Test Location Information	
Name	China Academy of Information and Telecommunication Technology
Address	CuiHu Cloud Center,No. 1 Gaolizhang Road,Wenquan Town, Haidian District, Beijing
Client Information	
Name	NAVITAS GREEN SOLUTIONS PVT. LTD
Address	B-20/3, Road No: 14, Hojiwala Industrial Estate Sachin Udyognagar Sahkari Mandli Limited Sachin Palsana Road Surat, Gujarat, 394230 India.
Report Information	
Report Number	4788939006
Report Date	2020-02-15
Standard References	IEC 62716 first edition: 2013-06 Photovoltaic (PV) modules – Ammonia corrosion testing, IEC61215 second edition:2005 -04 Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval IEC61730-2 first edition:2004-10 Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing
Test Product Information	
Type	NSM380
Product	Mono-crystalline photovoltaic module
Testing Engineer	
Name/Signature	Wu Yapan (from subcontract lab)
Laboratory Review	
Name/Signature	Johnny Zhu

General Information

Information conveyed by this Report applies only to the test sample(s) actually tested. UL Company did not select the sample(s), determine whether the sample(s) was representative of production sample(s), nor was UL provided with information relative to the formulation or identification of component materials used in the test sample(s).

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Table 1 "List of tests"

Table 2 "Appendix"

Sample Identification

Sample No.	Sample Identification Number	Date Received	Product Description /Serial Number
1	2733660	2019-12-04	PV module NS380071900004
2	2733659	2019-12-04	PV module NS380071900010
3	2733658	2019-12-04	PV module NS380071900014

Table 3 "Sample identification list"

Module Type	Voc (V)	Vmp (V)	MSV (V)	Imp (A)	Isc (A)	Pmax (Wp)	Fill Factor (%)
Module Series NSMxxx (x=320~380)							
NSM380	48.60	39.8	1500	9.55	9.88	380	79.14
NSM375	48.40	39.6	1500	9.47	9.83	375	78.82
NSM370	48.20	39.4	1500	9.39	9.78	370	78.49
NSM365	48.00	39.2	1500	9.31	9.73	365	78.15
NSM360	47.80	39	1500	9.23	9.68	360	77.80
NSM355	47.60	38.8	1500	9.15	9.63	355	77.45
NSM350	47.40	38.6	1500	9.07	9.58	350	77.08
NSM345	47.20	38.4	1500	8.98	9.53	345	76.70
NSM340	47.00	38.2	1500	8.90	9.48	340	76.31
NSM335	46.80	38	1500	8.82	9.43	335	75.91
NSM330	46.60	37.8	1500	8.73	9.38	330	75.50
NSM325	46.40	37.6	1500	8.64	9.33	325	75.07
NSM320	46.20	37.4	1500	8.56	9.28	320	74.64
Module Series NSMxxx-60 (x=250~330)							
Module Type	**Voc (V)**	**Vmp (V)**	**MSV (V)**	**Imp (A)**	**Isc (A)**	**Pmax (Wp)**	**Fill Factor (%)**
NSM330-60	41.10	33.7	1500	9.79	10.19	330	78.79
NSM325-60	40.90	33.5	1500	9.70	10.01	325	79.38
NSM320-60	40.70	33.3	1500	9.61	9.92	320	79.26
NSM315-60	40.50	33.1	1500	9.52	9.83	315	79.12
NSM310-60	40.30	32.9	1500	9.42	9.74	310	78.98
NSM305-60	40.10	32.7	1500	9.33	9.65	305	78.82
NSM300-60	39.90	32.5	1500	9.23	9.56	300	78.65
NSM295-60	39.70	32.3	1500	9.13	9.47	295	78.47
NSM290-60	39.50	32.1	1500	9.03	9.38	290	78.27
NSM285-60	39.30	31.9	1500	8.93	9.29	285	78.06

NSM280-60	39.10	31.7	1500	8.83	9.2	280	77.84
NSM275-60	38.90	31.5	1500	8.73	9.11	275	77.60
NSM270-60	38.70	31.3	1500	8.63	9.02	270	77.35
NSM265-60	38.50	31.1	1500	8.52	8.93	265	77.08
NSM260-60	38.30	30.9	1500	8.41	8.84	260	76.79
NSM255-60	38.10	30.7	1500	8.31	8.75	255	76.49
NSM250-60	37.90	30.5	1500	8.20	8.66	250	76.17
Module Series NSMxxx-54 (x=215~295)							
Module Type	**Voc**	**Vmp**	**MSV**	**Imp**	**Isc**	**Pmax**	**Fill Factor**
	(V)	**(V)**	**(V)**	**(A)**	**(A)**	**(Wp)**	**(%)**
NSM295-54	36.95	30.3	1500	9.74	10.05	295	79.44
NSM290-54	36.75	30.1	1500	9.63	9.95	290	79.31
NSM285-54	36.55	29.9	1500	9.53	9.85	285	79.16
NSM280-54	36.35	29.7	1500	9.43	9.75	280	79.00
NSM275-54	36.15	29.5	1500	9.32	9.65	275	78.83
NSM270-54	35.95	29.3	1500	9.22	9.55	270	78.64
NSM265-54	35.75	29.1	1500	9.11	9.45	265	78.44
NSM260-54	35.55	28.9	1500	9.00	9.35	260	78.22
NSM255-54	35.35	28.7	1500	8.89	9.25	255	77.98
NSM250-54	35.15	28.5	1500	8.77	9.15	250	77.73
NSM245-54	34.95	28.3	1500	8.66	9.05	245	77.46
NSM240-54	34.75	28.1	1500	8.54	8.95	240	77.17
NSM235-54	34.55	27.9	1500	8.42	8.85	235	76.86
NSM230-54	34.35	27.7	1500	8.30	8.75	230	76.52
NSM225-54	34.15	27.5	1500	8.18	8.65	225	76.17
NSM220-54	33.95	27.3	1500	8.06	8.55	220	75.79
NSM215-54	33.75	27.1	1500	7.93	8.45	215	75.39
Module Series NSMxxx-48 (x=180~265)							
Module Type	**Voc**	**Vmp**	**MSV**	**Imp**	**Isc**	**Pmax**	**Fill Factor**
	(V)	**(V)**	**(V)**	**(A)**	**(A)**	**(Wp)**	**(%)**
NSM265-48	33.00	27.1	1500	9.78	10.1	265	79.51
NSM260-48	32.80	26.9	1500	9.67	9.99	260	79.35
NSM255-48	32.60	26.7	1500	9.55	9.88	255	79.17
NSM250-48	32.40	26.5	1500	9.43	9.77	250	78.98
NSM245-48	32.20	26.3	1500	9.32	9.66	245	78.76
NSM240-48	32.00	26.1	1500	9.20	9.55	240	78.53
NSM235-48	31.80	25.9	1500	9.07	9.44	235	78.28
NSM230-48	31.60	25.7	1500	8.95	9.33	230	78.01
NSM225-48	31.40	25.5	1500	8.82	9.22	225	77.72
NSM220-48	31.20	25.3	1500	8.70	9.11	220	77.40

