



# Descriptive Report and Test Results

**MASTER CONTRACT:** 303385

**REPORT:** 80151490

**PROJECT:** 80151490

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## PRODUCTS

CLASS 5311 10 - POWER SUPPLIES - Photovoltaic Modules and Panels

CLASS 5311 90 - POWER SUPPLIES - Photovoltaic Modules and Panels - Certified to U.S. Standards

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-66H (xxx=630-700, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60H (xxx=570-630, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-55H (xxx=525-575, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-66HB (xxx=620-695, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60HB (xxx=560-615, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-55HB (xxx=520-565, in steps of 5), Fuse rating 30A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-78H (xxx=570-625, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-72H (xxx=520-575, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-66H (xxx=480-525, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60H (xxx=440-480, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-54H (xxx=395-430, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-78HB (xxx=565-620, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

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Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-72HB (xxx=520-570, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-66HB (xxx=475-525, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60HB (xxx=435-475, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-54HB (xxx=390-425, in steps of 5), Fuse rating 25A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-72H (xxx=440-475, in steps of 5), Fuse rating 20A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60H (xxx=350-395, in steps of 5), Fuse rating 20A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-72HB (xxx=435-470, in steps of 5), Fuse rating 20A, NOCT: 45+/-2°C.

Photovoltaic modules with Fire Performance (USA) Type 4, maximum system voltage of 1500 Vdc, model series: SPxxxM-60HB (xxx=350-390, in steps of 5), Fuse rating 20A, NOCT: 45+/-2°C.

Notes:

1. The electrical characteristics are within ±5 percent of the rated values of Isc, Voc, and Pmax under standard test conditions (irradiance of 1000 W/m<sup>2</sup>, AM 1.5 spectrum, and a cell temperature of 25°C (77°F)).
2. The operating ambient temperature of these devices may exceed 40 °C at full load for all wire sizes if it is determined suitable in the field use application.

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
<b>SPxxxM-66H (xxx=630-700, in steps of 5) with 210mm cell</b>					
SP630M-66H	44.50	18.23	36.60	17.22	630
SP635M-66H	44.70	18.28	36.80	17.26	635
SP640M-66H	44.90	18.33	37.00	17.30	640
SP645M-66H	45.10	18.38	37.20	17.34	645
SP650M-66H	45.30	18.43	37.40	17.39	650
SP655M-66H	45.50	18.48	37.60	17.43	655
SP660M-66H	45.70	18.53	37.80	17.47	660
SP665M-66H	45.90	18.58	38.00	17.50	665
SP670M-66H	46.10	18.63	38.20	17.54	670
SP675M-66H	46.30	18.68	38.40	17.58	675
SP680M-66H	46.50	18.73	38.60	17.62	680
SP685M-66H	46.70	18.78	38.80	17.66	685
SP690M-66H	46.90	18.83	39.00	17.70	690
SP695M-66H	47.10	18.88	39.20	17.73	695
SP700M-66H	47.30	18.93	39.40	17.77	700
<b>SPxxxM-60H (xxx=570-630, in steps of 5) with 210mm cell</b>					
SP570M-60H	40.30	18.22	33.20	17.17	570
SP575M-60H	40.50	18.27	33.40	17.22	575
SP580M-60H	40.70	18.32	33.60	17.27	580
SP585M-60H	40.90	18.37	33.80	17.31	585
SP590M-60H	41.10	18.42	34.00	17.36	590
SP595M-60H	41.30	18.47	34.20	17.40	595
SP600M-60H	41.50	18.52	34.40	17.45	600

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
SP605M-60H	41.70	18.57	34.60	17.49	605
SP610M-60H	41.90	18.62	34.80	17.53	610
SP615M-60H	42.10	18.67	35.00	17.58	615
SP620M-60H	42.30	18.72	35.20	17.63	620
SP625M-60H	42.50	18.77	35.40	17.66	625
SP630M-60H	42.70	18.82	35.60	17.70	630
SPxxxM-55H (xxx=525-575, in steps of 5) with 210mm cell					
SP525M-55H	36.90	18.26	30.60	17.16	525
SP530M-55H	37.10	18.31	30.80	17.21	530
SP535M-55H	37.30	18.36	31.00	17.26	535
SP540M-55H	37.50	18.41	31.20	17.31	540
SP545M-55H	37.70	18.46	31.40	17.36	545
SP550M-55H	37.90	18.51	31.60	17.41	550
SP555M-55H	38.10	18.56	31.80	17.46	555
SP560M-55H	38.30	18.61	32.00	17.50	560
SP565M-55H	38.50	18.66	32.20	17.55	565
SP570M-55H	38.70	18.71	32.40	17.59	570
SP575M-55H	38.90	18.76	32.60	17.64	575
SPxxxM-66HB (xxx=620-695, in steps of 5) with 210mm cell					
SP620M-66HB	44.42	18.07	36.52	16.99	620
SP625M-66HB	44.62	18.12	36.72	17.03	625
SP630M-66HB	44.82	18.17	36.92	17.07	630
SP635M-66HB	45.02	18.22	37.12	17.11	635
SP640M-66HB	45.22	18.27	37.32	17.15	640
SP645M-66HB	45.42	18.32	37.52	17.20	645
SP650M-66HB	45.62	18.37	37.72	17.24	650
SP655M-66HB	45.82	18.42	37.92	17.28	655
SP660M-66HB	46.02	18.47	38.12	17.32	660
SP665M-66HB	46.22	18.52	38.32	17.36	665
SP670M-66HB	46.42	18.57	38.52	17.40	670
SP675M-66HB	46.62	18.62	38.72	17.44	675
SP680M-66HB	46.82	18.67	38.92	17.48	680
SP685M-66HB	47.02	18.72	39.12	17.52	685
SP690M-66HB	47.22	18.77	39.32	17.55	690
SP695M-66HB	47.42	18.82	39.52	17.59	695
SPxxxM-60HB (xxx=560-615, in steps of 5) with 210mm cell					
SP560M-60HB	40.22	18.06	33.12	16.91	560
SP565M-60HB	40.42	18.11	33.32	16.96	565
SP570M-60HB	40.62	18.16	33.52	17.01	570
SP575M-60HB	40.82	18.21	33.72	17.06	575
SP580M-60HB	41.02	18.26	33.92	17.10	580
SP585M-60HB	41.22	18.31	34.12	17.15	585
SP590M-60HB	41.42	18.36	34.32	17.20	590
SP595M-60HB	41.62	18.41	34.52	17.24	595
SP600M-60HB	41.82	18.46	34.72	17.29	600
SP605M-60HB	42.02	18.51	34.92	17.33	605
SP610M-60HB	42.22	18.56	35.12	17.37	610
SP615M-60HB	42.42	18.60	35.32	17.42	615
SPxxxM-55HB (xxx=520-565, in steps of 5) with 210mm cell					
SP520M-55HB	37.00	18.15	30.72	16.94	520

