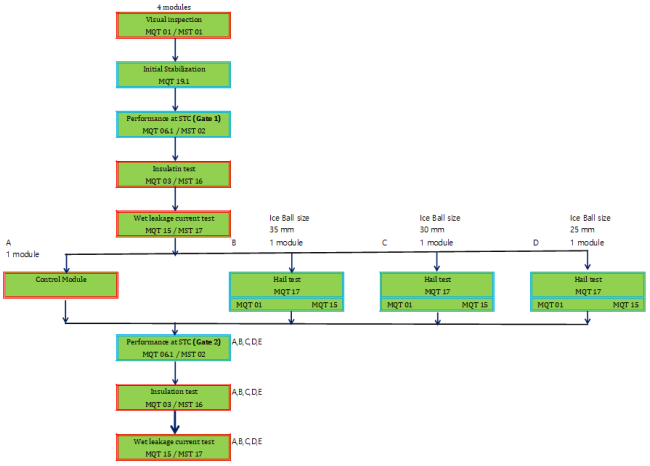
Technical Report No.: 077-2442824-000

Date: 2024-09-20

Client:	HD HYUNDAI ENERGY SOLUTIONS CO., LTD 477, Bundangsuseo-ro, Bundang-gu / Seongnam-si, Gyeonggi-do Republic of Korea Contact person: 임종엽 책임 연구원 H.P.: 010 9876 4527 E-Mail: jylim@hd.com
Test object:	Product: Photovoltaic Module Model: HiT-HxxxCE-BF, xxx=430 to 460 in step of 5 HiT-HxxxLE-FB, xxx=425 to 450 in step of 5 HiT-H450CE-BF was selected as the representative model which can cover all above listed models.
Test specification:	Partial test items of IEC 61215-2:2021 as requested by client as below.



Purpose of examination:	• Testing and evaluation (partial) according to the test specification
Test result:	See Cl. 3 Test result

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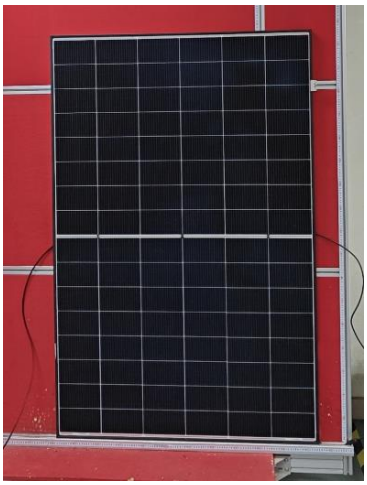
1. Description of the test object

1.1 Photo



Front

Back

1.2 Function

Apply for Max. system voltage 1500 Vd.c.
Generate DC power from Solar Energy.

1.3 Consideration of the foreseeable use

☒ Not applicable
☐ Covered through the applied standard
☐ Covered by the following comment*
☐ Covered by attached risk analysis
*

1.4 Technical Data

HD HYUNDAI ENERGY SOLUTIONS

www.hd-hyundaies.co.kr TEL:82-1522-5001
HD HYUNDAI ENERGY SOLUTIONS CO.,LTD.
477, Bundangsuseo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do,Korea

Product：PV Module
Model：HiT-H450CE-BF
STC: 1000W/m², AM1.5, Temp 25°C, BSI:1000W/m²+ φx300W/m²
BNPI: 1000W/m²+ φx135W/m², AM1.5, Temp 25°C
Accordance to IEC61215:2021 & IEC61730:2023

	STC	BNPI
Pmax 0~+3%(W):	450	504
Voc ±3%(V):	36.72	36.85
Isc ±5%(A):	15.53	17.42
Vmp(V):	30.83	30.94
Imp(A):	14.60	16.31
Power Selection:		0~+5W
Isc(BSI)(A):		19.72
Module(T98):		70°C
Min. Design Load:		+3600/-1600

Maximum System Voltage(V):	1500
Dimensions(mm):	1762×1134×30
Weight(kg):	21.8
Safety class:	Class II
Fire Rating:	Class C
Maximum Series Fuse(A):	30
φ Pmax:	90%±5%
φ Voc:	95%~100%
φ Isc:	90%±5%
Connector Type:	MC4-EVO 2
Connector Manufacture:	Stäubli Electrical