NSM215-48	31.00	25.1	1500	8.57	9.00	215	77.06
NSM210-48	30.80	24.9	1500	8.43	8.89	210	76.69
NSM205-48	30.60	24.7	1500	8.30	8.78	205	76.30
NSM200-48	30.40	24.5	1500	8.16	8.67	200	75.88
NSM195-48	30.20	24.3	1500	8.02	8.56	195	75.43
NSM190-48	30.00	24.1	1500	7.88	8.45	190	74.95
NSM185-48	29.80	23.9	1500	7.74	8.34	185	74.44
NSM180-48	29.60	23.7	1500	7.59	8.23	180	73.89
Module Series NSMxxx-36 (x=150~185)							
Module Type	**Voc**	**Vmp**	**MSV**	**Imp**	**Isc**	**Pmax**	**Fill Factor**
	(V)	**(V)**	**(V)**	**(A)**	**(A)**	**(Wp)**	**(%)**
NSM185-36	24.15	19.72	1000	9.38	9.80	185	78.17
NSM180-36	23.95	19.52	1000	9.22	9.68	180	77.64
NSM175-36	23.75	19.32	1000	9.06	9.56	175	77.08
NSM170-36	23.55	19.12	1000	8.89	9.44	170	76.47
NSM165-36	23.35	18.92	1000	8.72	9.32	165	75.82
NSM160-36	23.76	19.80	1000	8.08	8.74	160	77.05
NSM155-36	23.40	19.44	1000	7.97	8.61	155	76.93
NSM150-36	23.04	19.08	1000	7.86	8.48	150	76.77
Module Series NSMxxx-66 (x=295~355)							
Module Type	**Voc**	**Vmp**	**MSV**	**Imp**	**Isc**	**Pmax**	**Fill Factor**
	(V)	**(V)**	**(V)**	**(A)**	**(A)**	**(Wp)**	**(%)**
NSM355-66	44.75	36.6	1500	9.70	9.97	355	79.56
NSM350-66	44.55	36.4	1500	9.62	9.92	350	79.20
NSM345-66	44.35	36.2	1500	9.53	9.87	345	78.81
NSM340-66	44.15	36.0	1500	9.44	9.82	340	78.42
NSM335-66	43.95	35.8	1500	9.36	9.77	335	78.02
NSM330-66	43.75	35.6	1500	9.27	9.72	330	77.60
NSM325-66	43.55	35.4	1500	9.18	9.67	325	77.17
NSM320-66	43.35	35.2	1500	9.09	9.62	320	76.73
NSM315-66	43.15	35.0	1500	9.00	9.57	315	76.28
NSM310-66	42.95	34.8	1500	8.91	9.52	310	75.82
NSM305-66	42.75	34.6	1500	8.82	9.47	305	75.34
NSM300-66	42.55	34.4	1500	8.72	9.42	300	74.85
NSM295-66	42.35	34.2	1500	8.63	9.37	295	74.34

Table 4 Models Covered: Mono-PERC Solar Module

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
–	–	–	2019-12-31

Preconditioning

Description and Setup

The module was exposed to a total irradiance of 5 – 20kWh/m².

Results

Sample No.	Average irradiance during exposed time [W/m²]	Exposed time [hh:mm]	Total exposed irradiance [kWh/m²]
2733660 2733659 2733658	854	6.0	5.1

Table 5 "Preconditioning"

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
27.7	-	24.8	2019-12-31

Visual Inspection As Received

Description and Setup

Samples were visually inspected *according to IEC61215 2nd edition rev. date 2005-04*.
To detect visual defects prior testing. The test was performed with an illumination of not less than 1000 lux. The modules were inspected for the following conditions (if applicable) primarily, additionally all other observations on the modules were noted.

- cracked, bent, misaligned or torn external surfaces;
- broken cells;
- cracked cells;
- faulty interconnections or joints;
- cells touching one another or the frame;
- failure of adhesive bonds;
- bubbles or delamination forming a continuous path between a cell and the edge of the module;
- tacky surface of plastic materials;
- faulty terminations, exposed live electrical parts;
- any other conditions which may affect performance;

Results

The following figure illustrates the cell position on the module.

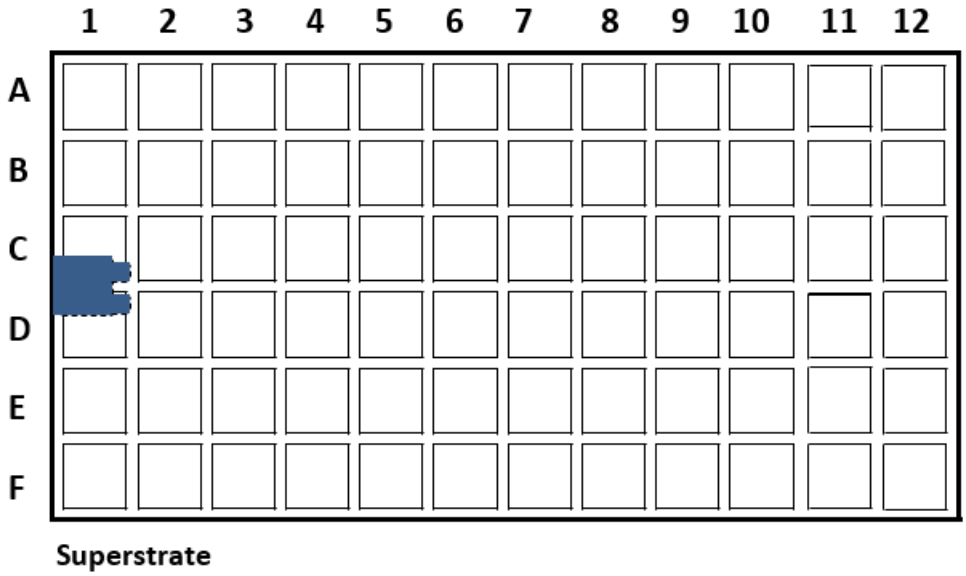

Figure 1 “Cell positions”