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
SP525M-55HB	37.20	18.20	30.92	16.99	525
SP530M-55HB	37.40	18.25	31.12	17.04	530
SP535M-55HB	37.60	18.30	31.32	17.09	535
SP540M-55HB	37.82	18.35	31.52	17.14	540
SP545M-55HB	38.02	18.40	31.72	17.19	545
SP550M-55HB	38.22	18.45	31.92	17.24	550
SP555M-55HB	38.42	18.50	32.12	17.28	555
SP560M-55HB	38.62	18.55	32.32	17.33	560
SP565M-55HB	38.82	18.60	32.52	17.38	565
SPxxxM-78H (xxx=570-625, in steps of 5) with 182mm cell					
SP570M-78H	53.33	44.12	13.62	12.93	570
SP575M-78H	53.43	44.22	13.69	13.01	575
SP580M-78H	53.53	44.32	13.76	13.09	580
SP585M-78H	53.63	44.42	13.83	13.17	585
SP590M-78H	53.73	44.52	13.90	13.26	590
SP595M-78H	53.83	44.62	13.97	13.34	595
SP600M-78H	53.93	44.72	14.04	13.42	600
SP605M-78H	54.03	44.82	14.11	13.50	605
SP610M-78H	54.13	44.92	14.18	13.58	610
SP615M-78H	54.23	45.02	14.25	13.67	615
SP620M-78H	54.33	45.12	14.32	13.75	620
SP625M-78H	54.43	45.22	14.39	13.83	625
SPxxxM-72H (xxx=520-575, in steps of 5) with 182mm cell					
SP520M-72H	49.04	40.35	13.58	12.92	520
SP525M-72H	49.14	40.43	13.65	13.00	525
SP530M-72H	49.24	40.53	13.72	13.08	530
SP535M-72H	49.34	40.63	13.79	13.17	535
SP540M-72H	49.44	40.72	13.86	13.27	540
SP545M-72H	49.54	40.81	13.93	13.36	545
SP550M-72H	49.64	40.90	14.00	13.45	550
SP555M-72H	49.74	40.99	14.07	13.54	555
SP560M-72H	49.84	41.08	14.14	13.64	560
SP565M-72H	49.94	41.17	14.21	13.73	565
SP570M-72H	50.04	41.26	14.28	13.82	570
SP575M-72H	50.14	41.35	14.35	13.91	575
SPxxxM-66H (xxx=480-525, in steps of 5) with 182mm cell					
SP480M-66H	48.22	39.94	12.92	12.03	480
SP485M-66H	48.34	40.08	12.99	12.11	485
SP490M-66H	48.46	40.22	13.06	12.19	490
SP495M-66H	48.58	40.36	13.13	12.27	495
SP500M-66H	48.70	40.50	13.20	12.35	500
SP505M-66H	48.82	40.64	13.27	12.43	505
SP510M-66H	48.94	40.78	13.34	12.51	510
SP515M-66H	49.06	40.92	13.41	12.59	515
SP520M-66H	49.18	41.06	13.48	12.67	520
SP525M-66H	49.30	41.20	13.55	12.75	525
SPxxxM-60H (xxx=440-480, in steps of 5) with 182mm cell					
SP440M-60H	41.02	33.72	13.73	13.05	440
SP445M-60H	41.12	33.84	13.80	13.16	445
SP450M-60H	41.22	33.96	13.87	13.26	450

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
SP455M-60H	41.32	34.08	13.94	13.36	455
SP460M-60H	41.42	34.20	14.01	13.46	460
SP465M-60H	41.52	34.32	14.08	13.55	465
SP470M-60H	41.62	34.44	14.15	13.65	470
SP475M-60H	41.72	34.56	14.22	13.75	475
SP480M-60H	41.82	34.68	14.29	13.85	480
SPxxxM-54H (xxx=395-430, in steps of 5) with 182mm cell					
SP395M-54H	36.90	30.32	13.71	13.03	395
SP400M-54H	36.98	30.42	13.78	13.15	400
SP405M-54H	37.06	30.52	13.85	13.27	405
SP410M-54H	37.14	30.62	13.92	13.39	410
SP415M-54H	37.22	30.72	13.99	13.51	415
SP420M-54H	37.30	30.82	14.06	13.63	420
SP425M-54H	37.38	30.92	14.13	13.75	425
SP430M-54H	37.46	31.02	14.20	13.87	430
SPxxxM-78HB (xxx=565-620, in steps of 5) with 182mm cell					
SP565M-78HB	53.37	44.16	13.51	12.80	565
SP570M-78HB	53.47	44.26	13.58	12.88	570
SP575M-78HB	53.57	44.36	13.65	12.97	575
SP580M-78HB	53.67	44.46	13.72	13.05	580
SP585M-78HB	53.77	44.56	13.79	13.13	585
SP590M-78HB	53.87	44.66	13.86	13.22	590
SP595M-78HB	53.97	44.76	13.93	13.30	595
SP600M-78HB	54.07	44.86	14.00	13.38	600
SP605M-78HB	54.17	44.96	14.07	13.46	605
SP610M-78HB	54.27	45.06	14.14	13.54	610
SP615M-78HB	54.37	45.16	14.21	13.62	615
SP620M-78HB	54.47	45.26	14.28	13.70	620
SPxxxM-72HB (xxx=520-570, in steps of 5) with 182mm cell					
SP520M-72HB	49.18	40.50	13.54	12.84	520
SP525M-72HB	49.28	40.59	13.61	12.94	525
SP530M-72HB	49.38	40.68	13.68	13.03	530
SP535M-72HB	49.48	40.77	13.75	13.13	535
SP540M-72HB	49.58	40.86	13.82	13.22	540
SP545M-72HB	49.68	40.95	13.89	13.31	545
SP550M-72HB	49.78	41.04	13.96	13.41	550
SP555M-72HB	49.88	41.13	14.03	13.50	555
SP560M-72HB	49.98	41.22	14.10	13.59	560
SP565M-72HB	50.08	41.31	14.17	13.68	565
SP570M-72HB	50.18	41.40	14.24	13.77	570
SPxxxM-66HB (xxx=475-525, in steps of 5) with 182mm cell					
SP475M-66HB	48.24	39.94	12.81	11.90	475
SP480M-66HB	48.36	40.08	12.88	11.98	480
SP485M-66HB	48.48	40.22	12.95	12.06	485
SP490M-66HB	48.60	40.36	13.02	12.15	490
SP495M-66HB	48.72	40.50	13.09	12.23	495
SP500M-66HB	48.84	40.64	13.16	12.31	500
SP505M-66HB	48.96	40.78	13.23	12.39	505
SP510M-66HB	49.08	40.92	13.30	12.47	510
SP515M-66HB	49.20	41.06	13.37	12.55	515

