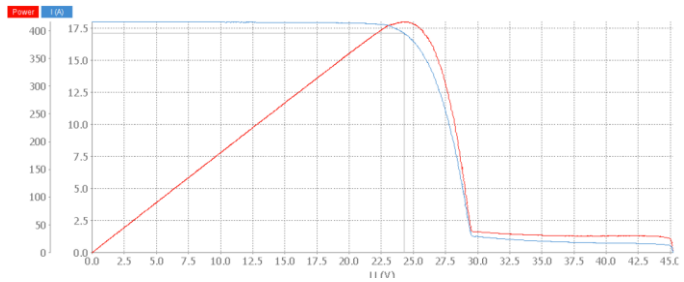
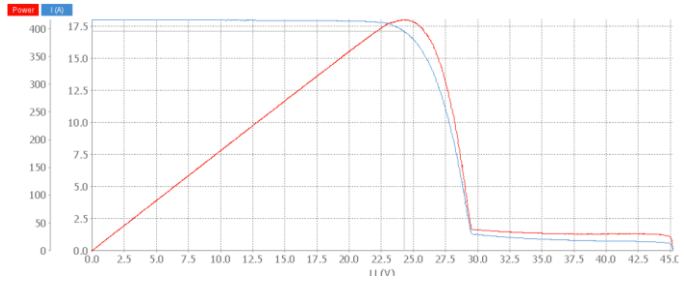
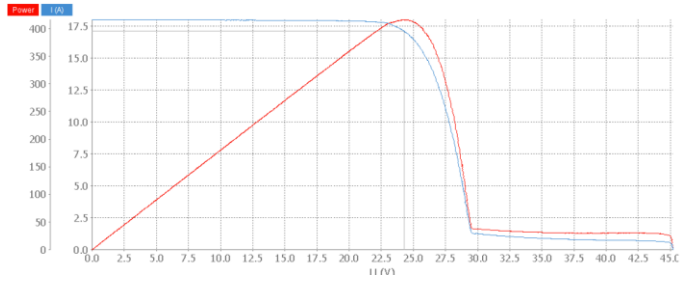
IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.6 Durability of markings - MST05		-
Test date [MM/DD/YYYY].....:	12/15/2021	-
Sample #	Requirements	-
1	☒ Marking is legible ☒ Not possible to remove marking plates easily ☒ No curling occurred	P
2	☒ Marking is legible ☒ Not possible to remove marking plates easily ☒ No curling occurred	P
3	☒ Marking is legible ☒ Not possible to remove marking plates easily ☒ No curling occurred	P
5	☒ Marking is legible ☒ Not possible to remove marking plates easily ☒ No curling occurred	P
7	☒ Marking is legible ☒ Not possible to remove marking plates easily ☒ No curling occurred	P
Supplementary information: N/A		

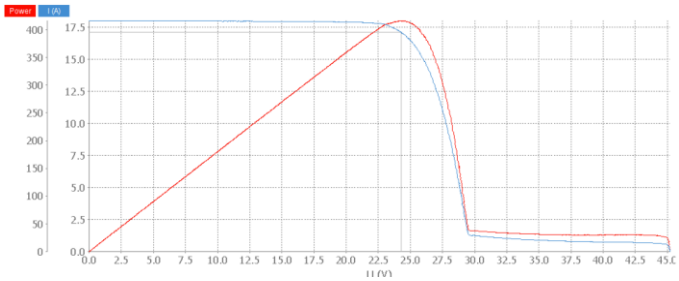
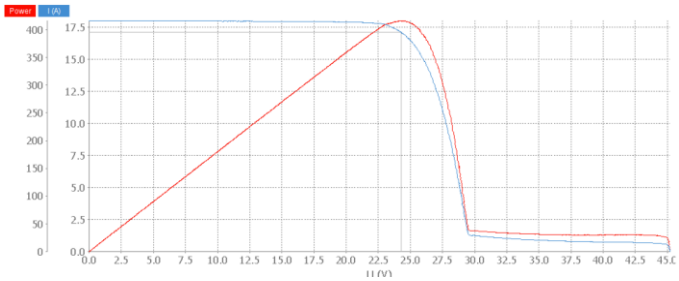
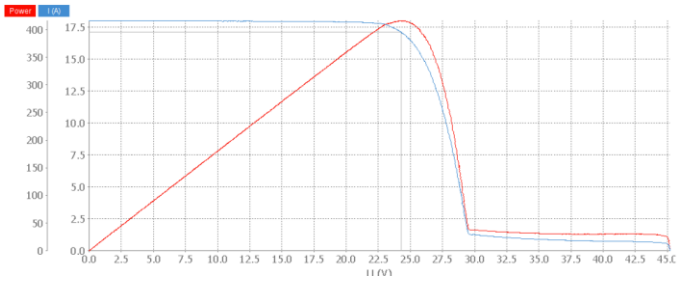
IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.7 Sharp edge test - MST06		-
Test date [MM/DD/YYYY].....:	12/15/2021	-
Sample #	Requirements	-
1	☒ No sharp edges, burrs, etc. ☒ Smooth surfaces	P
2	☒ No sharp edges, burrs, etc. ☒ Smooth surfaces	P
3	☒ No sharp edges, burrs, etc. ☒ Smooth surfaces	P
5	☒ No sharp edges, burrs, etc. ☒ Smooth surfaces	P
7	☒ No sharp edges, burrs, etc. ☒ Smooth surfaces	P
Supplementary information: Compliance is checked by inspection.		