Sample No.	Condition Visual Inspection
2733660	No major visual defects
2733659	No major visual defects
2733658	No major visual defects

Table 6 Results "Visual Inspection As Received"

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
31.1	-	24.9	2019-12-31

Maximum power determination as received

Description and Setup

The maximum power determination *according to IEC61215 2nd edition rev. date 2005-04* has been determined by use of a class A pulsed sun simulator *according to IEC60904-9* and a photovoltaic reference device *according to IEC 60904-2* of the same technology as the sample under test.

- Before each test the photovoltaic reference device was placed on the pulsed sun simulator to adjust the test equipment and assure the correctness of the measurement.
- After adjusting the pulsed sun simulator the sample under test was placed on the test area and hold at a temperature of 25°C +/-1°C.
- The current-voltage characteristics were measured and recorded at an irradiance of 1000 W/m².

Results

Sample No.	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]	T [°C]	Irr [W/m²]
2733660	48.581	39.611	9.697	9.187	363.908	77.24	25	1000
2733659	48.548	39.535	9.715	9.237	365.195	77.43	25	1000
2733658	48.616	39.655	9.672	9.244	366.562	77.96	25	1000

Table 7 "Maximum power determination"

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
30.7	-	24.1	2019-12-31

Dielectric voltage withstand test as received

Description and Setup

The insolation test was performed *according to 61730-2:2004*
A voltage of 4 times the maximum system voltage plus 2000Vdc was applied between shorted output terminals and the frame for 1 minute.
After this the maximum System Voltage, but at least 500V, was applied between the shorted output terminals and the frame. After 2 minutes the insulation resistance was measured.

Sample	**Length [m]**	**Width [m]**	**Area (L x W) [m²]**	**Minimum Resistance Required (40MΩ*m²/Area) [MΩ]**
2733660	1.960	0.990	1.94	20.62
2733659				
2733658				

Results

Sample No.	Applied test voltage [V]	Dielectric breakdown [Yes/No]
2733660	8000	**No**
2733659	8000	**No**
2733658	8000	**No**

Table 8 "Dielectric strength"

Sample No.	Applied test voltage [V]	Measured insulation resistance [MΩ]	Required insulation resistance [MΩ]
2733660	1500	> 9900	20.62
2733659	1500	> 9900	20.62
2733658	1500	> 9900	20.62

Table 9 "Insulation resistance"

Supplementary information: The maximum resistance measurement range is 9900 MΩ.

Outcome

There was no indication of dielectric breakdown for all Samples.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
30.7	-	24.1	2019-12-31

Wet leakage current test as received

Description and Setup

The wet leakage current test was performed *according to IEC61215 2nd edition rev. date 2005-04* .The module was placed in a water test solution so that all surfaces except the junction box entries were covered by the water solution. The cable entries were only sprayed with the water test solution.
The maximum system voltage, but at least 500V, was applied between the shorted output terminals and the solution. After 2 minutes the insulation resistance was measured.

The test solution shall meet following requirements:

- Resistivity: less than 3500Ω*cm
- Temperature: 22°C ± 3°C

Sample	Length [m]	Width [m]	Area (L x W) [m²]	Minimum Resistance Required (40MΩ*m²/Area) [MΩ]
2733660	1.960	0.990	1.94	20.62
2733659				
2733658				

Results

Resistivity of water test solution [Ω*cm]	Surface tension of water test solution [N/m]	Temperature of water test solution [°C]
1946	**-**	**22.8**

Table 10 "Measurement solution"

Sample No.	Applied test Voltage [V]	Measured insulation resistance [MΩ]	Required insulation resistance [MΩ]
2733660	1500	4672	20.62
2733659	1500	3876	20.62
2733658	1500	4155	20.62

Table 11 "Wet leakage current test as received"

Outcome

The measured insulation resistance of all Samples is greater than the minimum required resistance.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
30.7	-	24.1	2019-12-31

Ground continuity test as received

Description and Setup

The ground continuity test was performed *according to IEC61730-2 1st edition rev. date 2004-10.* A current of 2.5 times of the maximum over current protection rating of the module was applied between the grounding connection and the conductive frame. After 2 minutes the voltage drop across the grounding connection under test was measured. The resistance was then calculated. The test was repeated for each frame part of the Module.

Ground continuity test as received

Results

The following Figure illustrates the measurement points for the ground continuity test:

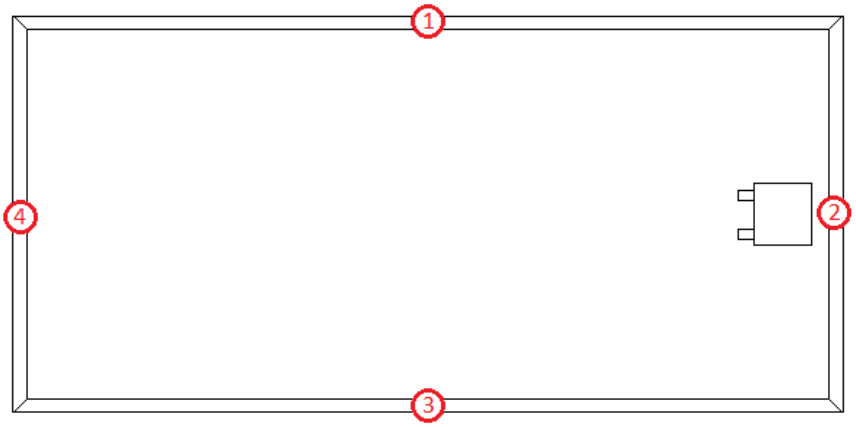

Figure 2 "Measurement points for ground continuity test"