Warning-Electrical Shock Hazard
This product generates electricity when exposed to light. 85 Volts or higher can introduce a shock hazard. Please refer to installation manual before installing, operating or servicing this unit.
Product Made in P.R.C

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2. Order

2.1 Date of Purchase Order, Customer's Reference

2024-07-01

2.2 Test Sample(s)

- Reception date(s): 2024-08-23
- Location(s) of reception: Yangzhou Opto-Electrical Products Testing Institute (YOT)
  No. 10 West Kaifa Road, Yangzhou, 225009 Jiang-su, P.R. China.
- Condition of test sample(s): No major defect found.

2.3 Testing

- Testing date(s): 2024-08-23 to 2024-09-11
- Location(s) of testing: Yangzhou Opto-Electrical Products Testing Institute (YOT)
  No. 10 West Kaifa Road, Yangzhou, 225009 Jiang-su, P.R. China.

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

- None

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3. Test Results

TESTED MODULE INFORMATION			
Sample #	Type/model	Sample S/N	Remark
1	HiT-H450CE-BF	HFC52407510000274	Control Module
2	HiT-H450CE-BF	HFC52407510003547	Hail Test / 25 mm
3	HiT-H450CE-BF	HFC52407510002563	Hail Test / 30 mm
4	HiT-H450CE-BF	HFC52407510002228	Hail Test / 35 mm
Supplementary information: Tested with HiT-H450CE-BF, accepted HiT-H450LE-FB. BOM of both two models can be checked in attachment.			

Abbreviations used in the report:

P_{max} – Maximum power

V_{mp}– Maximum power voltage

I_{mp} – Maximum power current

I_{sc} – Short circuit current

V_{oc} – Open circuit voltage

STC – Standard Test Conditions (25°C, 1 000 W/m²)

FF – Fill factor

φV_{oc} - open-circuit voltage bifaciality coefficient

φP_{max} - the maximum power bifaciality coefficient

φI_{sc} – the short circuit current bifaciality coefficient

BSI - for stress on bifacial modules, corresponding to 1 000 W/m^2 on the module front and 300 W/m^2 on the module rear

BNPI - for bifacial modules, corresponding to 1 000 W/m^2 on the module front and 135 W/m^2 on the module rear

P – Pass

N/A – Fail

F - Fail

TABLE 01: MQT 01 ini: Initial Visual inspection		P
Test Date [YYYY-MM-DD] .....:	2024-08-23	—
Sample #	Nature and position of initial findings – comments or attach photos	—
1	No major visual defects found	P
2	No major visual defects found	P
3	No major visual defects found	P
4	No major visual defects found	P
Supplementary information: N/A		

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TABLE 02: MQT 19.1 ini: Initial stabilization							P
TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization (Front side)							
Test Date [YYYY-MM-DD] ..... :	2024-08-23						—
Test method ..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Result
1	14.996	36.057	14.398	31.073	447.390	82.74	P
2	14.958	35.923	14.387	30.943	445.169	82.85	P
3	14.999	36.088	14.490	31.067	450.148	83.16	P
4	14.988	36.072	14.406	31.134	448.502	82.96	P
Supplementary information: N/A							
TABLE 02.2: MQT 06.1 ini: Performance at STC before initial stabilization (Back side)							P
Test Date [YYYY-MM-DD] ..... :	2024-08-23						—
Test method ..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Result
1	13.335	35.923	12.626	31.302	395.224	82.51	P
2	13.240	35.934	12.704	31.215	396.549	83.35	P
3	13.268	35.944	12.268	31.670	388.524	81.47	P
4	13.317	35.908	12.282	31.391	385.540	80.63	P
Supplementary information: N/A							
TABLE 02.3: MQT 06.1 ini: Performance at BNPI (front side irradiance 1 000 W/m², back side irradiance 135 W/m², 25 °C, AM 1.5) before initial stabilization							P
Test Date [YYYY-MM-DD] ..... :	2024-08-23						—
Test method ..... :	☒ Simulator ☐ Natural sunlight						—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Result
1	13.335	35.923	12.626	31.302	395.224	82.51	P
2	13.240	35.934	12.704	31.215	396.549	83.35	P
3	13.268	35.944	12.268	31.670	388.524	81.47	P
4	13.317	35.908	12.282	31.391	385.540	80.63	P
Supplementary information: N/A							