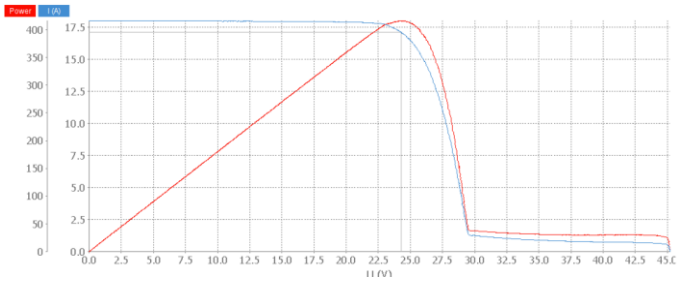
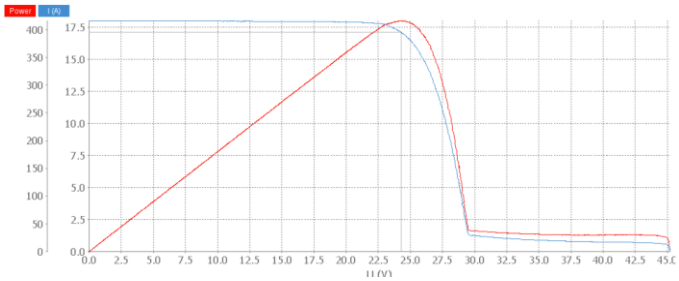
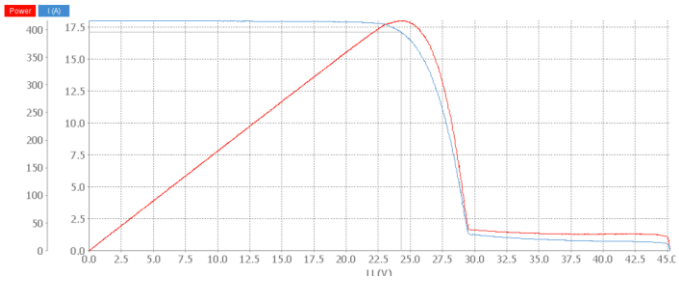
IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

10.8 Bypass diode functionality test - MQT18.2/MST07		-
Sample #.....:	1	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A] .....:	N/A	-
$V_{FMrated}$ [V] .....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading	P
1		P
2		P
3		P
Supplementary information: N/A		

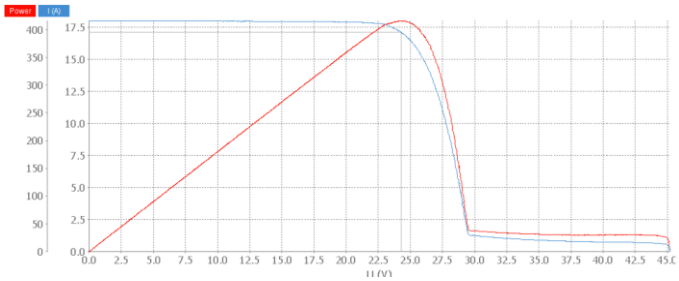
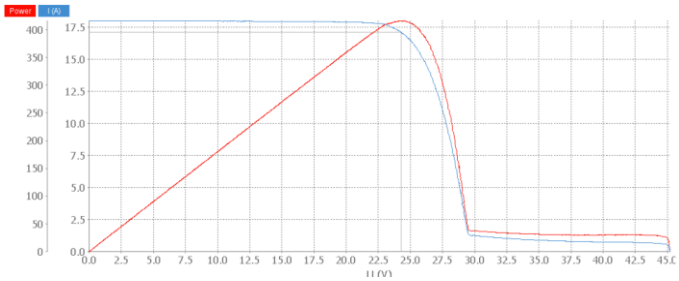
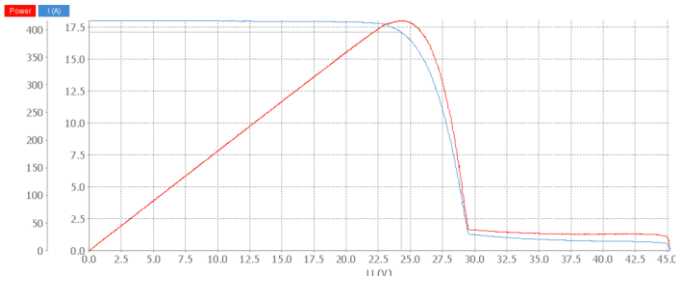
IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

Sample #.....:	2	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A].....:	N/A	-
$V_{FMrated}$ [V].....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading	P
1		P
2		P
3		P
Supplementary information: N/A		