Sample	Measurement Points	Protection rating [A]	Applied Current [A]	Voltage Drop [V]	Resistance [Ω]
2733660	1 to 2	15	37.5	0.049	0.0013
	1 to 3			0.066	0.0018
	1 to 4			0.083	0.0022
2733659	1 to 2			0.081	0.0022
	1 to 3			0.055	0.0015
	1 to 4			0.064	0.0017
2733658	1 to 2			0.074	0.0020
	1 to 3			0.087	0.0023
	1 to 4			0.061	0.0016

Table 12 "Ground Continuity Test"

Outcome

The grounding path resistance for all samples is below 0.1Ω.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
–	–	–	2019-12-31-2020-1-20

Ammonia resistance test procedure

Description and Setup

The Ammonia resistance test procedure was performed *according to IEC 62716 Edition 1.0 date 2013-06.*

Test condition:

Cycles	1 test section	Hours	Hours 8 h including heating up
		NH_3-concentration	6 667 ppm[1])
		Temperature	(60 ± 3) °C
		Relative humidity	Saturation at about 100 % (dewing of the samples)
	2 test section	Hours	16 h including cooling (Test chamber opened and/or ventilates)
		NH_3-concentration	0 ppm
		Temperature	18 °C to 28 °C
		Relative humidity	max. 75 %
Duration		Duration 20 cycles (480 h)	
1) The concentration is related to the volume of the test chamber and corresponds to a ground quantity of water of 2 l with a chamber volume of 300 l. The level of concentration is derived from DIN 50018, Table 1.			

During testing the inclination to the vertical of the face of the PV module normally exposed to solar irradiance shall be 15° to 30° inside the test chamber. The two samples shall be installed in the chamber such that they are oriented in opposite directions. One sample's front side facing the chamber outer wall, one sample's rear side facing the chamber outer wall.

After the ammonia test all samples shall be washed to remove the adherent ammonia using running tap water (not artificially pressurized) for a maximum time of 5 min per square meter of area of the sample. Once the washing is finished distilled or demineralized water shall be used to rinse the samples, followed by complete drying at room temperature. To accelerate drying it is allowed to shake the test sample by hand or to use air blasts with the aid of a fan. The temperature of the water used for washing shall not exceed 35 °C.

Results

Sample No.			2733660, 2733659
Cycles	1 test section	Hours(h)……:	8 (including heating up)
		NH_3-concentration(ppm) ……..:	6667
		Temperature(℃)……..……:	61
		Relative humidity(%)……..…...:	100
	2 test section	Hours(h)……:	16 (including cooling)
		NH_3-concentration(ppm) ……..:	0
		Temperature(℃)……..……:	25
		Relative humidity(%)……..…..:	36
Duration		20 cycles (480h)	
Supplementary information: N/A			

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
29.6	-	23.5	2020-01-21

Visual Inspection after Ammonia resistance test procedure

Description and Setup

Samples were visually inspected *according to IEC61215 2nd edition rev. date 2005-04*.
To detect visual defects prior testing. The test was performed with an illumination of not less than 1000 lux. The modules were inspected for the following conditions (if applicable) primarily, additionally all other observations on the modules were noted.

- cracked, bent, misaligned or torn external surfaces;
- broken cells;
- cracked cells;
- faulty interconnections or joints;
- cells touching one another or the frame;
- failure of adhesive bonds;
- bubbles or delamination forming a continuous path between a cell and the edge of the module;
- tacky surface of plastic materials;
- faulty terminations, exposed live electrical parts;
- any other conditions which may affect performance;

Results

The following figure illustrates the cell position on the module.

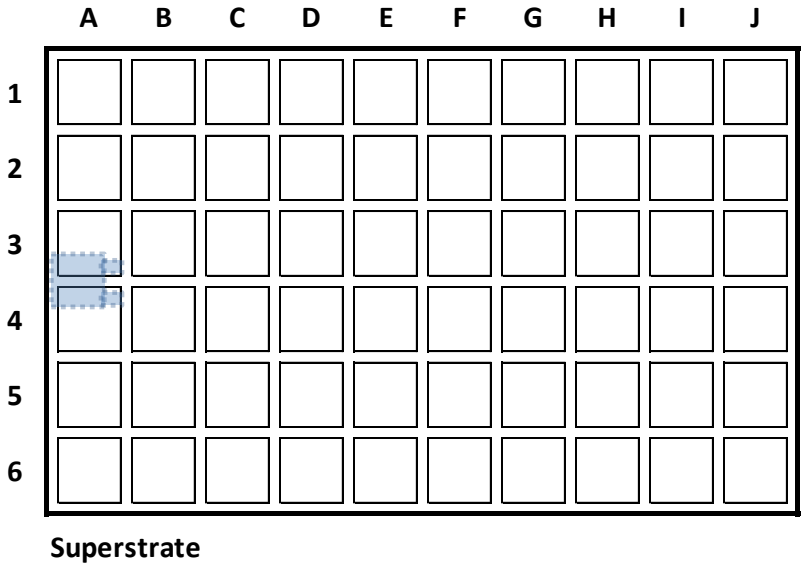

Figure 3 "Cell positions"

Sample No.	Condition Visual Inspection
2733660	No major visual defects
2733659	No major visual defects
2733658	No major visual defects

Table 13 "Visual Inspection after Ground continuity test"

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
24.6	-	25	2020-01-21

Maximum Power Determination after Ammonia resistance test procedure

Description and Setup

The maximum power determination *according to IEC61215 2nd edition rev. date 2005-04* has been determined by use of a class A pulsed sun simulator *according to IEC60904-9* and a photovoltaic reference device *according to IEC 60904-2* of the same technology as the sample under test.

- Before each test the photovoltaic reference device was placed on the pulsed sun simulator to adjust the test equipment and assure the correctness of the measurement.
- After adjusting the pulsed sun simulator the sample under test was placed on the test area and hold at a temperature of 25°C +/-1°C.
- The current-voltage characteristics were measured and recorded at an irradiance of 1000 W/m².

Results

Sample No.	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]	T [°C]	Irr [W/m²]
2733660	48.615	39.617	9.698	9.191	364.130	77.23	25	1000
2733659	48.670	39.650	9.609	9.144	362.549	77.52	25	1000
2733658	48.595	39.584	9.722	9.253	366.251	77.52	25	1000

Table 14 "Maximum power determination after Ammonia resistance test procedure "

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
27.8	-	23.2	2020-01-21

Dielectric voltage withstand test after Ammonia resistance test procedure

Description and Setup

The insolation test was performed *according to 61730-2:2004*
A voltage of 4 times the maximum system voltage plus 2000Vdc was applied between shorted output terminals and the frame for 1 minute.
After this the maximum System Voltage, but at least 500V, was applied between the shorted output terminals and the frame. After 2 minutes the insulation resistance was measured.

