Test Report

Novasys Greenergy Private Limited

REPORT NUMBER: 4790378634.5.1-S1

PROJECT NUMBER: 4790378634.5.1

Select the applicable test locations:

☒**LOCATION 1:**

UL India Private Limited,
Laboratory building, Kalyani Platina Campus, Sy.no.129/4, EPIP Zone, Phase II, Whitefield,
Bangalore – 560 066
P:91-80-41384400

☐**LOCATION 2:**

UL India Private Limited,
Oak building, Kalyani Platina Campus, Sy.No.129/4,
EPIP Zone, Phase II, Whitefield,
Bangalore, Karnataka – 560 066

☐**LOCATION 3:**

UL India Private Limited, 30/A, I Stage, Vishveshwarya Industrial Estate, Doddanekkundi Industrial Area, Bangalore - 560048

☐**Other:**

(#Refer Page no. for Test lab location)

TEST DISCIPLINE: ELECTRONICS
PRODUCT GROUP: SOLAR PANEL

General details

Customer / Applicant	Novasys Greenergy Private Limited KHASRA NO. 185, MOUZA-MAHALGAON, TAHSIL-KAMPTEE, NAGPUR MAHARASHTRA 441202 INDIA		
Manufacturer	Novasys Greenergy Private Limited KHASRA NO. 185, MOUZA-MAHALGAON, TAHSIL-KAMPTEE, NAGPUR MAHARASHTRA 441202 INDIA		
Program	**Other**		
Item Under Test	Mono crystalline PV modules (PERC)		
Model	NOVA550MP144 (tested Model)		
Number of Samples	03 Nos.		
UL Sample Identification	Refer sample identification table	**Refer Summary of Test results for multiple samples**	
Manufacturer Serial Number (if any)	NOVABTMPVD00082, NOVABTMPVD00083, NOVABTMPVD00084		
Condition of IUT on receipt	Good		
Date of Receipt	29 April 2022		
Applicable Standard	PID (Potential Induced Degradation) Testing of Solar Photovoltaic modules as per IEC TS 62804 – Test Methods for The Detection of Potential-Induced Degradation Part 1: Crystalline Silicon Photovoltaic Modules. Edition 1.0, 2015-08 [Negative Grounding] (Severity level as per MNRE requirement: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – Total 288Hrs).		
Date of Testing (Start date)	13 June 2022	**End Date**	5 July 2022
UL general^ ambient condition	**Temperature in °C**		23 ±5°C
	Relative humidity in %		<70 %
Date of Issue	28 July 2022		
Test In-charge	Mohan A		

Fill in the rows with information or add hyphen (-)

Supratik Ghosh Engineer Project Associate	Srimathy N Project Engineer
Reviewed by	**Authorized signatory**

General Remarks (If any)

1) The below got test results in this report will relate only to the items tested.
2) This report shall not be reproduced except in full, without the written approval of the testing laboratory.

Below listed models covered in this test report, on basis of having same construction, design and BOM as declared by manufacturer. No testing was considered necessary to cover below listed models. Only changes are the electrical ratings, number of cells and overall dimension from the tested model.

Models covered	144 cells module: NOVAxxxMP144, xxx stands for power range from 495~550, in step of 5 W; 132 cells module: NOVAxxxMP132, xxx stands for power range from 455~505, in step of 5 W; 120 cells module: NOVAxxxMP120, xxx stands for power range from 415~460, in step of 5 W; 108 cells module: NOVAxxxMP108, xxx stands for power range from 375~415, in step of 5 W; 96 cells module: NOVAxxxMP96, xxx stands for power range from 325~365, in step of 5 W; 72 cells module: NOVAxxxMP72, xxx stands for power range from 245~275, in step of 5 W.

Description of Item under Test (IUT)

Mono crystalline PV modules (PERC) of 540Wp was tested for PID (Model- NOVA550MP144). Total 3 samples were tested, 1 sample was used as control sample.