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TABLE 02.4: MQT 19.1: Initial Stabilization procedure							P
Light exposure method ..... :	☒ Simulator ☐ Natural sunlight						
Stabilization criterion x per IEC 61215-1-x ..... :	1						
Sample #	1f	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	447.390	—	—
1	5	800~1000	50 ± 10	MPPT	447.164	-	-
2	5	800~1000	50 ± 10	MPPT	446.492	0.201	Yes
Sample #	1b	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	395.224	—	—
1	5	800~1000	50 ± 10	MPPT	395.033	-	-
2	5	800~1000	50 ± 10	MPPT	394.708	0.131	Yes
Sample #	1dx	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	499.712	—	—
1	5	800~1000	50 ± 10	MPPT	498.896	-	-
2	5	800~1000	50 ± 10	MPPT	497.732	0.397	Yes
Sample #	2f	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	445.169	—	—
1	5	800~1000	50 ± 10	MPPT	444.472	-	-
2	5	800~1000	50 ± 10	MPPT	444.179	0.223	Yes
Sample #	2b	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)

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Initial	—	—	—	—	396.549	—	—
1	5	800~1000	50 ± 10	MPPT	394.265	-	-
2	5	800~1000	50 ± 10	MPPT	393.760	0.706	Yes
Sample #	2dx	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	499.143	—	—
1	5	800~1000	50 ± 10	MPPT	497.001	-	-
2	5	800~1000	50 ± 10	MPPT	495.558	0.721	Yes
Sample #	3f	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	450.148	—	—
1	5	800~1000	50 ± 10	MPPT	448.447	-	-
2	5	800~1000	50 ± 10	MPPT	447.319	0.631	Yes
Sample #	3b	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	388.524	—	—
1	5	800~1000	50 ± 10	MPPT	386.700	-	-
2	5	800~1000	50 ± 10	MPPT	386.437	0.539	Yes
Sample #	3dx	Test Date (YYYY-MM-DD) start/end.....:			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	502.539	—	—
1	5	800~1000	50 ± 10	MPPT	500.699	-	-
2	5	800~1000	50 ± 10	MPPT	499.690	0.569	Yes
Sample #	4f	Test Date (YYYY-MM-DD) start/end ..... :			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)

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Initial	—	—	—	—	448.502	—	—
1	5	800~1000	50 ± 10	MPPT	447.218	-	-
2	5	800~1000	50 ± 10	MPPT	446.337	0.484	Yes
Sample #	4b	Test Date (YYYY-MM-DD) start/end ..... :			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	385.540	—	—
1	5	800~1000	50 ± 10	MPPT	383.928	-	-
2	5	800~1000	50 ± 10	MPPT	382.823	0.707	Yes
Sample #	4dx	Test Date (YYYY-MM-DD) start/end ..... :			2024-08-23/2024-08-25		
Test cycle	Integrated irradiation (kWh/m2)	Irradiance (W/m2)	Module temperature (°C)	Resistive load	Pmax (W) at the end of cycle	Pmax – Pmin) / Paverage (%)	Stable (Yes/No)
Initial	—	—	—	—	500.811	—	—
1	5	800~1000	50 ± 10	MPPT	499.086	-	-
2	5	800~1000	50 ± 10	MPPT	498.332	0.496	Yes

Supplementary information:
f: front, b: back, dx: bifacial

TABLE 03.1: MQT 06.1 ini: Performance at STC after initial stabilization (Front side)		
Test Date [YYYY-MM-DD] .....:	2024-08-25	—
P_{max} lower limit (W) .....:	See table below: P_{max} [W] – Min calc.	—
$\bar{P}_{max}$ (lab) lower limit (V) .....:	-	—
V_{oc}(lab) upper limit (V) .....:	See table below: V_{oc} [V] Max. calc.	—
I_{sc} (lab) upper limit (A) .....:	See table below: I_{sc} [A] Max. calc.	—
Test method ..... :	☒ Simulator ☐ Natural sunlight	—