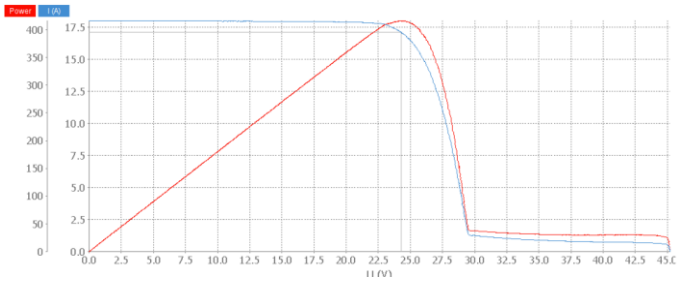
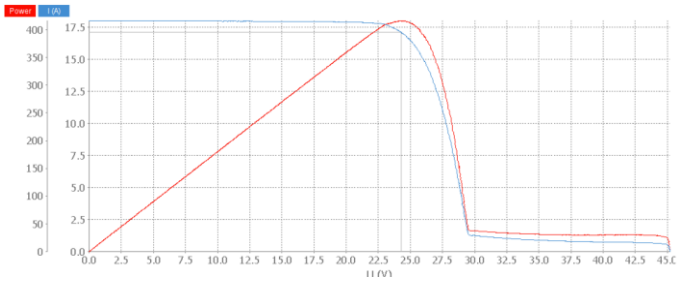
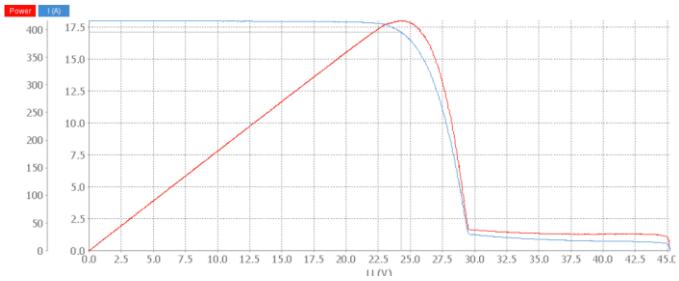
IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

Sample #.....:	3	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A].....:	N/A	-
$V_{FMrated}$ [V].....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading	P
1		P
2		P
3		P
Supplementary information: N/A		

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

Sample #.....:	5	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A] .....:	N/A	-
$V_{FMrated}$ [V] .....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading	P
1		P
2		P
3		P
Supplementary information: N/A		

IEC / EN 61730-2			
Clause	Requirement + Test	Result - Remark	Verdict

Sample #.....:	7	-
Test date [MM/DD/YYYY].....:	12/14/2021	-
☐ Method A		-
Ambient temperature [°C].....:	N/A	-
Current flow applied [A] .....:	N/A	-
$V_{FMrated}$ [V] .....:	N/A	-
N x $V_{FMrated}$ [V].....:	N/A	-
Measured VFM [V].....:	N/A	N/A
☒ Method B		-
Diode #	IV curve after shading	P
1		P
2		P
3		P
Supplementary information: N/A		

Annex 1: Constructional Data Form (CDF)

File No.: PVP07070/21P-02 Attached to Test Report No.: 492011836.002

CDF (Constructional Data Form) for Electrical Products

Applicant	CSUN Solar Tech Co., Ltd No.6, Shuige Road, Jiangning District, Nanjing City, 211106, Jiangsu Province, P.R. China
Manufacturer	NINGBO LEFENG NEW ENERGY CO., LTD. No. 37 Jingang Road, Sizhoutou Town Industrial Park, Xiangshan County, Ningbo City, Zhejiang Province, P.R. China
Product	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
Standard(s)	IEC / EN 61215-1:2016; IEC / EN 61215-1-1:2016; IEC 61215-2:2016 / EN 61215-2:2017 + AC:2017 + AC:2018; IEC 61730-1:2016 / EN IEC 61730-1:2018 + AC:2018; IEC 61730-2:2016 / EN IEC 61730-2:2018 + AC:2018
Trade mark	CSUN energy for today
Module type(s)	**PV Modules with 6" Mono-crystalline Half-cut Silicon Solar Cells:** 144 cells: CSUNxxx-144MH (xxx=425-460, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=415-440, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=390-420, in increment of 5) 144 cells: CSUNxxx-144MH-BB (xxx=385-400, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=355-380, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=355-365, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=325-340, in increment of 5) 120 cells: CSUNxxx-120MH-BB (xxx=320-330, in increment of 5) **PV Modules with 7" Mono-crystalline Half-cut Silicon Solar Cells:** 156 cells: CSUNxxx-156MH (xxx=580-600, in increment of 5) 144 cells: CSUNxxx-144MH (xxx=535-550, in increment of 5) 132 cells: CSUNxxx-132MH (xxx=490-505, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=445-460, in increment of 5) **PV Modules with 8" Mono-crystalline Half-cut Silicon Solar Cells:** 132 cells: CSUNxxx-132MH (xxx=645-670, in increment of 5) 120 cells: CSUNxxx-120MH (xxx=585-610, in increment of 5)