Sample Identification for PID Test				
Sl. No.	**Sample card Number**	**Sample Serial Number**	**Test**	**Product Identification & Serial Number**
1	4915522 (control)	NOVABTMPVD00082	PID (Negative Grounding)	Solar PV Module 550W, Model No- NOVA550MP144, Sl No.- NOVABTMPVD00082
2	4915527	NOVABTMPVD00083		Solar PV Module 550W, Model No- NOVA550MP144, Sl No.- NOVABTMPVD00083
3	4915528	NOVABTMPVD00084		Solar PV Module 550W, Model No- NOVA550MP144, Sl No.- NOVABTMPVD00084

Summary of Test Results

Test No.	Test Name	Results
1	Preconditioning (Pre- PID Test)	REFER INDIVIDUAL TEST TABLE
2	Visual Inspection Test (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
3	Maximum Power Determination (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
4	Performance at low irradiance (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
5	Wet Leakage Current Test (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
6	Electroluminescence at Isc and 0.1*Isc (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE

7	Ground continuity test (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
8	Insulation test (Pre-PID Test)	REFER INDIVIDUAL TEST TABLE
8	**PID Test: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – Total 288Hrs**	**Test Condition: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – FIRST CYCLE**
9	Maximum Power Determination (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
10	Performance at low irradiance (Post-PID Test) - Final	REFER INDIVIDUAL TEST TABLE
11	Wet Leakage Current Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
12	Electroluminescence at Isc (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
13	Visual Inspection Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
14	Insulation test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
15	**PID Test: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – Total 288Hrs**	**Test Condition: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – SECOND CYCLE**
16	Maximum Power Determination (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
17	Performance at low irradiance (Post-PID Test) - Final	REFER INDIVIDUAL TEST TABLE
18	Wet Leakage Current Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
19	Electroluminescence at Isc (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
20	Visual Inspection Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
21	Insulation test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
22	**PID Test: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – Total 288Hrs**	**Test Condition: 3 Cycles at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs – THIRD CYCLE**
23	Maximum Power Determination (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
24	Performance at low irradiance (Post-PID Test) - Final	REFER INDIVIDUAL TEST TABLE
25	Wet Leakage Current Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
26	Electroluminescence at Isc (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
27	Visual Inspection Test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE
28	Insulation test (Post-PID Test)	REFER INDIVIDUAL TEST TABLE

Master Equipment and Calibration details

Sl No.	Test Name	Id Number	Description	Expiration Date
1	Preconditioning	54584	Apparatus, Pyranometer, Solar Diffuse Radiance	2025-AUG-26
2	Preconditioning	175794	Fixture, For Testing, Metal Plate	Support Equipment
3	Preconditioning	168531	Datalogger	2023-FEB-25
4	Visual inspection- Initial	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
5	Visual inspection- Initial	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
6	Visual inspection- Initial	180089	Meter and/or Sensor, Light	2022-JUL-16
7	Visual inspection- Initial	76645	Magnifying Lens, Without Ruler	Support Equipment
8	Visual inspection- Initial	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
9	Maximum power determination- Initial	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
10	Maximum power determination- Initial	199796	Apparatus, Solar Simulator	Support Equipment
11	Maximum power determination- Initial	64832	Datalogger, RH & Temperature	2022-SEP-30
12	Maximum power determination- Initial	199638	Thermometer, Infrared	2023-APR-05
13	Maximum power determination- Initial	176312	Reference Standard, Voltage or Current	2022-DEC-15
14	Maximum power determination- Initial	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
15	Electroluminescence Test-Power supply- Initial	70251	Power Supply, DC	2023-JUN-07
16	INSULATION RESISTANCE TESTER-Initial	169917	Apparatus, Dielectric Strength Test	2023-APR-13
17	INSULATION RESISTANCE TESTER-Initial	64832	Datalogger, RH & Temperature	2022-SEP-30
18	WET LEAKAGE CURRENT TEST- Initial	177914	Meter, pH, Digital or Analog	2023-JAN-24
19	WET LEAKAGE CURRENT TEST- Initial	151524	Apparatus, High Voltage Low Current Arc Tester	2022-DEC-06
20	WET LEAKAGE CURRENT TEST- Initial	167776	Fixture, For Testing, Water Tank	Support Equipment
21	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	78723	Ammeter, Digital, Clamp-on	2022-AUG-06
22	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	78719	Multimeter, Digital, Handheld	2021-AUG-04
23	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	70580	Power Supply, DC	2022-DEC-01
24	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	69871	Power Supply, DC	2023-JUN-07