Sample #	I_{sc} [A]		V_{oc} [V]		I_{mp} [A]	V_{mp} [V]	P_{max} [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
1	15.018	-	35.957	-	14.385	31.038	446.492	-	82.68	P
2	14.964	-	35.925	-	14.364	30.924	444.179	-	82.63	P
3	14.984	-	35.949	-	14.467	30.920	447.319	-	83.04	P

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4	15.015	-	35.926	-	14.425	30.942	446.337	-	82.74	P
Average	—						446.082	-	—	-
Supplementary information: The limit values are calculated considering manufacturer's tolerances ***t*** of rated nameplate values and laboratory measurement uncertainties ***m***.										

TABLE 03.2: MQT 06.1: Performance at STC after initial stabilization (Back side)										P
Test Date [YYYY-MM-DD] .....:	2024-08-25									—
Test method .....:	☒ Simulator ☐ Natural sunlight									—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	φI_{sc}	φV_{oc}	φP_{max}	Result
1	13.344	35.846	12.643	31.220	394.708	82.52	0.889	0.997	0.884	P
2	13.250	35.804	12.703	30.998	393.760	83.00	0.885	0.997	0.886	P
3	13.286	35.802	12.269	31.497	386.437	81.24	0.887	0.996	0.864	P
4	13.298	35.765	12.276	31.184	382.823	80.49	0.886	0.996	0.858	P
Supplementary information: N/A										

TABLE 03.3: MQT 06.1: Performance at BNPI (front side irradiance 1 000 W/m², backside irradiance 135 W/m², 25 °C, AM 1.5) after initial stabilization										P
Test Date [YYYY-MM-DD] .....:	2024-08-25									—
P_{max} lower limit (W) .....:	See table below: P_{max} [W] – Min calc.									—
$\bar{P}_{max}$ (lab) lower limit (V) .....:	-									—
V_{oc}(lab) upper limit (V) .....:	See table below: V_{oc} [V] Max. calc.									—
I_{sc} (lab) upper limit (A) .....:	See table below: I_{sc} [A] Max. calc.									—
Test method ..... :	☒ Simulator ☐ Natural sunlight									—
Sample #	I_{sc} [A]		V_{oc} [V]		I_{mp} [A]	V_{mp} [V]	P_{max} [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
1	16.776	-	36.052	-	16.177	30.768	497.732	-	82.29	P
2	16.709	-	36.032	-	16.137	30.710	495.558	-	82.31	P

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3	16.778	-	36.048	-	16.110	31.017	499.690	-	82.62	P
4	16.777	-	36.028	-	16.081	30.989	498.332	-	82.45	P
Average	—						497.828	-	—	-
Supplementary information: The limit values are calculated considering manufacturer's tolerances ***t*** of rated nameplate values and laboratory measurement uncertainties ***m***.										

TABLE 04: MQT 03: Initial Insulation test				P
Test Date [YYYY-MM-DD] .....:	2024-08-25			—
Test Voltage applied [V] .....:	8000/1500			—
Size of module [m²].....:	1.998			—
Required Resistance [MΩ] ..... :	20.02			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
1	>10000		√	P
2	>10000		√	P
3	>10000		√	P
4	>10000		√	P
Supplementary information: Module size: 1762 x 1134 = 1.998 m^2 Required Resistance: 40 MΩ · m^2 / 1.998 m^2 = 20.02 MΩ				

TABLE 05: MQT 15: Initial Wet leakage current test			P
Test Date [YYYY-MM-DD] .....:	2024-08-25		—
Test Voltage applied [V].....:	1500		—
Solution temperature [°C] .....:	22.3		—
Solution resistivity [Ω cm] .....:	2732		—
Size of module [m²].....:	1.998		—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
1	20.02	>10000	P
2	20.02	>10000	P
3	20.02	>10000	P
4	20.02	>10000	P