Electrical ratings:

Module type	144 cells: CSUNxxx-144MH (xxx=425-460, in increment of 5) for 6" mono cell 2		
Dimensions [mm] / l x w x h	2094 x 1038 x 35		
Rated Pmpp [W]	425; 430; 435; 440; 445; 450; 455; 460	Tolerance of rated Pmpp [%]	±3.0

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Design load [Pa] / negative ..... :	1600	Safety factor / back ..... :	1.5

Module type ..... :	144 cells: CSUNxxx-144MH-BB (xxx=385-400, in increment of 5) for 6" mono cell 1		
Dimensions [mm] / l x w x h ..... :	2008 x 1002 x 35		
Rated Pmpp [W] ..... :	385; 390; 395; 400	Tolerance of rated Pmpp [%] ..... :	±3.0
Rated Voc [V] ..... :	48.30; 48.50; 48.70; 48.90	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	10.05; 10.12; 10.19; 10.26	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II
Min. creepage distance [mm] ..... :	15.525±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / front ..... :	1.5
Design load [Pa] / negative ..... :	1600	Safety factor / back ..... :	1.5

Module type ..... :	120 cells: CSUNxxx-120MH (xxx=355-380, in increment of 5) for 6" mono cell 2		
Dimensions [mm] / l x w x h ..... :	1755 x 1038 x 35		
Rated Pmpp [W] ..... :	355; 360; 365; 370; 375; 380	Tolerance of rated Pmpp [%] ..... :	±3.0
Rated Voc [V] ..... :	40.30; 40.50; 40.70; 40.90; 41.10; 41.30	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	11.27; 11.35; 11.45; 11.54; 11.62; 11.70	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II
Min. creepage distance [mm] ..... :	14.5±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / positive ..... :	1.5
Design load [Pa] / negative ..... :	1600	Safety factor / negative ..... :	1.5

Module type ..... :	120 cells: CSUNxxx-120MH-BB (xxx=355-365, in increment of 5) for 6" mono cell 2		
Dimensions [mm] / l x w x h ..... :	1755 x 1038 x 35		
Rated Pmpp [W] ..... :	355; 360; 365	Tolerance of rated Pmpp [%] ..... :	±3.0
Rated Voc [V] ..... :	40.30; 40.50; 40.70	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	11.27; 11.35; 11.45	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II

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Rated Voc [V] ..... :	48.30; 48.50; 48.70; 48.90; 49.10; 49.30; 49.50; 49.70	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	11.22; 11.30; 11.37; 11.44; 11.52; 11.59; 11.66; 11.73	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II
Min-creepage distance [mm] ..... :	14.4±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / front ..... :	1.5
Design load [Pa] / negative ..... :	1600	Safety factor / back ..... :	1.5

Module type ..... :	144 cells: CSUNxxx-144MH-BB (xxx=415-440, in increment of 5) for 6" mono cell 2		
Dimensions [mm] / l x w x h ..... :	2094 x 1038 x35		
Rated Pmpp [W] ..... :	415; 420; 425; 430; 435; 440	Tolerance of rated Pmpp [%] ..... :	±3.0
Rated Voc [V] ..... :	47.90; 48.10; 48.30; 48.50; 48.70; 48.90	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	11.06; 11.14; 11.22; 11.30; 11.37; 11.44	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II
Min-creepage distance [mm] ..... :	14.4±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / positive ..... :	1.5
Design load [Pa] / negative ..... :	1600	Safety factor / negative ..... :	1.5

Module type ..... :	144 cells: CSUNxxx-144MH (xxx=390-420, in increment of 5) for 6" mono cell 1		
Dimensions [mm] / l x w x h ..... :	2008 x 1002 x35		
Rated Pmpp [W] ..... :	390; 395; 400; 405; 410; 415; 420	Tolerance of rated Pmpp [%] ..... :	±3.0
Rated Voc [V] ..... :	48.50; 48.70; 48.90; 49.10; 49.30; 49.50; 49.70	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	10.12; 10.19; 10.26; 10.33; 10.40; 10.47; 10.54	Tolerance of rated Isc [%] ..... :	±3.5
Maximum system voltage [V] ..... :	1500	Safety class acc. to IEC 61140 ..... :	Class II
Min-creepage distance [mm] ..... :	15.525±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / front ..... :	1.5

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Min-creepage distance [mm] ..... :	14.5±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / positive ..... :	1.5
Design load [Pa] / negative..... :	1600	Safety factor / negative..... :	1.5

Module type ..... :	120 cells: CSUNxxx-120MH (xxx=325-340, in increment of 5) for 6" mono cell 1		
Dimensions [mm] / l x w x h ..... :	1684 x 1002 x 35		
Rated Pmpp [W]..... :	325; 330; 335; 340	Tolerance of rated Pmpp [%]..... :	±3.0
Rated Voc [V]..... :	40.40; 40.70; 41.00; 41.20	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	10.27; 10.34; 10.41; 10.48	Tolerance of rated Isc [%]..... :	±3.5
Maximum system voltage [V]..... :	1500	Safety class acc. to IEC 61140..... :	Class II
Min-creepage distance [mm] ..... :	15.25±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / positive ..... :	1.5
Design load [Pa] / negative..... :	1600	Safety factor / negative..... :	1.5