25	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	72840	Power Supply, DC	2023-JUN-07
26	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Initial	157279	Stopwatch, Digital or Analog	2022-AUG-10
27	PID (Potential Induced Degradation) Testing- 1st cycle	72835	Chamber, Climatic, Temp and RH	2023-APR-01
28	PID (Potential Induced Degradation) Testing- 1st cycle	85103	Datalogger, Temperature	2023-APR-01
29	PID (Potential Induced Degradation) Testing- 1st cycle	216904	Power Supply, DC	2023-MAY-04
30	PID (Potential Induced Degradation) Testing- 1st cycle	202654	Load, Resistive, Variable	Support Equipment
31	PID (Potential Induced Degradation) Testing- 1st cycle	59358	Datalogger	2023-FEB-03
32	PID (Potential Induced Degradation) Testing- 1st cycle	78719	Multimeter, Digital, Handheld	2021-AUG-04
33	Visual inspection AFTER 1st cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
34	Visual inspection AFTER 1st cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
35	Visual inspection AFTER 1st cycle	180089	Meter and/or Sensor, Light	2022-JUL-16
36	Visual inspection AFTER 1st cycle	76645	Magnifying Lens, Without Ruler	Support Equipment
37	Visual inspection AFTER 1st cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
38	Maximum power determination AFTER 1st cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
39	Maximum power determination AFTER 1st cycle	199796	Apparatus, Solar Simulator	Support Equipment
40	Maximum power determination AFTER 1st cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
41	Maximum power determination AFTER 1st cycle	199638	Thermometer, Infrared	2023-APR-05
42	Maximum power determination AFTER 1st cycle	176312	Reference Standard, Voltage or Current	2022-DEC-15

43	Maximum power determination AFTER 1st cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
44	Electroluminescence Test- Power supply- AFTER 1st cycle	70251	Power Supply, DC	2023-JUN-07
45	INSULATION RESISTANCE TESTER AFTER 1st cycle	169917	Apparatus, Dielectric Strength Test	2023-APR-13
46	INSULATION RESISTANCE TESTER AFTER 1st cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
47	WET LEAKAGE CURRENT TEST AFTER 1st cycle	177914	Meter, pH, Digital or Analog	2023-JAN-24
48	WET LEAKAGE CURRENT TEST AFTER 1st cycle	151524	Apparatus, High Voltage Low Current Arc Tester	2022-DEC-06
49	WET LEAKAGE CURRENT TEST AFTER 1st cycle	167776	Fixture, For Testing, Water Tank	Support Equipment
50	PID (Potential Induced Degradation) Testing- 2nd cycle	85103	Datalogger, Temperature	2023-APR-01
51	PID (Potential Induced Degradation) Testing- 2nd cycle	216904	Power Supply, DC	2023-MAY-04
52	PID (Potential Induced Degradation) Testing- 2nd cycle	202654	Load, Resistive, Variable	Support Equipment
53	PID (Potential Induced Degradation) Testing- 2nd cycle	59358	Datalogger	2023-FEB-03
54	PID (Potential Induced Degradation) Testing- 2nd cycle	72835	Chamber, Climatic, Temp and RH	2023-APR-01
55	PID (Potential Induced Degradation) Testing- 2nd cycle	78719	Multimeter, Digital, Handheld	2021-AUG-04
56	Visual inspection AFTER 2nd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
57	Visual inspection AFTER 2nd cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
58	Visual inspection AFTER 2nd cycle	180089	Meter and/or Sensor, Light	2022-JUL-16
59	Visual inspection AFTER 2nd cycle	76645	Magnifying Lens, Without Ruler	Support Equipment
60	Visual inspection AFTER 2nd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06