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
SP520M-66HB	49.32	41.20	13.44	12.63	520
SP525M-66HB	49.44	41.34	13.51	12.71	525
SPxxxM-60HB (xxx=435-475, in steps of 5) with 182mm cell					
SP435M-60HB	41.06	33.74	13.62	12.90	435
SP440M-60HB	41.16	33.86	13.69	13.00	440
SP445M-60HB	41.26	33.98	13.76	13.10	445
SP450M-60HB	41.36	34.10	13.83	13.20	450
SP455M-60HB	41.46	34.22	13.90	13.30	455
SP460M-60HB	41.56	34.34	13.97	13.40	460
SP465M-60HB	41.66	34.46	14.04	13.50	465
SP470M-60HB	41.76	34.58	14.11	13.60	470
SP475M-60HB	41.86	34.70	14.18	13.70	475
SPxxxM-54HB (xxx=390-425, in steps of 5) with 182mm cell					
SP390M-54HB	36.96	30.36	13.60	12.85	390
SP395M-54HB	37.04	30.46	13.67	12.97	395
SP400M-54HB	37.12	30.56	13.74	13.09	400
SP405M-54HB	37.20	30.66	13.81	13.21	405
SP410M-54HB	37.28	30.76	13.88	13.33	410
SP415M-54HB	37.36	30.86	13.95	13.45	415
SP420M-54HB	37.44	30.96	14.02	13.57	420
SP425M-54HB	37.52	31.06	14.09	13.69	425
SPxxxM-72H (xxx=440-475, in steps of 5) with 166mm cell					
SP440M-72H	49.2	40.6	11.39	10.84	440
SP445M-72H	49.4	40.8	11.46	10.91	445
SP450M-72H	49.6	41.0	11.53	10.98	450
SP455M-72H	49.8	41.2	11.60	11.05	455
SP460M-72H	50.0	41.4	11.67	11.12	460
SP465M-72H	50.2	41.6	11.74	11.18	465
SP470M-72H	50.4	41.8	11.81	11.25	470
SP475M-72H	50.6	42.0	11.88	11.31	475
SPxxxM-60H (xxx=350-395, in steps of 5) with 166mm cell					
SP350M-60H	40.1	33.2	11.09	10.55	350
SP355M-60H	40.4	33.5	11.16	10.60	355
SP360M-60H	40.7	33.8	11.23	10.66	360
SP365M-60H	41.0	34.1	11.30	10.71	365
SP370M-60H	41.3	34.4	11.37	10.76	370
SP375M-60H	41.6	34.7	11.44	10.81	375
SP380M-60H	41.9	35.0	11.51	10.86	380
SP385M-60H	42.2	35.3	11.58	10.91	385
SP390M-60H	42.5	35.6	11.65	10.96	390
SP395M-60H	42.8	35.9	11.72	11.01	395
SPxxxM-72HB (xxx=435-470, in steps of 5) with 166mm cell					
SP435M-72HB	49.36	40.72	11.23	10.69	435
SP440M-72HB	49.56	40.92	11.30	10.76	440
SP445M-72HB	49.76	41.12	11.37	10.83	445
SP450M-72HB	49.96	41.32	11.44	10.90	450
SP455M-72HB	50.16	41.52	11.51	10.96	455
SP460M-72HB	50.36	41.72	11.58	11.03	460
SP465M-72HB	50.56	41.92	11.65	11.10	465
SP470M-72HB	50.76	42.12	11.72	11.17	470

Model	Open Circuit Voltage at STC (V dc)	Short Circuit Current at STC (A dc)	Rated Voltage at STC (V dc)	Rated Current at STC (A dc)	Rated Maximum Power at STC (Watts)
SPxxxM-60HB (xxx=350-385, in steps of 5) with 166mm cell					
SP350M-60HB	40.64	33.58	11.00	10.43	350
SP355M-60HB	40.94	33.88	11.07	10.48	355
SP360M-60HB	41.24	34.18	11.14	10.54	360
SP365M-60HB	41.54	34.48	11.21	10.59	365
SP370M-60HB	41.84	34.78	11.28	10.64	370
SP375M-60HB	42.14	35.08	11.35	10.69	375
SP380M-60HB	42.44	35.38	11.42	10.75	380
SP385M-60HB	42.74	35.68	11.49	10.80	385
SP390M-60HB	43.04	36.08	11.56	10.82	390

**APPLICABLE REQUIREMENTS**

CSA C22.2 No. 61730-1:19 Photovoltaic (PV) module safety qualification — Part 1: Requirements for construction, 2019-12.

CSA C22.2 No. 61730-2:19 Photovoltaic (PV) module safety qualification — Part 2: Requirements for testing, 2019-12.

UL 61730-1 1st: Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, 2017-12-04, revision date 2020-04-30.

UL 61730-2 1st: Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing, 2017-12-04, revision date 2020-04-30.

**MARKINGS**

The manufacturer is required to apply the following markings:

- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.



Nameplate adhesive label material approval information:

Label Material: Certified or cUL Recognized.