Module type ..... :	120 cells: CSUNxxx-120MH-BB (xxx=320-330, in increment of 5) for 6" mono cell 1		
Dimensions [mm] / l x w x h ..... :	1684 x 1002 x 35		
Rated Pmpp [W]..... :	320; 325; 330	Tolerance of rated Pmpp [%]..... :	±3.0
Rated Voc [V]..... :	40.20; 40.40; 40.70	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	10.20; 10.27; 10.34	Tolerance of rated Isc [%]..... :	±3.5
Maximum system voltage [V]..... :	1500	Safety class acc. to IEC 61140..... :	Class II
Min-creepage distance [mm] ..... :	15.25±0.5	Fuse rating [A] ..... :	20
Design load [Pa] / positive ..... :	1600	Safety factor / positive ..... :	1.5
Design load [Pa] / negative..... :	1600	Safety factor / negative..... :	1.5

Module type ..... :	156 cells: CSUNxxx-156MH (xxx=580-600, in increment of 5) for 7" mono cell 3		
Dimensions [mm] / l x w x h ..... :	2465 x 1134 x 35		
Rated Pmpp [W] ..... :	580; 585; 590; 595; 600	Tolerance of rated Pmpp [%]..... :	±3.0
Rated Voc [V]..... :	53.44; 53.61; 53.79; 53.97; 54.14	Tolerance of rated Voc [%] ..... :	±3.0
Rated Isc [A] ..... :	13.79; 13.85; 13.91; 13.97; 14.03	Tolerance of rated Isc [%]..... :	±3.5

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Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min-creepage distance [mm] :	14.9	Fuse rating [A] :	25
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

Module type :	144 cells: CSUNxxx-144MH (xxx=535-550, in increment of 5) for 7" mono cell 3		
Dimensions [mm] / l x w x h :	2279 x 1134 x 35		
Rated Pmpp [W] :	535; 540; 545; 550	Tolerance of rated Pmpp [%] :	±3.0
Rated Voc [V] :	49.35; 49.50; 49.65; 49.80	Tolerance of rated Voc [%] :	±3.0
Rated Isc [A] :	13.78; 13.85; 13.92; 13.98	Tolerance of rated Isc [%] :	±3.5
Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min-creepage distance [mm] :	15.0	Fuse rating [A] :	25
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

Module type :	132 cells: CSUNxxx-132MH (xxx=490-505, in increment of 5) for 7" mono cell 3		
Dimensions [mm] / l x w x h :	2094 x 1134 x 35		
Rated Pmpp [W] :	490; 495; 500; 505	Tolerance of rated Pmpp [%] :	±3.0
Rated Voc [V] :	45.25; 45.40; 45.55; 45.70	Tolerance of rated Voc [%] :	±3.0
Rated Isc [A] :	13.74; 13.82; 13.90; 13.97	Tolerance of rated Isc [%] :	±3.5
Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min-creepage distance [mm] :	15.0	Fuse rating [A] :	25
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

Module type :	120 cells: CSUNxxx-120MH (xxx=445-460, in increment of 5) for 7" mono cell 3		
Dimensions [mm] / l x w x h :	1903 x 1134 x 35		
Rated Pmpp [W] :	445; 450; 455; 460	Tolerance of rated Pmpp [%] :	±3.0

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Rated Voc [V] :	41.10; 41.25; 41.40; 41.55	Tolerance of rated Voc [%] :	±3.0
Rated Isc [A] :	13.75; 13.82; 13.89; 13.96	Tolerance of rated Isc [%] :	±3.5
Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min. creepage distance [mm] :	14.7	Fuse rating [A] :	25
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

Module type :	132 cells: CSUNxxx-132MH (xxx=645-670, in increment of 5) for 8" mono cell 4		
Dimensions [mm] / l x w x h :	2384 x 1303 x 35		
Rated Pmpp [W] :	645; 650; 655; 660; 665; 670	Tolerance of rated Pmpp [%] :	±3.0
Rated Voc [V] :	45.08; 45.27; 45.46; 45.65; 45.84; 46.00	Tolerance of rated Voc [%] :	±3.0
Rated Isc [A] :	18.38; 18.43; 18.46; 18.50; 18.55; 18.65	Tolerance of rated Isc [%] :	±3.5
Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min. creepage distance [mm] :	15.0	Fuse rating [A] :	30
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