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Supplementary information: Module size: 1762 x 1134 = 1.998 m^2 Required Resistance: 40 MΩ · m^2 / 1.998 m^2 = 20.02 MΩ

TABLE 21: MQT 17 - Hail impact test							P
Test Date [YYYY-MM-DD] .....:	2024-09-10						—
Sample #	2						—
Ice ball size [mm] .....:	1	2	3	4	5	6	—
	24.7	24.8	25.0	24.9	25.0	24.9	
	7	8	9	10	11	/	
	24.5	24.5	24.7	24.8	25.0	/	
Ice ball weight [g] .....:	1	2	3	4	5	6	—
	7.33	7.38	7.51	7.42	7.47	7.49	
	7	8	9	10	11	/	
	7.37	7.44	7.46	7.36	7.44	/	
Ice ball velocity [m/s] .....:	1	2	3	4	5	6	—
	23.01	22.86	23.04	23.09	22.74	22.58	
	7	8	9	10	11	/	
	23.11	22.65	23.02	22.80	22.63	/	
Number of impact locations .....:	11						—

Supplementary information: (impact location descriptions)

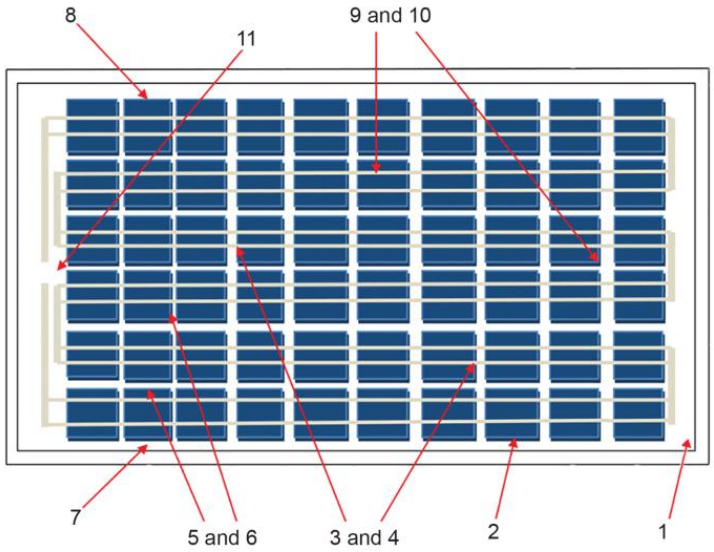

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TABLE 21: MQT 17 - Hail impact test							P
Test Date [YYYY-MM-DD] .....:	2024-09-10						—
Sample #	3						—
Ice ball size [mm] .....:	1	2	3	4	5	6	—
	30.6	30.7	30.5	30.8	30.4	30.3	
	7	8	9	10	11	/	
	30.7	30.6	30.5	30.2	30.9	/	
Ice ball weight [g] .....:	1	2	3	4	5	6	—
	13.17	13.45	13.23	13.42	13.41	13.16	
	7	8	9	10	11	/	
	13.85	13.47	13.66	13.77	13.26	/	
Ice ball velocity [m/s] .....:	1	2	3	4	5	6	—
	24.15	24.41	24.83	24.57	24.66	24.44	
	7	8	9	10	11	/	
	24.65	24.47	24.55	24.47	24.75	/	
Number of impact locations .....:	11						—

Supplementary information: (impact location descriptions)