61	Maximum power determination AFTER 2nd cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
62	Maximum power determination AFTER 2nd cycle	199796	Apparatus, Solar Simulator	Support Equipment
63	Maximum power determination AFTER 2nd cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
64	Maximum power determination AFTER 2nd cycle	199638	Thermometer, Infrared	2023-APR-05
65	Maximum power determination AFTER 2nd cycle	176312	Reference Standard, Voltage or Current	2022-DEC-15
66	Maximum power determination AFTER 2nd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
67	Electroluminescence Test-Power supply AFTER 2nd cycle	70251	Power Supply, DC	2023-JUN-07
68	INSULATION RESISTANCE TESTER AFTER 2nd cycle	169917	Apparatus, Dielectric Strength Test	2023-APR-13
69	INSULATION RESISTANCE TESTER AFTER 2nd cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
70	WET LEAKAGE CURRENT TEST AFTER 2nd cycle	177914	Meter, pH, Digital or Analog	2023-JAN-24
71	WET LEAKAGE CURRENT TEST AFTER 2nd cycle	151524	Apparatus, High Voltage Low Current Arc Tester	2022-DEC-06
72	WET LEAKAGE CURRENT TEST AFTER 2nd cycle	167776	Fixture, For Testing, Water Tank	Support Equipment
73	PID (Potential Induced Degradation) Testing- 2nd cycle	85103	Datalogger, Temperature	2023-APR-01
74	PID (Potential Induced Degradation) Testing- 2nd cycle	216904	Power Supply, DC	2023-MAY-04
75	PID (Potential Induced Degradation) Testing- 2nd cycle	202654	Load, Resistive, Variable	Support Equipment
76	PID (Potential Induced Degradation) Testing- 2nd cycle	59358	Datalogger	2023-FEB-03
77	PID (Potential Induced Degradation) Testing- 2nd cycle	72835	Chamber, Climatic, Temp and RH	2023-APR-01

78	PID (Potential Induced Degradation) Testing- 2nd cycle	78719	Multimeter, Digital, Handheld	2022-AUG-06
79	Visual inspection AFTER 3rd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
80	Visual inspection AFTER 3rd cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
81	Visual inspection AFTER 3rd cycle	180089	Meter and/or Sensor, Light	2022-JUL-16
82	Visual inspection AFTER 3rd cycle	76645	Magnifying Lens, Without Ruler	Support Equipment
83	Visual inspection AFTER 3rd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
84	Maximum power determination AFTER 3rd cycle	69881	Measuring Tool, Caliper, Digital or Analog	2022-DEC-07
85	Maximum power determination AFTER 3rd cycle	199796	Apparatus, Solar Simulator	Support Equipment
86	Maximum power determination AFTER 3rd cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
87	Maximum power determination AFTER 3rd cycle	199638	Thermometer, Infrared	2023-APR-05
88	Maximum power determination AFTER 3rd cycle	176312	Reference Standard, Voltage or Current	2022-DEC-15
89	Maximum power determination AFTER 3rd cycle	176846	Measuring Tool, Rigid Ruler	2022-DEC-06
90	Electroluminescence Test- Power supply- AFTER 3rd cycle	70251	Power Supply, DC	2023-JUN-07
91	INSULATION RESISTANCE TESTER AFTER 3rd cycle	169917	Apparatus, Dielectric Strength Test	2023-APR-13
92	INSULATION RESISTANCE TESTER AFTER 3rd cycle	64832	Datalogger, RH & Temperature	2022-SEP-30
93	WET LEAKAGE CURRENT TEST AFTER 3rd cycle	177914	Meter, pH, Digital or Analog	2023-JAN-24
94	WET LEAKAGE CURRENT TEST AFTER 3rd cycle	151524	Apparatus, High Voltage Low Current Arc Tester	2022-DEC-06
95	WET LEAKAGE CURRENT TEST AFTER 3rd cycle	167776	Fixture, For Testing, Water Tank	Support Equipment

96	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	78723	Ammeter, Digital, Clamp-on	2022-AUG-06
97	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	78719	Multimeter, Digital, Handheld	2022-AUG-06
98	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	70580	Power Supply, DC	2022-DEC-01
99	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	69871	Power Supply, DC	2023-JUN-07
100	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	72840	Power Supply, DC	2023-JUN-07
101	CONTINUITY TEST OF EQUIPOTENTIAL BONDING- Final	157279	Stopwatch, Digital or Analog	2022-AUG-10

Test methodology adopted:- As per IEC TS 62804-1: 2015 and MNRE requirement.