Manufacturer: AVERY (CHINA) CO LTD. (MH20558)

Type: 50 micron Matte Silver PET TC/S333

1. The following markings appear on the enclosure by silk-screening, permanent ink stamping, on adhesive labels that appear on the CSA List of Accepted Adhesive Nameplates, or by other permanent method:
  - a) Submitter’s name and/or CSA Master Contract number “303385”.
  - b) Model designation.
  - c) Complete electrical ratings at STC:

- Open-circuit voltage (include tolerance)
  - Maximum system voltage
  - Short-circuit current (include tolerance)
  - Maximum power (include tolerance)
  - Maximum power voltage
  - Maximum Power current
- d) date and place of manufacture, alternatively serial number assuring traceability of date and place of manufacture
- e) PV module classification: Class II, as indicated 
- f) PV module application class: Class A
- g) For Class II PV modules, the (IEC 60417-6042: Caution, risk of electric shock) symbol shall be applied, the caution mark: 
- h) Maximum over-current protection rating
- i) The CSA Monogram with the “C/US” indicators;
- j) For USA market a PV module may be marked with “Fire Type:4. See Installation Instructions for Installation Requirements to Achieve a Specified System Fire Class Rating with this Product”.

Module Serial Number Coding System:

- SP 66 M H 20220912 00001
- 1<sup>st</sup>~2<sup>nd</sup> digit: Denotes the Sunpal Power (SP)
  - 3<sup>rd</sup>~4<sup>th</sup> digit: Denotes the cell quantity (66 stands for 66 cells)
  - 5<sup>th</sup> digit: Denotes the cell type (M stands for Mono cell)
  - 6<sup>th</sup> digit: Denotes the manufacturer (H stands for Leapton)
  - 7<sup>th</sup> and 14<sup>th</sup> digit: Denotes the date code (20220912 stands 2022-09-12)
  - 15<sup>th</sup> to 19<sup>th</sup> digit: Denotes the sequence number 00001 to 99999

Model difference

Model	SP	455	M	-	72	H	B
Address	1	2	3	-	4	5	6

Address:

1. Abbreviation of Manufacturer’s Name:  
[SP]: Sunpal Power
2. Maximum Power Rating:  
[455]: 455 Wattage
3. Type of PV module:  
[M]: Monocrystalline module
4. Quantity of cell:  
[78]: 156 cells  
[72]: 144 cells  
[66]: 132 cells  
[60]: 120 cells  
[54]: 108 cells
5. Size of cell:  
[H]: Half-cut cell

6. Color of substrate:  
[B]: Black module  
[Blank]: White module
2. All electrical data shall be shown as relative to standard test conditions (STC) (1 000 W/m<sup>2</sup>, (25 ± 2) °C, AM 1,5 according to IEC 60904-3).
3. Polarity of terminals or leads, PV connectors shall be clearly marked indicating the terminal polarity. A module or panel may be identified with one of the following marking statements:  
“+” and “-” or  
“POS” and “NEG” or  
“POSITIVE” and “NEGATIVE”
4. PV connectors or wiring shall be marked in accordance to IEC 62852 with “Do not disconnect under load / NE PAS UTILISER POUR COUPER LE”. Symbol or warning notice shall be imprinted or labelled close to connector.

The following symbols may be used to show that a PV connector shall not be disconnected under load. See Figures A.1 and A.2.



Figure A.1 – Symbol “DO NOT DISCONNECT UNDER LOAD”

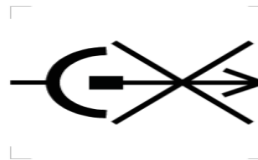



Figure A.2 – Symbol “DO NOT DISCONNECT UNDER LOAD” (IEC 60417-6070)

5. A wiring terminal or bonding location of a PV module intended to accommodate a field installed bonding conductor for equipotential bonding shall be identified with the appropriate symbol IEC 60417-5019 . Each grounding point is identified with ground symbol located adjacent to terminal.
6. Module Fire Performance of UL61730:2017 for USA: (Type 4)
7. The panel is marked relative to the maximum electrical rating of an acceptable series fuse 20 or 25 or 30A (for protection against overcurrent).
8. Installation and Assembly Instructions:  
The panel is supplied with installation instructions describing the methods of electrical and mechanical installation and the electrical ratings of the panel. When the fire rating is dependent on a specific mounting structure, specific spacings, or specific means of attachment to the roof or structure, details of the specific parameter or parameters shall be included in the instructions.

The module is considered to be in compliance with standard requirement only when the module is either mounted in the manner specified by the mounting instructions, or when the mounting means has been evaluated with this PV module to UL 2703. A module with exposed conductive parts is considered to be in compliance with standard requirement only when it is either electrically grounded in accordance with the manufacturer’s instructions and the requirements of the National Electrical Code, ANSI/NFPA 70 (2014-2017), or when the bonding means has been evaluated with this PV module to UL 2703.

- a) The environmental conditions to which the module has been qualified, which by default includes a temperature range of  $-40\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$  and wind/snow load including safety factor.
- b) For identical PV modules it is considered to be sufficient that one set of documentation is supplied with the PV module shipping unit.
- c) The items listed in the nameplate requirement section.
- d) The recommended maximum series/ parallel module configurations shall be applied to either the module or placed into the instruction and installation manual.
- e) The electrical ratings include following statement or the equivalent: “The electrical characteristics are within  $\pm 3$  percent of the indicated values of  $I_{sc}$ ,  $V_{oc}$ , and  $P_{max}$  under standard test conditions (irradiance of  $1000\text{ W/m}^2$ , AM 1.5 spectrum, and a cell temperature of  $25^{\circ}\text{C}$  ( $77^{\circ}\text{F}$ )).”
- f) The electrical installation instructions include a detailed description of the wiring method to be used in accordance with the National Electrical Code refer to modules with a wiring compartment intended for use with field-installed wiring. This description includes:
  - i) The minimum cable diameters for PV modules intended for field wiring,
  - ii) The size, type, and temperature rating of the conductors to be used,
  - iii) Type of terminals for field wiring,
- g) Specific PV connector model/types and manufacturer to which the PV module connectors can be mated.
- h) 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).
- i) Installation Instructions shall specify that the modules have been evaluated by CSA for a maximum positive design loading of  $3600\text{ Pa}$  ( $75.2\text{ lbs/ft}^2$ ) and negative design loading of  $1600\text{ Pa}$  ( $33.3\text{ lbs/ft}^2$ ) with safety factor 1.5.
- j) A statement indicating the maximum altitude the PV module is designed for.
- k) The installation instructions for roof mounting include:
  - i) A statement indicating the minimum mechanical means to be used for securement of the module or panel to the roof,
  - ii) A statement that 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.
- l) A statement advising that external or otherwise artificially concentrated sunlight shall not be directed onto the front or back face of the PV module
- m) 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 UL 61730 standard series.
- n) The following or equivalent statement shall be included:

“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  $I_{sc}$  and  $V_{oc}$  marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to the PV output.”
- o) Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable.
- p) System Fire Class Rating: See Installation Instructions for Installation Requirements to Achieve a Specified System Fire Class Rating with this Product, this statement should be marked on the label.