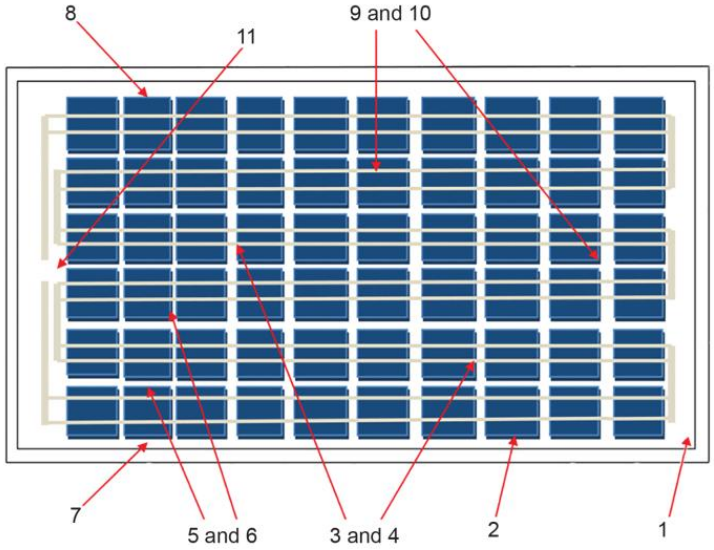

TABLE 21: MQT 17 - Hail impact test		P
Test Date [YYYY-MM-DD] .....:	2024-09-10	—

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Sample #	4						—
Ice ball size [mm] .....:	1	2	3	4	5	6	—
	35.6	34.9	34.5	35.8	35.4	34.3	
	7	8	9	10	11	/	
	34.7	35.6	35.5	34.2	35.9	/	
Ice ball weight [g] .....:	1	2	3	4	5	6	—
	20.17	20.45	20.53	20.62	20.41	20.16	
	7	8	9	10	11	/	
	20.85	20.47	20.56	20.77	20.86	/	
Ice ball velocity [m/s] .....:	1	2	3	4	5	6	—
	26.25	26.51	26.83	26.77	26.66	26.44	
	7	8	9	10	11	/	
	26.25	26.47	26.55	26.87	26.75	/	
Number of impact locations .....:	11						—

Supplementary information: (impact location descriptions)

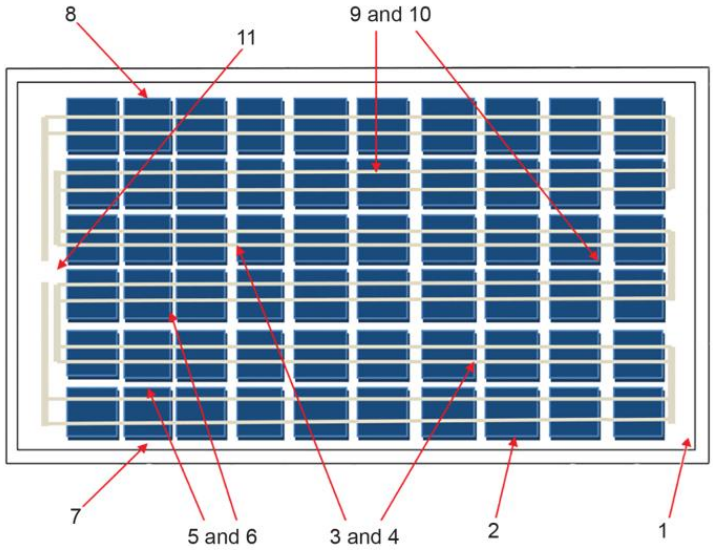

TABLE 21.1: MQT 01 - Visual inspection after hail impact test		P
Test Date [YYYY-MM-DD] .....:	2024-09-11	—

Sample #	Nature and position of initial findings – comments or attach photos	—
2	No major visual defects found	P
3	No major visual defects found	P

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4	No major visual defects found	P
Supplementary information: N/A		

TABLE 21.2: MQT 15 - Wet leakage current test after hail impact test			P
Test Date [YYYY-MM-DD] .....:	2024-09-11		—
Test Voltage applied [V].....:	1500		—
Solution temperature [°C] .....:	22.5		—
Size of module [m²].....:	1.998		—
Solution resistivity [Ω cm] .....:	2867		—
Sample #	Required Resistance [MΩ]	Measured [MΩ]	Result
2	20.02	>10000	P
3	20.02	>10000	P
4	20.02	>10000	P
Supplementary information: Module size: 1762 x 1134 = 1.998 m^2 Required Resistance: 40 MΩ · m^2 / 1.998 m^2 = 20.02 MΩ			