Test Observation and Results:

Table 10.1	MST 01 – VISUAL INSPECTION– INITIAL (Pre PID Test after Preconditioning) Test Date [MM/DD/YYYY] …… : 06/13/2022		P
Sample No.	Position in test sequence:		
4915522 (control)	Initial examination	No major finding	—
	Preconditioning: (mm/dd/yyyy)	Exposed for 5 kwh/m2 (06/11/2022 to 06/12/2022)	5.50 kwh/m2
	Final examination	No major finding	—
4915527	Initial examination	No major finding	—
	Preconditioning: (mm/dd/yyyy)	Exposed for 5 kwh/m2 (06/11/2022 to 06/12/2022)	5.50 kwh/m2
	Final examination	No major finding	—
4915528	Initial examination	No major finding	—
	Preconditioning: (mm/dd/yyyy)	Exposed for 5 kwh/m2 (06/11/2022 to 06/12/2022)	5.50 kwh/m2
	Final examination	No major finding	—

10.2	TABLE: MAXIMUM POWER DETERMINATION – INITIAL (PRE PID TEST AFTER PRECONDITIONING)	P
Test Date [MM/DD/YYYY] ..... :	06/13/2022	—
Module temperature [°C] ..... :	25	—
Irradiance [W/m^2] ..... :	1000	—

Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915522 (control)	49.84	41.46	13.77	13.20	547.29	80.0
4915527	49.66	41.52	13.85	13.24	549.60	80.0
4915528	49.77	41.87	13.84	13.25	554.60	81.0
Supplementary information: N/A						

10.7 B	TABLE: PERFORMANCE AT LOW IRRADIANCE- INITIAL (PRE PID TEST)	P
Test Date [MM/DD/YYYY] ..... :	06/13/2022	—
Ambient air temperature [°C] ..... :	25.1	—
Irradiance [W/m2](200 W/m2) ..... :	200	—
Module temperature [°C] ..... :	25.0	—
Test method ..... :	☒ Data corrected to a 25°C cell temperature and 200 W/m² irradiance ☐ Directly measured	—