Sample	**Length [m]**	**Width [m]**	**Area (L x W) [m²]**	**Minimum Resistance Required (40MΩ*m²/Area) [MΩ]**
2733660	1.960	0.990	1.94	20.62
2733659				
2733658				

Results

Sample No.	Applied test voltage [V]	Dielectric breakdown [Yes/No]
2733660	8000	No
2733659	8000	No
2733658	8000	No

Table 15 " Dielectric voltage withstand test"

Sample No.	Applied test voltage [V]	Measured insulation resistance [MΩ]	Required insulation resistance [MΩ]
2733660	1500	>9900	20.62
2733659	1500	>9900	20.62
2733659	1500	>9900	20.62

Table 16 "Insulation resistance "

Supplementary information: The maximum resistance measurement range is 9900 MΩ.

Outcome

There was no indication of dielectric breakdown for all Samples.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
27.8	-	23.1	2020-01-21

Wet leakage current test after Ammonia resistance test procedure

Description and Setup

The wet leakage current test was performed *according to IEC61215 2nd edition rev. date 2005-04* .The module was placed in a water test solution so that all surfaces except the junction box entries were covered by the water solution. The cable entries were only sprayed with the water test solution.
The maximum system voltage, but at least 500V, was applied between the shorted output terminals and the solution. After 2 minutes the insulation resistance was measured.

The test solution shall meet following requirements:

- Resistivity: less than 3500Ω*cm
- Temperature: 22°C ± 3°C

Sample	**Length [m]**	**Width [m]**	**Area (L x W) [m²]**	**Minimum Resistance Required (40MΩ*m²/Area) [MΩ]**
2733660	1.960	0.990	1.94	20.62
2733659				
2733658				

Results

Resistivity of water test solution [Ω*cm]	Surface tension of water test solution [N/m]	Temperature of water test solution [°C]
2087	-	23.0

Table 17 "Measurement solution"

Sample No.	Applied test voltage [V]	Measured insulation resistance [MΩ]	Required insulation resistance [MΩ]
2733660	1500	3896	20.62
2733659	1500	4016	20.62
2733658	1500	4328	20.62

Table 18 "Wet leakage current test after Ground continuity test"

Outcome

The measured insulation resistance of all samples is greater than the minimum required resistance.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
27.8	-	23.2	2020-01-21

Ground continuity test after Ammonia resistance test procedure

Description and Setup

The Ground continuity test after Ground continuity test was performed *according to IEC61730 edition 1.1 rev. date 2012-11*. A current of 2.5 times of the maximum over current protection rating of the module was applied between the grounding connection and the conductive frame. After 2 minutes the voltage drop across the grounding connection under test was measured. The resistance was then calculated.
The test was repeated for each frame part of the Module.

Results

The following Figure illustrates the measurement points for the Ground continuity test after Ground continuity test:

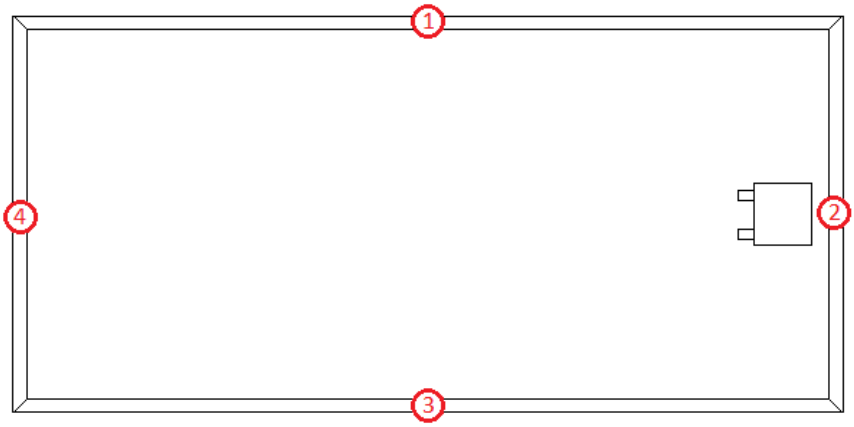

Figure 4 “Measurement points for Ground continuity test after Ground continuity test”

Sample	Measurement Points	Protection rating [A]	Applied Current [A]	Voltage Drop [V]	Resistance [Ω]
2733660	1 to 2	15	37.5	0.070	0.0019
	1 to 3			0.053	0.0014
	1 to 4			0.086	0.0023
2733659	1 to 2			0.093	0.0025
	1 to 3			0.039	0.0010
	1 to 4			0.045	0.0012
2733658	1 to 2			0.096	0.0026
	1 to 3			0.088	0.0023
	1 to 4			0.047	0.0013

Table 19 "Ground continuity test after Ground continuity test"

Outcome

The grounding path resistance for all samples is below 0.1Ω.

Humidity/ [%r.H]	Barometric Pressure / [mBar]	Ambient / [°C]	Date
29.6	-	23.7	2020-01-22

Bypass diode functionality test

Description and Setup

The diode functionality test after environmental duct and sand test was performed *according to IEC61701Salt mist corrosion testing of PV modules 2nd edition date 2011-12.*

a) Electrically short any blocking diodes incorporated to the test sample.

b) Determine the rated STC short-circuit current of the test sample from its label or instruction sheet.

c) Connect the DC power source's positive output to the test sample negative lead, and the DC power source's negative output to the test sample positive lead by using wires of the manufacturer's minimum recommended wire gauge. Follow the manufacturer's recommendations for wire entry into the wiring compartment. With this configuration the current shall pass through the cells in the reverse direction and through the diode(s) in the forward direction.

d) Apply a current equal to of 1,25 times (± 5 %) the STC short-circuit current of the test sample for a period of 1 h.

e) to shade a solar cell protected by each diode (one per string, step by step) in the PV module and verify the characteristics of the resulting I-V curve (under illumination close to STC) to check if the bypass diode(s) is(are) working.