TABLE 21.3: MQT 03 - Initial Insulation test after hail impact test				P
Test Date [YYYY-MM-DD] .....:	2024-09-11			—
Test Voltage applied [V] .....:	8000/1500			—
Size of module [m²].....:	1.998			—
Required Resistance [MΩ] ..... :	20.02			—
Sample #	Measured	Dielectric breakdown		Result
	MΩ	Yes (description)	No	
2	>10000		√	P
3	>10000		√	P
4	>10000		√	P
Supplementary information: Module size: 1762 x 1134 = 1.998 m^2 Required Resistance: 40 MΩ · m^2 / 1.998 m^2 = 20.02 MΩ				

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TABLE 23.4: MQT 19.2: Final stabilization									P
☒Method 4									P
Performance at BNPI before final stabilization — for bifacial modules									P
Test Date [YYYY-MM-DD] .....:	2024-09-11								—
Test method.....:	■ Solar simulator ☐ Natural sunlight								—
Sample #	I_{sc} [A]	V_{oc} [V]	I_{mp} [A]	V_{mp} [V]	P_{max} [W]	FF [%]	Pmax [W] (Lab Gate No.1)	Power Degradation	Result
2f	14.964	35.911	14.320	30.868	442.030	82.26	444.179	-0.48%	P
2b	13.251	35.791	12.717	30.854	392.370	82.73	393.760	-0.35%	P
2dx	16.707	36.019	16.094	30.633	493.008	81.93	495.558	-0.51%	P
3f	14.981	35.934	14.479	30.798	445.924	82.84	447.319	-0.31%	P
3b	13.281	35.786	12.296	31.340	385.357	81.08	386.437	-0.28%	P
3dx	16.773	36.035	16.138	30.859	498.003	82.39	499.690	-0.34%	P
4f	15.014	35.908	14.441	30.826	445.158	82.57	446.337	-0.26%	P
4b	13.295	35.749	12.264	31.086	381.239	80.21	382.823	-0.41%	P
4dx	16.778	36.012	16.104	30.836	496.583	82.19	498.332	-0.35%	P

Supplementary information: This module was not stabilized, and therefore the amount of degradation observed may be larger than what would have been obtained if the module had been stabilized, due to polarization artifacts

f: front

b: back

dx: bifacial

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4. Construction information

A1.1	MODULE TYPE/S
	HiT-HxxxCE-BF (xxx = 430~460) xxx is standing for rated output power at STC.

A1.2	MODULE DESIGN	
	Module dimensions (L x W x H) [mm] ..... :	1762*1134*30
	Weights..... :	21.8kg
	Front/Rear cover bonding classification ..... :	☐ rigid/flexible ■ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL	
	Cell type reference ..... :	Manufacturer: HUASUN Type: n-Type Mono HJT
	Cell dimensions L x W x T (± %) [mm] ..... :	182*105*0.11
	Cell thickness [µm] ..... :	110
	Cell area [cm²] ..... :	191.1

A1.4	IDENTIFICATION OF MATERIALS	
	Front cover ..... :	Manufacturer: Almaden Type: Semi-tempered glass Thickness: 1.6 mm
	Rear cover ..... :	Manufacturer: Almaden Type: White-grid semi-tempered glass Thickness: 1.6 mm
	Encapsulation material front side ..... :	Manufacturer: HIUV Type: S201MT2 Material: EVA
	Encapsulation material back side..... :	Manufacturer: HIUV Type: S201MT2 Material: EVA
	Frame parts ..... :	Manufacturer: Shengxin Type: 6005-T6 Color: Black
	Mounting parts..... :	Manufacturer: Type: Color:
	Adhesive for frame ..... :	Manufacturer: Tonsan Type: 1527

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	Edge sealing ..... :	PIB(Butyl adhesive)
	Internal wiring ..... :	-
	Cell connector ..... :	Manufacturer: Telison Dimensions: 0.28mm
	String connector ..... :	Manufacturer: Telison - Top, bottom: Dimensions: 0.35*4mm - Middle: Dimensions: 0.35*6mm
	Soldering material ..... :	N/A
	Fluxing agent ..... :	Manufacturer: Asahi Type: SF105
	Junction box ..... :	Manufacturer: Renhe Type: FT50XY
	Cable ..... :	Manufacturer: Renhe Type: H1Z2Z2-K
	Connector ..... :	Manufacturer: Staubli Type: MC4-EVO2
	Bypass diode ..... :	Manufacturer: Renhe Type: Schottky
	Potting material ..... :	Manufacturer: Tonson Type: 1521
	Adhesive for junction box ..... :	Manufacturer: Tonson Type: 1527
	Additional material (e. g. fixing tape, insulation tape) ..... :	Cell fixing tape Manufacturer: 3M Type: UV-1

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A1.1	MODULE TYPE/S
	HiT- HxxxLE-FB (xxx = 425 to 450) xxx is standing for rated output power at STC.