## **ALTERATIONS**

Markings as describe above are provided.

## **FACTORY TESTS**

1. Factory Insulation Test and Wet Insulation-Resistance Test:

Each module or panel shall comply with either the Factory Insulation Test or the Factory Wet Insulation-Resistance Test.

(1) Factory Insulation Test

This test verifies that the insulation properties of the production PV modules meet the electrical safety requirements of this standard. For modules with a metal frame surrounding the edges of the module, either this test or the test in DVA.3 shall be performed with a sampling rate of 100%. For modules without a metal frame surrounding the edges of the module, the test in DVA.3 shall be performed with a sampling rate of 100%.

Each module (100%) shall withstand for 1 second without electrical breakdown as a routine production line test, the application of a dc test potential of  $1.2 \times (2 \times V_{SYS} + 1000V)$  where  $V_{SYS}$  is the maximum rated system voltage. The voltage shall be applied between the active circuit of the module and the accessible metal frame surrounding the edges of the module. The test is to be conducted when the module is complete and ready for packing, or when it is complete except for covers or other parts that may interfere with the performance of the test. The test equipment is to include a means of indicating the test voltage that is being applied to the product under test and a means of effectively indicating unacceptable performance. A leakage current of greater than 50  $\mu A$  represents a failure. Alternatively the test of DVA.3 shall be complied with.

Exception No. 1: A module with a system voltage rating of 30 V or less need not be tested.

Exception No. 2: A module with no exposed conductive parts need not be tested.

(2) Factory Wet Insulation-Resistance Test:

This test verifies that the insulation properties of outer surfaces of the production PV modules meet the electrical safety requirements of this standard. For modules with a metal frame surrounding the edges of the module, either this test or the test in DVA.7 shall be performed with a sampling rate of 100%. For modules without a metal frame surrounding the edges of the module, this test shall be performed with a sampling rate of 100%.

Each module shall withstand the requirements of Clause 10.14 (MST 17).

Exception No. 1: Test voltage, test duration and water temperature of Clause 10.14 (MST 17) shall be changed for Production Line Tests as described below.

Exception No. 2: Terminal boxes and pigtail-leads or other connectors don't need to be wetted.

The test voltage  $V_{TEST}$  is calculated by multiplying the maximum system voltage  $V_{SYS}$  by a factor  $Y$ .

$$V_{test} = V_{sys} \times Y$$

$Y = 1$  is used for a minimum test duration of 1 min.  $Y = 1.2$  is used for a minimum test duration of 5 s. Ramp-up time for test voltage is chosen such that no time induced breakdown will occur. During the test no breakdown of test voltage shall occur.

The temperature range of the water is 20 ° C to 30 ° C. The leakage current shall be corrected to 25 ° C using a demonstrated correction factor for the PV module, to be determined for each PV module type.

For PV modules with cemented joints  $V_{TEST}$  shall be increased by a factor of 1.35.

Note: An example for  $V_{SYS} = 1500 V$  for cemented joints for test duration of 5 s is  $V_{TEST} = 1500 V \times 1.2 \times 1.35 = 2430 V$

2. Factory Module output power Test:

The electrical output power shall be verified on the final wiring configuration on a 100% basis. Results from I-V curve measurements shall also be used to verify that the current and voltage rating falls within the specification. All production values of  $I_{sc}$  and  $V_{oc}$  shall be covered by the tolerances of the product qualified under IEC 61730. Possible stabilization effects shall be considered if changes of  $I_{sc}$  and  $V_{oc}$  are expected during operation in sunlight. This test will also verify that bypass diodes are not shorted.

3. Visual Inspection:

Visual inspection shall be performed on a 100% basis aiming to verify that clearance distances (distances of live parts to PV module edges) are within the product specification.

Special care shall be taken if cemented joints are used for insulation. PV modules utilizing cemented joints shall be inspected along all edges and areas with cemented joints on a 100% basis aimed to verifying the cemented joint spacing visual inspection criteria as defined in 10.2.3 c) are met.

4. Bypass Diodes Test:

Verification that bypass diodes are working properly shall be performed on 100 % sampling rate.

Three alternative test methods can be applied:

- a) Perform successive additional I-V measurements in conjunction with maximum power determination with one cell of each string in the interconnection circuit completely shaded. The bypass diode belonging to this string is working properly, if the characteristic bend in the I-V curve is observed.
- b) A conductivity test can be performed with the PV module terminals connected in reverse polarity to a current source. The current flow and voltage drop across the PV module terminals can be used as indicator that the diodes are working properly.
- c) The I-V characteristics of all diodes can be verified just before their assembly. If the bypass diodes are in the junction box this could be done through measurement at the corresponding terminals of the junction box. A precondition for the latter method is an appropriate plan to mitigate possible influence of electrostatic discharges on the diodes in production.

NOTE Bypass diode verification procedures might be MQT 18.2 from IEC 61215-2 and IEC TS 62916.

5. Continuity test of equipotential bonding:

PV modules provided with a connection for equipotential bonding are subjected to a continuity test for equipotential bonding (MST 13). At a sampling rate of 1 PV module per framing station per working shift demonstrate the electrical continuity between the grounding connection and all accessible conductive parts. Any appropriate indication device is able to be employed (current supply in conjunction with current and voltage measurement).

PV modules that have no frames or equipotential bonding locations identified shall be exempt from this requirement.

**WARNING:** The factory test(s) specified may present a hazard of injury to personnel and/or property and should only be performed by persons knowledgeable of such hazards and under conditions designed to minimise the possibility of injury.

**SPECIAL INSTRUCTIONS FOR FIELD SERVICES**

1. Component descriptions marked with either the "(INT)" or "(INT\*)" identifiers may be substituted with other components providing the requirements specified under the notes in the "Description" are complied with.