Module type :	120 cells: CSUNxxx-120MH (xxx=585-610, in increment of 5) for 8" mono cell 4		
Dimensions [mm] / l x w x h :	2172 x 1303 x 35		
Rated Pmpp [W] :	585; 590; 595; 600; 605; 610	Tolerance of rated Pmpp [%] :	±3.0
Rated Voc [V] :	40.96; 41.14; 41.32; 41.50; 41.68; 41.85	Tolerance of rated Voc [%] :	±3.0
Rated Isc [A] :	18.37; 18.42; 18.46; 18.50; 18.56; 18.66	Tolerance of rated Isc [%] :	±3.5
Maximum system voltage [V] :	1500	Safety class acc. to IEC 61140 :	Class II
Min. creepage distance [mm] :	15.5	Fuse rating [A] :	30
Design load [Pa] / positive :	3600	Safety factor / front :	1.5
Design load [Pa] / negative :	1600	Safety factor / back :	1.5

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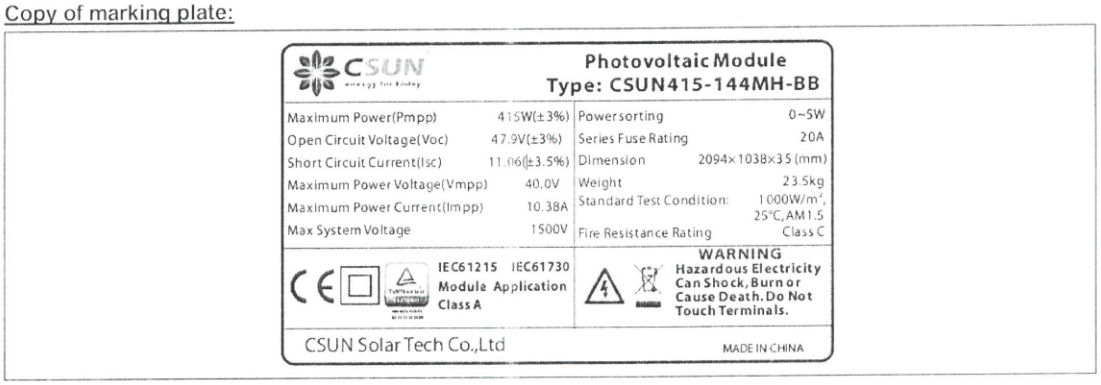
Copy of marking plate:



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List of critical materials and components:

Object	Manufacturer	Type	Technical Data	Remark
Components				
6" mono cell 1	Tongwei Solar Co., Ltd.	M1589BPERC	Dimension (w x l) = 158.75 mm x 79.375 mm±0.25mm Thickness = 180±15 µm Cell area = 126.008 cm^2 9 busbars	Tested with PV modules
6" mono cell 2	Tongwei Solar Co., Ltd.	M1669BPERC	Dimension (w x l) = 166 mm x 83 mm±0.25mm Thickness = 180±15 µm Cell area = 137.8 cm^2 9 busbars	Tested with PV modules
7" mono cell 3	JIANGSU RUNERGY YUEDA PV TECHNOLOGY CO., LTD	PM1011BF1B1	Dimension (w x l) = 182 mm x 91 mm±0.5mm Thickness = 175±17.5 µm Cell area = 165.075 cm^2 10 busbars	Tested with PV modules
8" mono cell 4	Tongwei Solar (Meishan) Co., Ltd.	M2101ZBPER CBP SE	Dimension (w x l) = 210 x 105±0.25mm Thickness = 180±18 µm Cell area = 220.48 cm^2 12 busbars	Tested with PV modules
Front cover 1	Suzhou Taiyue Solar Glass	Tempered glass with external AR coating	Thickness = 3.2mm	Tested with PV modules
Front cover 2	Wuxi Haida Glass Co., Ltd.	Tempered glass with external AR coating	Thickness = 3.2mm	Tested with PV modules
Rear cover 1 (Combine with encapsulation material 1)	Jolywood (Suzhou) Sunwatt Co., Ltd.	FFC-JW30(Plus)	Thickness = 0.315mm Fluorine resin/PET/Fluorine resin 25/275/15µm Rated voltage = 1500V CTI =600(V) Color: white or black	Tested with PV modules Certificate no. Q 50407366
Encapsulation material 1 (Combine with mono cell 1, 2, 3)	Jiangsu Lushan New Materials Co., Ltd.	EV1050G1 (front side) EV1050G5 (rear side)	EV1050G1 Thickness = 0.60mm EV1050G5 Thickness = 0.60mm CTI = 600 (V)	Tested with PV modules CTI report no. 70.407.20.100.01.00 issued by TÜV SÜD
Frame parts 1	Changzhou Kainuo Aluminum Co., Ltd. (supplier) Jiangyin ShengTong Aluminum Co., Ltd. (raw material)	6063-T5	Material: Aluminum Thickness = 35mm Color : silver	Tested with PV modules

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File No.: PVP07070/21P-02 Attached to Test Report No.: 492011836.002