Results

Sample No.	2733659		
Module temperature [°C]	25		
Number of diodes in junction box	3		
Diode manufacturer	—		
Diode type designation	—		
STC short-circuit current [A]	9.88		
Current flow (1.25 * Isc) [A]	12.4		
Test duration (hour)	1		
Diode functional? Yes/No	Diode 1	Diode 2	Diode 3
	Yes	Yes	Yes

Sample No.	2733658		
Module temperature [°C]	25		
Number of diodes in junction box	3		
Diode manufacturer	—		
Diode type designation	—		
STC short-circuit current [A]	9.88		
Current flow (1.25 * Isc) [A]	12.4		
Test duration (hour)	1		
Diode functional? Yes/No	Diode 1	Diode 2	Diode 3
	Yes	Yes	Yes

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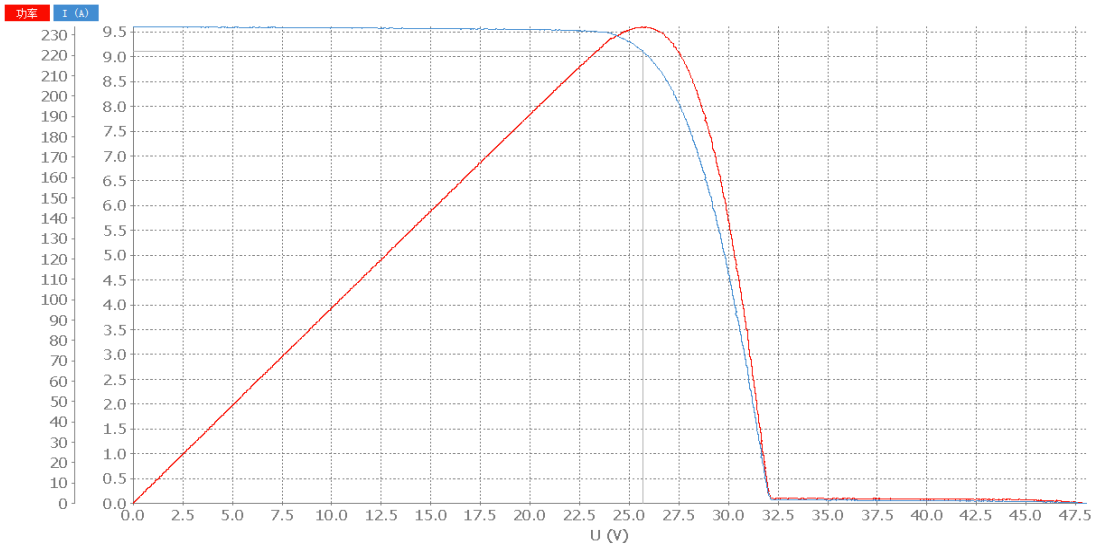
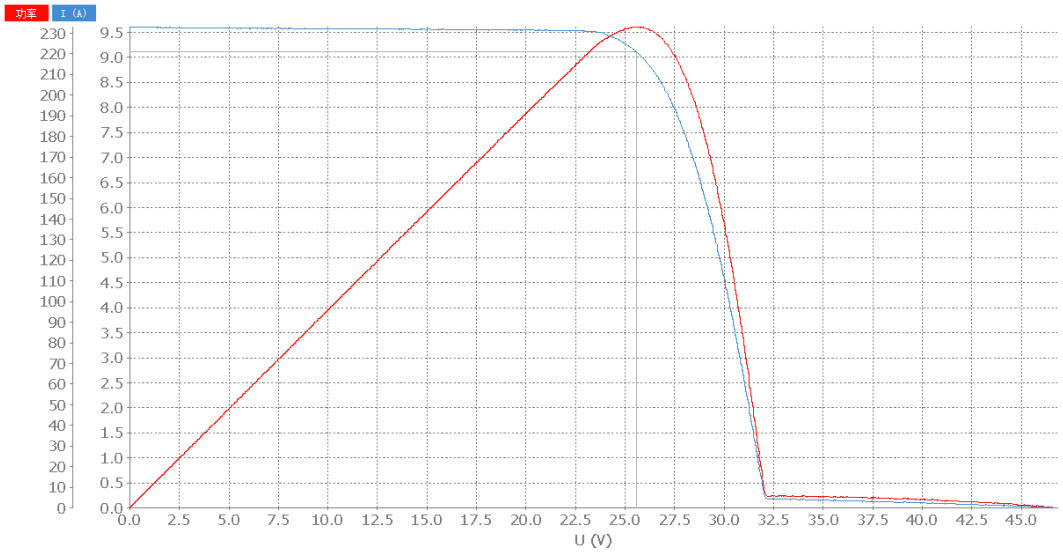
Outcome

Sample No	2733659					
Test Diode#	**Voc [V]**	**Vmp [V]**	**Isc [A]**	**Imp [A]**	**Pmax [W]**	**FF [%]**
1	39.881	25.702	9.623	9.103	233.959	60.96
2	39.586	25.587	9.616	9.105	232.970	61.20
3	38.287	25.699	9.621	9.096	233.754	63.46