**COMPONENT SPECIAL PICKUP**

1. Component descriptions marked with the identifier "(CT)" are subject to annual pickup and Conformity Testing.

**DESCRIPTION**

Notes:

1. Component Substitution
  - a) Critical components (those identified by mfr name, cat no), which are NOT identified with either "INT" or "INT\*" are not eligible for substitution without evaluation and report updating
  - b) The term "INT" means a "Certified" and/or "Listed" (or a "Recognized" and/or "Accepted") component may be replaced by one "Certified" and/or "Listed" by another certification organization accredited by the appropriate accreditation body or scheme requirements to the correct standard, for the same application; providing the applicable country identifiers are included and requirements in item "d" below are complied with.
  - c) The Term "(INT\*)" means a "Recognized" and/or "Accepted" component may be replaced by a component that is CSA Certified. The applicable country identifiers shall be included, the requirements in item "d" below as well as any "conditions of suitability" for the component (as recorded in this descriptive report) shall be complied with;
  - d) Components which have been substituted, must be of an equivalent rating, configuration (size, orientation, mounting) and the applicable minimum creepage and clearance distances are to be maintained from live parts to bonded metal parts and secondary parts.
  - e) Substitution of a "Certified" and/or "Listed" component with a component that is "Recognized" or "Accepted" is not permitted without evaluation and report updating.
  - f) Substitution of a "Recognized" and/or "Accepted" component by one that is not CSA Certified is not permitted without a proper evaluation as well as a report update because the Conditions of Acceptance of the original component may be different than the Conditions of Acceptance of the substitute component.

**INTRODUCTION**

Spacing: All spacing between primary terminals and ground, and between other bare live parts and ground, were based on pollution degree 1, material group II, conform to Tables 3 and 4 of UL Std. 61730-1.

Spacings from the cells to the laminate edges were measured as follows:

Model	Design Spacings, mm			
	Top	Bottom	Left	Right
SPxxxM-66H/66HB (210 cell) SPxxxM-60H/60HB (210 cell)	13	13	13.75	13.75
SPxxxM-55H/55HB (210 cell)	13	13	12.05	12.05
SPxxxM-78H/78HB (182 cell)	10.9	10.9	13.25	13.25
SPxxxM-72H/72HB (182 cell)	10.8	10.8	13.25	13.25
SPxxxM-66H/66HB (182 cell)	11	11	13.25	13.25
SPxxxM-60H/60HB (182 cell)	11.2	11.2	13.25	13.25

SPxxxM-54H/54HB (182 cell)	11.4	11.4	13.25	13.25
SPxxxM-72H/72HB (166 cell)	12.25	12.25	13.2	13.2
SPxxxM-60H/60HB (166 cell)	12.25	12.25	13.3	13.3

Dimensions: All specified dimensions are approximate, based on the evaluation on pollution degree 1 the spacings can be reduced to 10.4mm (for 1500Vdc system).

General: The Photovoltaic (PV) Module converts power in the visible portion of the electromagnetic spectrum to DC electrical potential. The basic construction of the laminate consists of laminated assembly of individual solar cells and interconnecting ribbons encapsulated within an insulating material. This encapsulated assembly is pressed between a rigid transparent top surface, referred to as the superstrate, and an insulating back surface, referred to as the substrate. The laminated assembly is supported by a frame which is used for mounting the modules.

Model	Weight of module (Kg)	Total Number of Cells	Total Number of Parallel Circuits	Total Number of Strings	Temperature Coefficient for cells (% change/deg. K (C) rise)		
					Voc	Isc	Pmax
					66H/66HB (210 cell)	34.0	132
60H/60HB (210 cell)	31.0	120	2	3	-0.250	0.004	-0.340
55H/55HB (210 cell)	28.7	110	2	3	-0.250	0.004	-0.340
78H/78HB (182 cell)	30.5	156	2	3	-0.250	0.004	-0.340
72H/72HB (182 cell)	28.0	144	2	3	-0.250	0.004	-0.340
66H/66HB (182 cell)	26.0	132	2	3	-0.250	0.004	-0.340
60H/60HB (182 cell)	23.5	120	2	3	-0.250	0.004	-0.340
54H/54HB (182 cell)	21.5	108	2	3	-0.250	0.004	-0.340
72H/72HB (166 cell)	23.5	144	2	3	-0.270	0.048	-0.350
60H/60HB (166 cell)	20	120	2	3	-0.270	0.048	-0.350

**CONSTRUCTION**

1. Overall Dimensions:
  - 2384 x 1303 x 35 mm (SPxxxM-66H/66HB (210 cell) series)
  - 2172 x 1303 x 35 mm (SPxxxM-60H/60HB (210 cell) series)
  - 2384 x 1096 x 35 mm (SPxxxM-55H/55HB (210 cell) series)
  - 2464 x 1134 x 35 mm (SPxxxM-78H/78HB (182 cell) series)
  - 2279 x 1134 x 35 mm (SPxxxM-72H/72HB (182 cell) series)
  - 2094 x 1134 x 35 mm (SPxxxM-66H/66HB (182 cell) series)
  - 1909 x 1134 x 35 mm (SPxxxM-60H/60HB (182 cell) series)
  - 1724 x 1134 x 35 mm (SPxxxM-54H/54HB (182 cell) series)
  - 2094 x 1038 x 35 mm (SPxxxM-72H/72HB (166 cell) series)
  - 1755 x 1038 x 35 mm (SPxxxM-60H/60HB (166 cell) series)
2. a) Superstrate: Manufactured by XINYI PV PRODUCTS (ANHUI) HOLDINGS LTD., type "AR Coated Tempered Glass", with thickness 3.2 mm.
3. a) Cells: type PM69BF32B2, made by JIANGSU RUNERGY YUEDA PV TECHNOLOGY CO., LTD, 166 x 83 mm, 180 μm ± 18 μm thickness, Mono-crystalline, 9 busbar.
  - b) Cells: type PJ310BF47B2, made by JIANGSU RUNERGY YUEDA PV TECHNOLOGY CO., LTD, 182 x 91 mm, 175 μm ± 17.5 μm thickness, Mono-crystalline, 10 busbar.

c) Cells: type PM1212BF50B2, made by JIANGSU RUNERGY YUEDA PV TECHNOLOGY CO., LTD, 210 x 105 mm, 180  $\mu\text{m} \pm 15 \mu\text{m}$  thickness, Mono-crystalline, 12 busbar.