A1.2	MODULE DESIGN	
	Module dimensions (L x W x H) [mm] ..... :	1762*1134*30
	Weights..... :	21.8kg
	Front/Rear cover bonding classification ..... :	☐ rigid/flexible ■ rigid/rigid ☐ flexible/flexible

A1.3	SOLAR CELL	
	Cell type reference ..... :	Manufacturer: HUASUN Type: n-Type Mono HJT
	Cell dimensions L x W x T (± %) [mm] ..... :	182*105*0.11
	Cell thickness [µm] ..... :	110
	Cell area [cm²] ..... :	191.1

A1.4	IDENTIFICATION OF MATERIALS	
	Front cover ..... :	Manufacturer: Almaden Type: Semi-tempered glass Thickness: 1.6 mm
	Rear cover..... :	Manufacturer: Almaden Type: Semi-tempered glass Thickness: 1.6 mm
	Encapsulation material front side ..... :	Manufacturer: Lushan Type: EV1050G1 Material: EVA
	Encapsulation material back side..... :	Manufacturer: Lushan Type: EV1050G7 Material: EVA
	Frame parts ..... :	Manufacturer: Shengxin Type: 6005-T6 Color: Black
	Mounting parts..... :	Manufacturer: Type: Color:
	Adhesive for frame ..... :	Manufacturer: Tonsan Type: 1527

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	Edge sealing ..... :	PIB(Butyl adhesive)
	Internal wiring ..... :	-
	Cell connector ..... :	Manufacturer: Telison Dimensions: 0.28mm
	String connector ..... :	Manufacturer: Telison - Top, bottom: Dimensions: 0.35*4mm - Middle: Dimensions: 0.35*6mm
	Soldering material ..... :	N/A
	Fluxing agent ..... :	Manufacturer: Asahi Type: SF105
	Junction box ..... :	Manufacturer: Renhe Type: FT50XY
	Cable ..... :	Manufacturer: Renhe Type: H1Z2Z2-K
	Connector ..... :	Manufacturer: Staubli Type: MC4-EVO2
	Bypass diode ..... :	Manufacturer:Renhe Type: Schottky
	Potting material ..... :	Manufacturer: Tonson Type: 1521
	Adhesive for junction box ..... :	Manufacturer: Tonson Type: 1527
	Additional material (e. g. fixing tape, insulation tape) ..... :	Cell fixing tape Manufacturer: 3M Type: UV-1

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5. Test Equipment(s):

Equipment Number	Name	Calibration Validity
SB08125	Illuminance Meter	2024.10.20
SB08111	Lamp	/
SB08102	Measuring tape	2024.08.16
SB08092	Camera	/
SB08108	Ruler	2024.10.20
SB18003	Pulsed Solar Simulator	2024.09.20
SB23003	Electrical Safety Compliance Analyzer	2025.07.10
SB23002	Electrical Safety Compliance Analyzer	2025.07.10
SB16001	Conductivity meter	2025.07.11
SB08076	Hail tester	2025.08.11
SB10036	Electronic balance	2025.05.19
SB08105	Vernier caliper	2025.05.19
SB08142	Freezer	2025.07.10
SB08143	Freezer	2025.07.11

TÜV SÜD Korea Ltd.

Tested by:

In-Seop Lee / Project Handler

Approved by:

Hwi-Jun Lim / Project Reviewer

Tel.: +82-(0)2-3215-1100
Fax: +82-(0)2-3215-1111
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TÜV SÜD Korea Ltd.
29F, Two IFC, 10 Gukjegeumyung-ro,
Yeongdeungpo-gu, Seoul, 07326,
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