I-V Curve1



I-V Curve2



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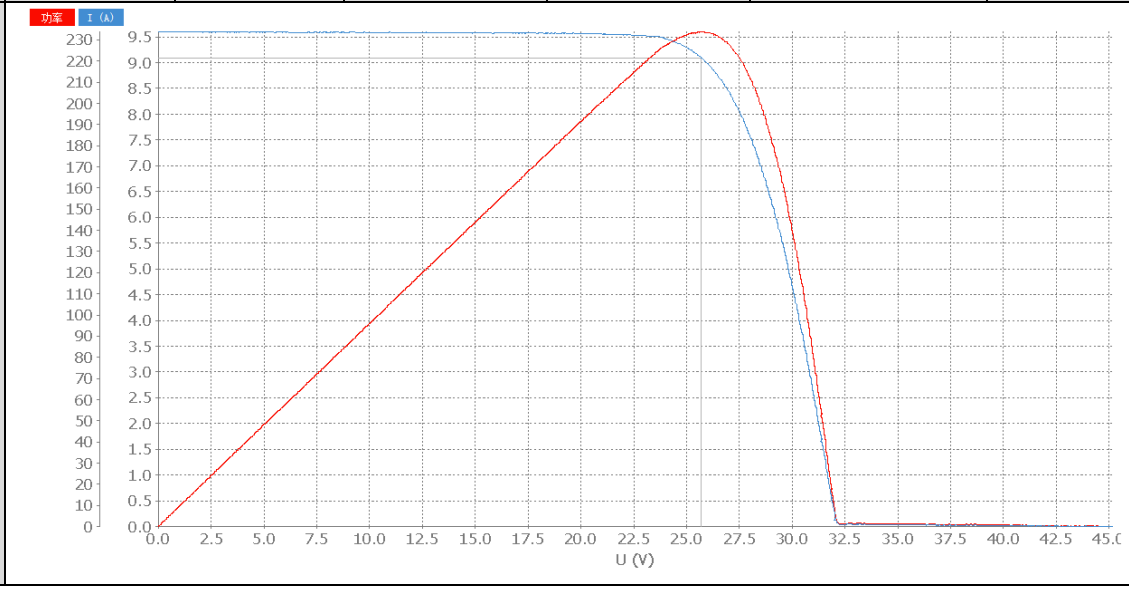
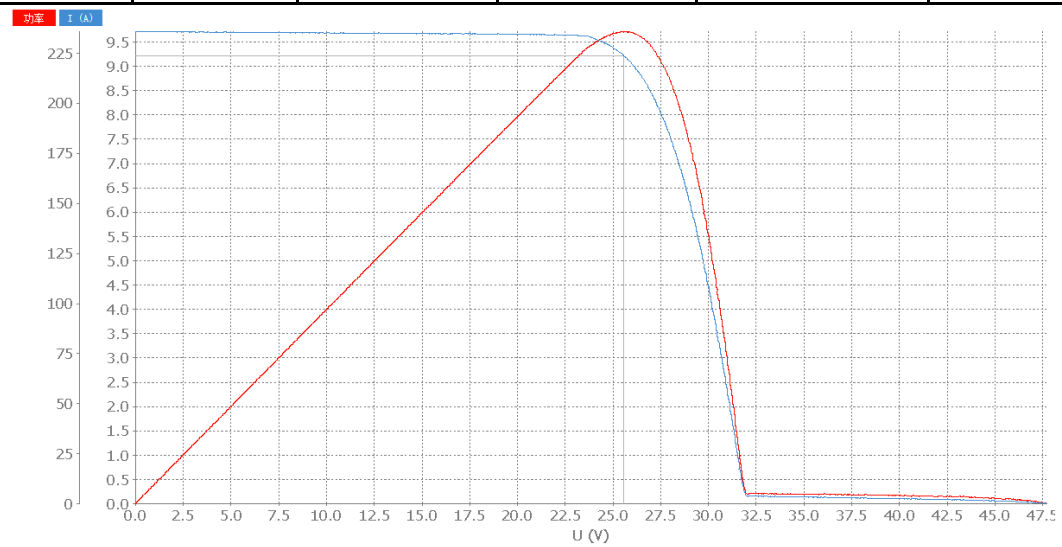
Report Date: 2020-02-15

Sample No	2733659					
Test Diode#	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]
I-V Curve3						

Sample No	2733658					
Test Diode#	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmax [W]	FF [%]
1	39.939	25.579	9.731	9.218	235.784	60.67
2	39.326	25.515	9.744	9.208	234.940	61.31
3	37.641	25.560	9.725	9.200	235.137	64.24
I-V Curve1						

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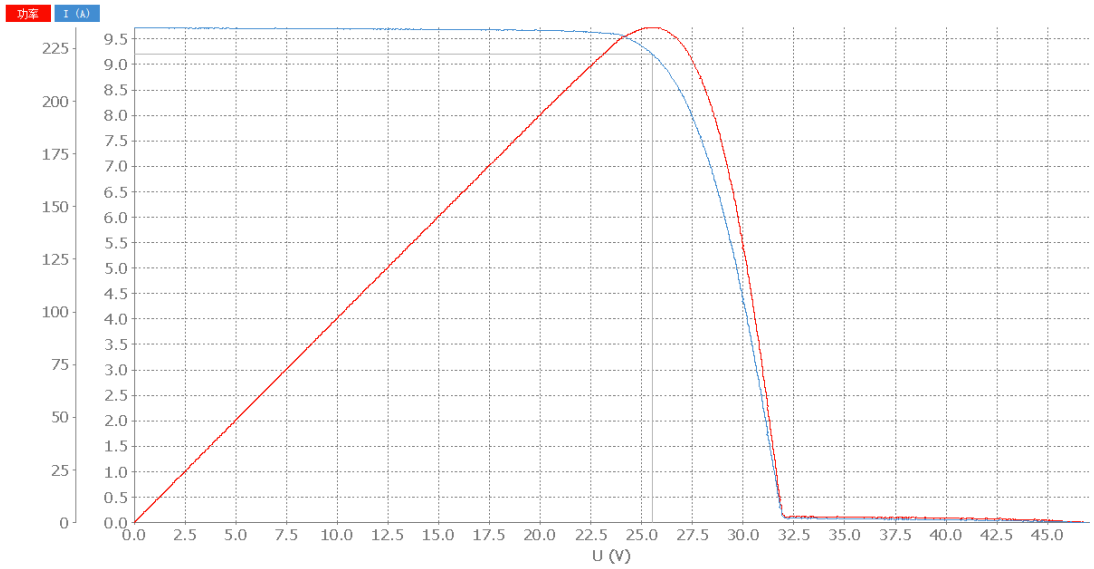
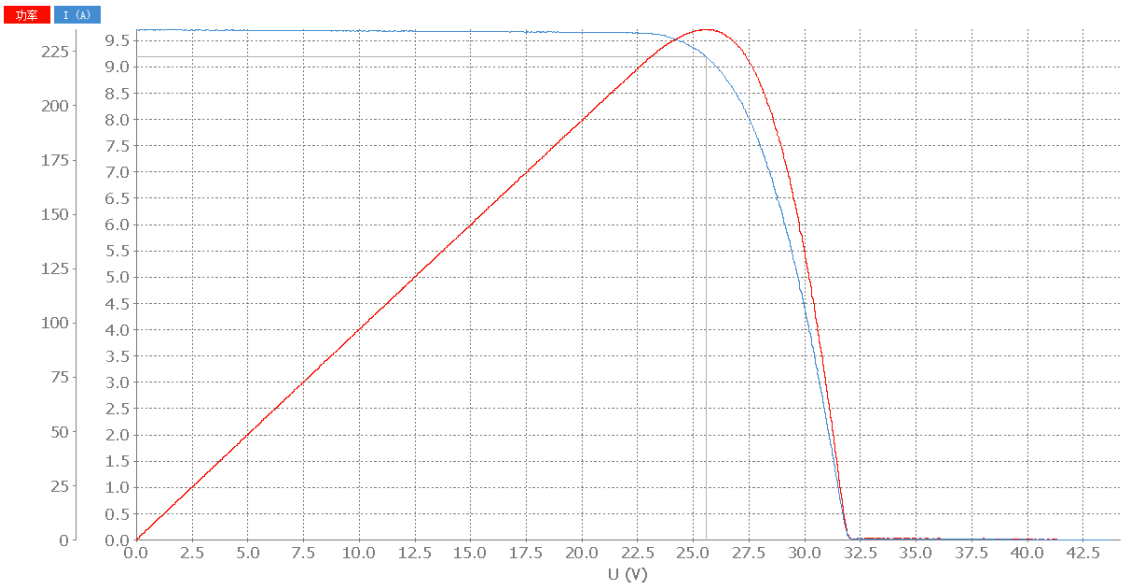
Sample No	2733658					
Test Diode#	**Voc [V]**	**Vmp [V]**	**Isc [A]**	**Imp [A]**	**Pmax [W]**	**FF [%]**
I-V Curve2						
I-V Curve3						