4. Interconnection between Cells: provided as follows:

- a. 9 bus strips in parallel, Sn60Pb40 composition solder, 0.35mm diameter.  
Manufacturer 1: Wuxi Sveck Technology Co., Ltd;
- b. 10 bus strips in parallel, Sn60Pb40 composition solder, 0.35mm diameter.  
Manufacturer 1: Wuxi Sveck Technology Co., Ltd;
- c. 12 bus strips in parallel, Sn60Pb40 composition solder, 0.35mm diameter.  
Manufacturer 1: Wuxi Sveck Technology Co., Ltd;

5. Cross Connectors (Inter-string connection):

- a. Sn60Pb40 composition solder.  
Applied models - 166 & 182mm cell series;  
Dimension:  
- Product: 0.35 mm thickness, 4.0 or 6.0 mm width  
Manufacturer 1: Wuxi Sveck Technology Co., Ltd;
- b. Sn60Pb40 composition solder.  
Applied models – 210mm cell series;  
Dimension:  
- Product: 0.35 mm thickness, 4.0 or 8.0 mm width  
Manufacturer 1: Wuxi Sveck Technology Co., Ltd;

6. Encapsulation:

a) Ethylene Vinyl Acetate (EVA), Manufacturer Hangzhou First PV material Co., Ltd. (UL recognized: E326347), type "F406P", NC color, thickness:0.5mm for cell above and "F806W", White color, thickness:0.5mm for cell bottom, CTI 600V evaluated by TUV Rheinland (Report No.: 15101259 002, 15101259 004).

7. Substrate:

a) TUV SUD/UL recognized. Manufactured by JOLYWOOD (SUZHOU) SUNWATT CO LTD (E331286), type "FFC-JW30(plus)", white or black, Fluorine Resin/PET/Fluorine Resin, the thickness is 0.315mm, TI=125 C, CTI 600 (TUV SUD Report No.: 70.407.19.105.01-00).

8. Junction Box: TÜV Rheinland certified, No. R 50488820 0002, made by Zhejiang Forsol Energy Co., Ltd., type "F303x", maximum system voltage 1500Vdc, maximum current 30A with enclosure material RTI: 105°C (UL recognized: E479691).

a) Connecting Cable: TÜV Rheinland certified, No. R 50439595, 62930 IEC 131 1 x 4.0mm<sup>2</sup>, manufactured by WUXI XINHONGYE WIRE & CABLE CO., LTD.(E332548), rated sunlight resistant, 90°C wet or dry, 2000 V, 12 AWG, 56 strands, outer wire insulation diameter 6.4±0.2 mm, crimped with Current Carrying Parts.

Alternate - TÜV Rheinland certified, No. R 50413678, 62930 IEC 131 1x4.0mm<sup>2</sup>, manufactured by NINGBO KIBOR WIRE & CABLE CO., LTD. (E470608), rated sunlight resistant, 90°C wet or dry, 2000 V, 12 AWG, 56 strands, outer wire insulation diameter 6.35±0.15 mm, crimped with Current

Carrying Parts.

- b) Connectors: TÜV Rheinland certified, No. R 50340749, Type SIKE6, male and female, manufactured by Zhejiang Forsol Energy Co., Ltd., rated 1500Vdc, maximum current 35 A with 12 AWG cables, 48~65 strands, outer wire insulation diameter 6.3±0.15 mm (UL recognized: E479692).

Alternate - TÜV Rheinland certified, No. R 60127169, Type PV-KBT4-EVO 2/6I-UR(Female) and PV-KST4-EVO2/6I-UR(Male), manufactured by STAUBLI ELECTRICAL CONNECTORS AG, rated 1500Vdc, maximum current 35 A with 12 AWG cables, 19~65 strands, outer wire insulation diameter 5.69~6.47 mm (UL recognized: E343181).

- c) Bypass Diode: three provided. Type MK5050, by ZHEJIANG FORSOL ENERGY CO., LTD., Rated 50V, 50A, Tj: 200°C.
- d) Potting of Junction box material: UL recognized. Manufacturer: Shanghai Huitian New Material Co Ltd. (E248611), Type: 5299W-S, White or Black, Rating: V-0, HWI PLC 1, HAI PLC 0, CTI PLC 0, RTI (Elec) 105 C, thickness 3.0mm.
- e) Junction box adhesive: UL recognized. Provided between junction box and substrate for all model series. Manufacturer: Shanghai Huitian New Material Co Ltd. (E248611), Type: HT906Z, White or Black, Rating: V-0, HWI PLC 1, HAI PLC 0, CTI PLC 0, RTI (Elec) 105 C, thickness 3.0mm.

- 9. Frame: Silver. Extruded anodized aluminum, type 6005-T6, composed of two side rails and two end rails, assembled together with four corner pieces, profiles as indicated in Attachment 2 - Illustrations page 1~40.

- a) Dimensions as follows:

Model Series	Overall Dimensions [mm]	Note
See construction item 1 for detail		Framed

- b) Mounting Holes:

Mounting methods as specified in Attachment 3 - Installation Manual.

Model Series	Overall Dimensions [mm]	Rail	Size [mm]	Number provided
66H/66HB (210 cell) 60H/60HB (210 cell) 55H/55HB (210 cell)	See construction item 1 for detail	Side	9 x 14 / 7 x 10	4 for each side / 2 for each side
		End	-	-
78H/78HB (182 cell)	See construction item 1 for detail	Side	9 x 14	4 for each side
		End	-	-
72H/72HB (182 cell)	See construction item 1 for detail	Side	9 x 14	4 for each side
		End	-	-
66H/66HB (182 cell)	See construction item 1 for detail	Side	9 x 14	2 for each side
		End	-	-
60H/60HB (182 cell)	See construction item 1 for detail	Side	9 x 14	2 for each side
		End	-	-
54H/54HB (182 cell)	See construction item 1 for detail	Side	9 x 14	2 for each side
		End	-	-
72H/72HB (166 cell)	See construction item 1 for detail	Side	9 x 14	2 for each side
		End	-	-
60H/60HB (166 cell)	See construction item 1 for detail	Side	9 x 14	4 for each side
		End	-	-

- a) Grounding Holes:

Grounding methods as specified in Attachment 3 - Installation Manual.