Object	Manufacturer	Type	Technical Data	Remark
Frame parts 2	Suzhou LangCheng Metallic Material Co., Ltd. (supplier) Jiangyin Wangfa Technical Co., Ltd. (raw material)	6063-T5	Material: Aluminum Thickness = 35mm Color : silver	Tested with PV modules
Frame parts 3	WUHU POLYONE PHOTOVOLTAIC CO., LTD.	6063-T5	Material: Aluminum Thickness=35 mm Color : silver or black	Tested with PV modules
Adhesive (frame) 1	Changzhou Huitian New Material Co., Ltd.	HT9087	Silicone Color: white or black	Tested with PV modules
Adhesive (frame) 2	Shandong LingYu Electric Co., Ltd.	LY-688	Silicone Color: white	Tested with PV modules
Adhesive (frame) 3	Guangzhou Baiyun Chemical Industry Co., Ltd.	SMG533	Silicone Color: white	Tested with PV modules
Internal wiring (for interconnection cell-to-cell bus bar)	Wuxi Sveck Technology Co., Ltd.	Copper belt with tin plated	Φ = 0.32mm Sn60%Pb40%	Tested with PV modules
Internal wiring (for inter-string connection)	Wuxi Sveck Technology Co., Ltd.	Copper belt with tin plated	4.0 x 0.4 mm 6.0 x 0.4mm Sn60%Pb40%	Tested with PV modules
Soldering material	N/A	N/A	N/A	-
Fluxing agent 1	ASAHI Solder	SF56	-	Tested with PV modules
Fluxing agent 2	Xiamen XinJieDa Electronic Technology Co. Ltd.	NL-800	-	Tested with PV modules
Fluxing agent 3	Shenzhen Vital New Material Co., Ltd.	WTO-HV105A	-	Tested with PV modules
Fixing tape 1	3M	Transparent Film Tape 600	-	Tested with PV modules
Fixing tape 2	TERAOKA SEISAKUSHO CO., LTD.	631S#25	-	Tested with PV modules
Insulation tape 1	Taizhou Luminary Solar Technology Co., Ltd.	EPE300	Thickness = 0.3mm	Tested with PV modules
Insulation tape 2		EPE160	Thickness = 0.16mm	Tested with PV modules
Junction box set 1				
Junction box	ZHEJIANG FORSOL ENERGY CO., LTD.	F302x (x = D)	Max. Voltage=1500 VDC Rated current = 20A Number of diodes: 3	Certificate No. R 50465822
Adhesive (junction box)	Guangzhou Baiyun Chemical Industry Co., Ltd.	SMG533		Combine with rear cover 1
Potting material	Guangzhou Baiyun Chemical Industry Co., Ltd.	SKF323 AB	-	-
	Shanghai Huitian New Chemical Material Co., Ltd.	5299W-S	-	-
	TONSAN ADHESIVE INC.	1533	-	-

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File No.: PVP07070/21P-02 Attached to Test Report No.: 492011836.002

Object	Manufacturer	Type	Technical Data	Remark
Bypass diodes	ZHEJIANG FORSOL ENERGY CO., LTD.	GF3045T/MK3045	Tj max = 200°C If = 30A	-
Cable	Wuxi Xinhongye Wire & Cable Co., Ltd.	62930 IEC 131 1x4.0 mm² HALOGEN FREE LOW SMOKE	Rated voltage = 1500VDC	Certificate no. R 50439595
Connectors	ZHEJIANG FORSOL ENERGY CO., LTD.	SIKE6	Rated voltage = 1500VDC Rated current = 30A	Certificate no. R 50340749
Junction box set 2				
Junction box	Zhejiang Renhe Photovoltaic Technology Co., Ltd.	FT50xy (x= 4, y=B, D or F)	Max. Voltage=1500 VDC Rated current = 25A Number of diodes: 3	Certificate no. R 50415465
Adhesive (junction box)	Shanghai Huitian New Chemical Material Co., Ltd.	HT9067	-	Combine with rear cover 1
Potting material	Shanghai Huitian New Chemical Material Co., Ltd.	5299W/S	-	-
Bypass diodes	Zhejiang Renhe Photovoltaic Technology Co., Ltd.	FMK5040D	Tj max = 200°C If = 50A	-
Cable	Zhejiang Renhe Photovoltaic Technology Co., Ltd.	H1Z2Z2-K 1x4.0mm²	Rated voltage = 1500VDC	Certificate no. R 50318681
Connectors	Zhejiang Renhe Photovoltaic Technology Co., Ltd.	RHC2x/zu	Rated voltage = 1500VDC Rated current = 35A	Certificate no. R 50473621

Remark:

(1) Fire test Class C according to ANSI/UL 1703-2018 (MST 23 of IEC / EN 61730-2) has been evaluated on all the raw materials listed above.

(2) Pollution degree I (Sequence B1 of IEC / EN 61730-2) has been evaluated on all the raw materials listed above.