The diode did still function as a diode after the conclusion of the test.

Appendix 1 – Statement of the estimated uncertainty of the PIV test results

Statement of the estimated uncertainty of the I/V test, K=2.
U(Isc)=2.4%
U(Voc)=0.6%
U(Pmax)=2.6%

Appendix 2 – PV module Family Bill of Material

BILL OF MATERIAL DETAIL OF NAVITAS GREEN SOLUTIONS PVT LTD

SR No.	Object	Manufacturer	Specifications
1	Solar Glass	Gujarat Borosil Ltd	AR Coated Tempered Glass Thickness 3.2mm
2	Ribbon(Cell Connector)	Luvata	SN/PB – 60/ 40
3	Busbar(string Connector)	Luvata	SN/PB – 60/ 40
4	EVA(Encapsulation Material)	Renewsys India Pvt Ltd	Conserv PUVT-14FC Conserv P360-14 FC
5	Backsheet(Rear Cover)	Renewsys India Pvt ltd	Preserv A-190 WN
6	Silicon Sealant	Tonson Adhesive, Inc.	1527
7	Aluminum Frame	Lead Solar Holding Ltd	T5 35 HS
8	Solar Cell	Viet-energy	Mono Perc
9	Junction Box	Jiangsu Haitian Microelectronics	PV-HT013, 1500V, 15A, IP68
10	Adhession	Tonsan Adhessive	1527

Prepared By	Approved By
Roshan Tandel	*Sanjeev Gupta*

NAVITAS GREEN SOLUTIONS PVT. LTD.

Appendix 3 – Instrument reference list

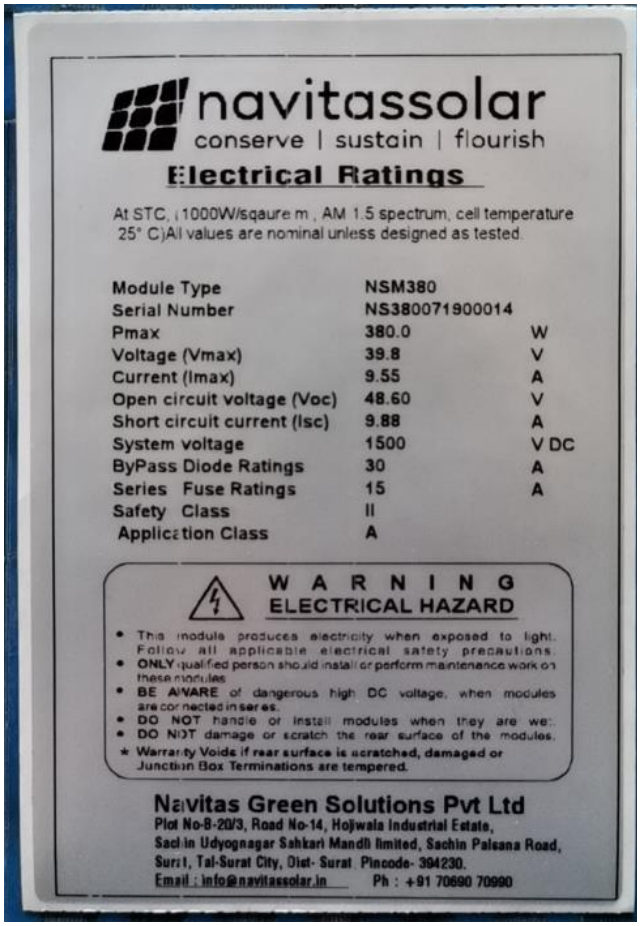
All instruments calibrations are traceable to national normal.

Instrument reference list

Instrument ID	Instrument type	Model	Calibration date	
			Last	Due
10045783000100359	Solar simulator	Flash Generator HighLight3 LMT	2019.01.31	2020.01.30
2016LB1016	Ammonia corrosion chamber	F-(NH3)SO2-09	2019.11.25	2020.11.24
736400	Stopwatch	Diamond	2019.08.20	2020.08.19
/	Shunt	FL-27(50A/75mV)	2019.10.14	2020.10.13
/	Steel tape	2000mm	2019.11.22	2020.11.21
JC01563	Conductivity meter	3173	2019.02.20	2020.02.19
1711213	Dielectrometer	SE7430	2019.04.19	2020.04.18
90810022	Light Meter	TES 1332A	2019.04.09	2020.04.08
16440050	Multimeter	289C	2019.01.29	2020.01.28
93621	Gas Flowmeter	YDOOO3955	2019.07.15	2020.07.14
02130835	Pyranometer	TBQ-2	2019.07.11	2020.07.10
OMS-1110-01	Outdoor tester	BR-PV-OMS	2019.04.16	2020.04.15

Table 20 “Instrument reference list”

Appendix 4 – Label and module picture



Module Label

Junction box and connector

Module front view

Module rear view

END OF TEST REPORT