Model Series	Rail	Size [mm]	Number provided
All	Side	Φ 4	2 for each side
	End	-	-

Frame Manufacturer 1: Lipu Metal (JiangYin) co., Ltd.

Frame Manufacturer 1: Jiangyin Yuansheng Aluminium Co., Ltd.

Frame Manufacturer 1: Changshu Dongneng Solar Technology Co., Ltd.

Frame Manufacturer 1: Changzhou Chenghui New Energy Technology Co., Ltd.

- 10. Frame Adhesive: UL recognized. Provided between junction box and substrate for all model series. Manufacturer: Shanghai Huitian New Material Co Ltd. (E248611), Type: HT906Z, White or Black, Rating: V-0, HWI PLC 1, HAI PLC 0, CTI PLC 0, RTI (Elec) 105 C, thickness 3.0mm.

- 11. Grounding:  
The installation instructions shall specify that the use of the following hardware is required in order to provide a reliable grounding connection to the module frame.

See described in the Attachment 3 - Installation Manual.

Model	Parts	Size	Number provided
All	Bolts	M3.5	1
	Flat washer	M3.5	2
	Star washer	M3.5	1
	Cup washer	M3.5	1
	Spring washer	M3.5	2
	Nut	M3.5	1

- 12. Flux: type TFHF9200 made by Tongfang Tech.

- 13. Position Tape: type UV-1, made by 3M

**TESTED COMBINATION OF MATERIALS**

1. The following combinations of the Superstrates and the Encapsulations are approved.

	6(a)	-	-
2(a)	x	-	-

2. The following combinations of the Cells and the Encapsulations are approved.

	6(a)	-	-
3(a)	x	-	-
3(b)	x	-	-
3(c)	x	-	-

3. The following combinations of the Substrates and the Encapsulations are approved.

	6(a)	-	-
7(a)	x	-	-

4. The following combinations of the Substrates and the Junction Box Adhesives are approved.

	7(a)	-	-
HT906Z	x	-	-

**TEST HISTORY**

Edition 1: Project 80151490

Original certificate, new model series: 78H/78HB, 72H/72HB, 66H/66HB, 60H/60HB, 55H/55HB, 54H/54HB.

The representative models of photovoltaic modules were found to comply with the following requirements of CSA-C22.2 No. 61730-2:19 & UL 61730:2017.

The following tests were conducted at Changzhou HuaYang PV Testing Co., Ltd. under APT program. The Clauses are referred to CSA-C22.2 No. 61730-2:19 & UL 61730:2017, respectively. Detailed test results are being kept on Documentum at CSA Group.

Clause	Test name as in CSA-C22.2 No. 61730-2:19 & UL 61730-2:2017	Models Tested	Results	Comments
10.2 / 10.2	Visual inspection MST 01	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.3 / 10.3	Performance at STC MST 02	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.4 / 10.4	Maximum power determination MST 03	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.5 / N/A	Insulation thickness test MST 04	SP660M-66H	Pass	
10.6 / 10.6	Durability of markings MST 05	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.7 / 10.7	Sharp edge test MST 06	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.8 / 10.8	Bypass diode functionality test MST 07	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.9 / 10.9	Accessibility test MST 11	SP660M-66H SP550M-72H	Pass	
10.10 / 10.10	Cut susceptibility test MST 12	SP660M-66H		
10.11 / 10.11	Ground continuity test MST 13 / Continuity test of equipotential bonding MST 13	SP550M-72H SP455M-72H	Pass	
10.12 / 10.12	Impulse voltage test MST 14	SP660M-66H	NA	
10.13 / 10.13	Dielectric withstand test MST 16 / Insulation test MST 16	SP660M-66H SP645M-66HB	Pass	

		SP550M-72H SP455M-72H		
10.14 / 10.14	Wet leakage current test MST 17	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.15 / 10.15	Temperature test MST 21	SP660M-66H SP645M-66HB SP550M-72H SP455M-72H	Pass	
10.16 / 10.16	Hot-spot endurance test MST 22	SP660M-66H SP550M-72H SP455M-72H	Pass	
10.17 / 10.17	Fire test MST 23	SP660M-66H	Pass	
10.18 / N/A	Ignitability test MST 24	SP660M-66H	Pass	
10.19 / 10.19	Bypass diode thermal test MST 25	SP660M-66H	Pass	
10.20 / 10.20	Reverse current overload test MST 26	SP660M-66H SP550M-72H SP455M-72H	Pass	
10.21 / 10.21	Module breakage test MST 32	SP660M-66H	Pass	
10.22 / 10.22	Screw connections test MST 33	NA	NA	No such parts
10.23 / 10.23	Mechanical load test / Static mechanical load test MST 34	SP660M-66H	Pass	
10.24 / 10.24	Peel test MST 35	NA	NA	No cemented joint
10.25 / 10.25	Lap shear strength test MST 36	NA	NA	No cemented joint
10.26 / 10.26	Materials creep test MST 37	SP660M-66H	Pass	
10.27 / 10.27	Robustness of terminations test MST 42	SP660M-66H	Pass	
10.28 / 10.28	Thermal cycling test MST 51	SP660M-66H	Pass	
10.29 / 10.29	Humidity freeze test MST 52	SP660M-66H	Pass	
10.30 / 10.30	Damp heat test MST 53	SP660M-66H	Pass	
10.31 / 10.31	UV preconditioning test / UV test MST 54	SP660M-66H	Pass	
10.32 / 10.32	Cold conditioning MST 55	SP660M-66H	Pass	
10.33 / 10.33	Dry heat conditioning MST 56	SP660M-66H	Pass	

The following tests were conducted at Yangzhou Opto-Electrical Products Testing Institute (YOT) under APT program. The Clauses are referred to CSA-C22.2 No. 61730-2:19 & UL 61730:2017, respectively. Detailed test results are being kept on Documentum at CSA Group.

Clause	Test name as in CSA-C22.2 No. 61730-2:19 & UL 61730-2:2017	Models Tested	Results	Comments
10.17 / 10.17	Fire test MST 23	SP660M-66H	Pass	
10.18 / 10.18	Ignitability test MST 24	SP660M-66H	Pass	

Construction Review:

Construction review performed with satisfactory results.

---End of Report---