---------- End of CDF ----------

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Annex 2: List of measurement equipment

Measurement / testing	Measuring equipment	Equipment ID	Calibration due date
Visual inspection	Luminometer	TNRDTO002	12/12/2022
Maximum power determination	Pulsed Solar Simulator	TNRDEQ001	11/17/2022
Insulation test	Withstanding voltage/Insulation resistance tester	TNRDTI020	09/27/2022
Performance at STC	Pulsed Solar Simulator	TNRDEQ001	11/17/2022
Hot-spot endurance test	Steady-state solar simulator	TNRDEQ011	03/16/2022
	Pulsed Solar Simulator	TNRDEQ001	11/17/2022
Thermal cycling test	High and low temperature chamber	TNRDEQ005	04/01/2022
Damp heat test	High and low temperature chamber	TNRDEQ006	04/03/2022
Wet leakage current test	Withstanding voltage/ Insulation resistance tester	TNRDTI020	09/27/2022
Bypass diode thermal test	High and low temperature chamber	TNRDEQ008	03/16/2022
	Diode thermal performance testing system	TNRDTI027	04/09/2022
Bypass diode functionality test	Pulsed Solar Simulator	TNRDEQ001	11/07/2022
Initial stabilization	Irradiance tester	TNRDTI002	12/08/2021
Accessibility test	Test finger	TNRDTI010	04/19/2022
Continuity test of equipotential bonding	Safety tester	TNRDTI020	09/27/2022
Temperature test	Steady-state solar simulator	TNRDEQ011	03/16/2022
Reverse current overload test	DC Power Supply	TNRDTI007	12/14/2021
Sharp edge test	Sharp edge tester	TNRDTO053	03/22/2022

Annex 3: Statement of the estimated uncertainty of the test results

The total measuring uncertainty of Pmpp is ≤ 2.48%

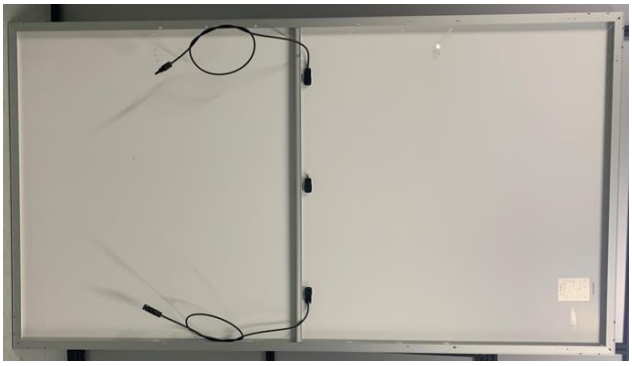
The total measuring uncertainty of Isc is ≤ 2.44%

The total measuring uncertainty of Voc is ≤ 0.90%

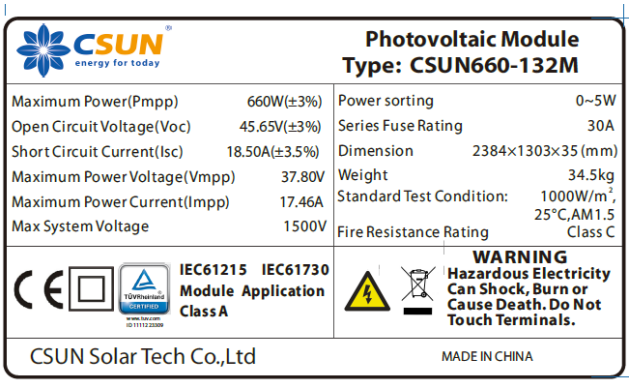
Annex 4: Photos

Module type: CSUN660-132MH

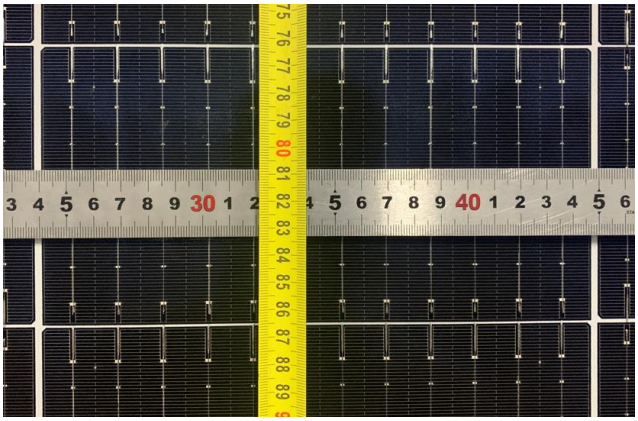
Front overview



Back overview

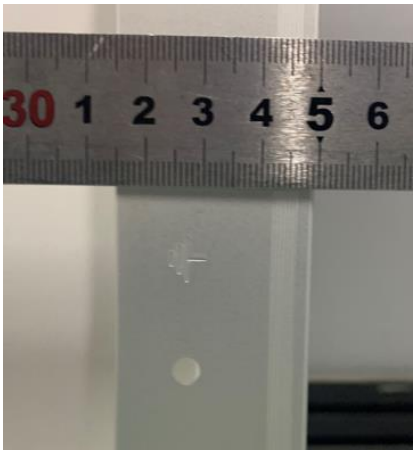


Label



Solar cell

Frame



Grounding Mark

Junction box (FT50xy)

Junction box (opened)

N/A

Bypass diode (Junction box is potted)

Cable (H1Z2Z2-K 1x4.0mm²)

Mark (Do not disconnect under load)

Connectors (RHC2)

----- End of test report -----