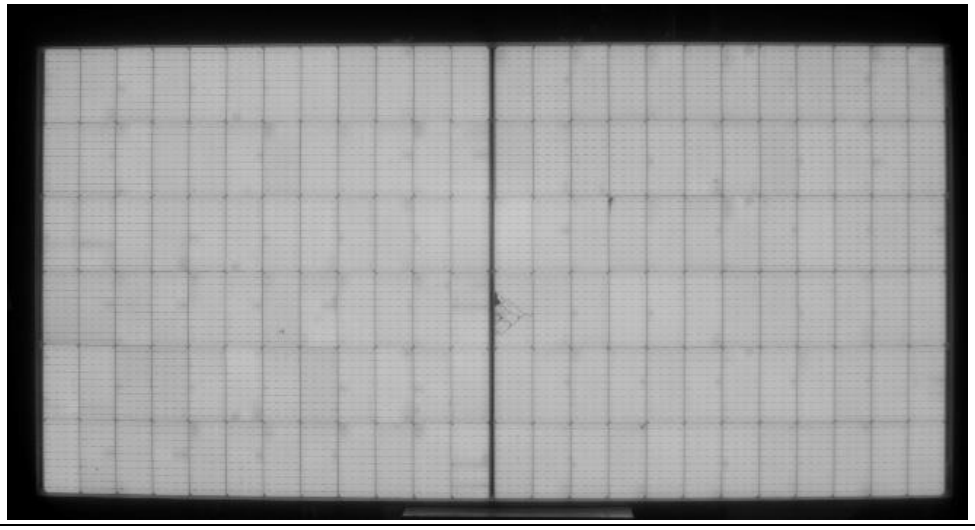
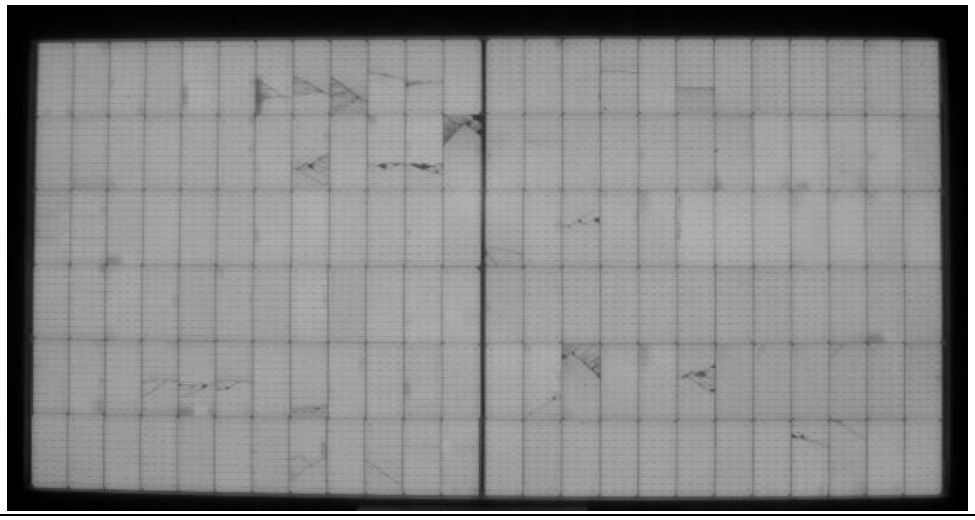
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915522 (control)	46.76	40.26	2.76	2.63	105.88	82.0
4915527	46.61	40.48	2.77	2.63	106.53	82.0
4915528	46.74	40.45	2.77	2.64	106.93	83.0

Supplementary information: N/A

10.15	TABLE: Wet leakage current test- (Pre PID Test)		P
Test Date [MM/DD/YYYY] ..... :	06/16/2022		—
Test Voltage applied [V] ..... :	1500		—
Solution resistivity [Ω cm) ..... :	**Required**	**Measured**	--
	< 3,500 Ω-cm at 22 ± 3°C	2100	--
Solution temperature [°C] ..... :	23.1		--

Sample #	Measured [MΩ]	Limit [MΩ]	Result
4915522 (control)	3900	15.50	P
4915527	3000	15.50	P
4915528	4100	15.50	P

Supplementary information: Size of module [m²]: 2.58

Table	ELECTROLUMINESCENCE IMAGES – INITIAL (PRE PID TEST) Test Date [MM/DD/YYYY] …….. : 06/13/2022
Sample No.	Image At Isc
4915522 (control)	
4915527	

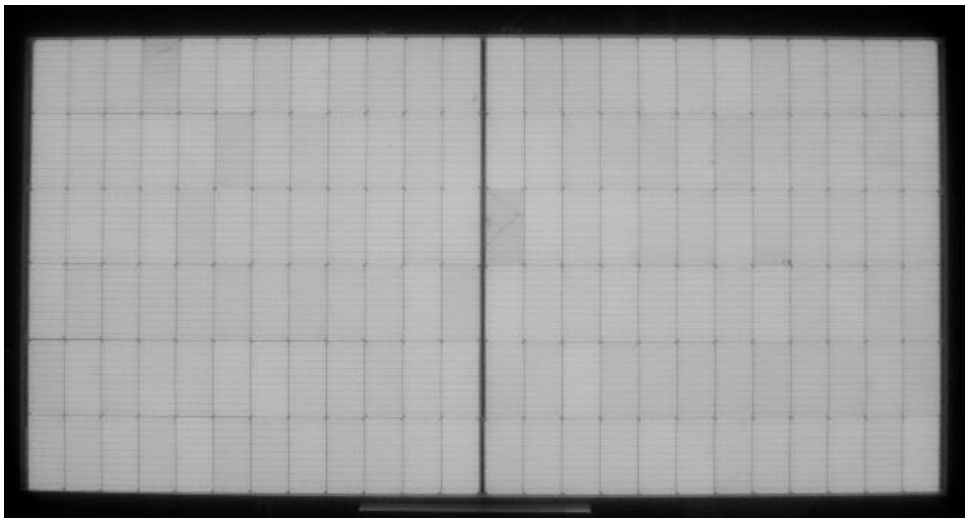
4915528	

Table 10.4	MST 13 – GROUND CONTINUITY TEST (Pre PID Test)			P
	Maximum over-current protection rating (A):	*25*		—
	Current applied (A) ..... :	*62.5*		—
	Location of designated grounding point..... :	*Grounding hole on frame left side (long side)*		—
	Location of second contacting point ..... :	*Grounding hole on frame right side (long side)*		—
Sample No.	Position in test sequence:	Voltage (V)	Resistance (Ω)	P/F
4915522 (control)	Initial examination Test Date [MM/DD/YYYY] … : 06/16/2022	0.678	0.0108	P
	Final examination Test Date [MM/DD/YYYY] … : 07/05/2022	0.789	0.0126	P
4915527	Initial examination Test Date [MM/DD/YYYY] … : 06/16/2022	0.650	0.0104	P
	Final examination Test Date [MM/DD/YYYY] … : 07/05/2022	0.854	0.0136	P
4915528	Initial examination Test Date [MM/DD/YYYY] … : 06/16/2022	0.720	0.0115	P
	Final examination Test Date [MM/DD/YYYY] … : 07/05/2022	0.567	0.0090	P
Supplementary information: N/A				

10.3 Insulation test (Pre PID Test)				**P**
Test Date [MM/DD/YYYY]..... :			06/16/2022	—
Test Voltage applied [V] ..... :			IR=1500, Dielectric=8000	—
Sample #	Measured, MΩ	Required, MΩ	Dielectric breakdown; Yes (description)/ No	Result
4915522 (control)	6700	15.50	No	P
4915527	9800	15.50	No	P
4915528	8400	15.50	No	P
Supplementary information: Size of module [m²]: 2.58				

Procedure for PID Test:

a) The module shall be placed into an environmental chamber supported by a non-porous electrically insulating mounting material. Modules shall be placed by default in any upright position; however, this placement may be changed if it is helpful to better achieve the intended goals of this test method, including improved air circulation, temperature and relative humidity uniformity, tolerances, and set points, or implementation of the module's specifically documented mounting or grounding instructions.

NOTE Insulator mounts are used to prevent alternative paths for leakage current between the biased active cell circuit and the manufacturers intended ground points, if any are provided, and for the safety of personnel and equipment. The insulation of the individual modules from each other may also be required to control the path to ground.

b) The method of the connection at the grounding point shall be based on the installation manual. For continuous metallic frames encasing the perimeter of the module that have grounding points or that have points for mounting the module that are not specified to be used on insulating mounting structures, the ground terminal of the voltage power supply shall be connected to a grounding point of the module with the manufacturer-specified grounding hardware, or if not specified, an insulated wire terminated with a crimped-on ring terminal attached with a stainless steel nut, bolt, and star washer. Thin layer coatings on the metallic frame shall be removed by abrasion to achieve metal-to-metal contact between the connector and the module frame.

In the case of modules with frames that are not continuous or compliant with IEC 61730-2 MST 13, non-metallic frames, and metallic frames with insulating surfaces that cannot be reasonably penetrated anywhere by abrasion, all module mounting points and grounding points available on the module shall be connected at those points of attachment to one another and to the ground terminal of the DC voltage supply with insulated wire terminated with a crimped-on screw connector and stainless steel annulus washers in contact with the module.

Modules without frames (frameless modules) should be tested with the supplied mounting brackets that are consistent in every way with that specified in the module installation manual. If none are specified in the installation manual or if the specifications do not indicate a specific bracket model or materials and dimensions of mounting brackets, then the stress test shall include a conductively adhered conductive foil on the perimeter of the module that spans from the module edges to the active cell circuit. The foil, which simulates a grounded module frame, is connected to the ground terminal of the DC voltage supply.

The testing shall reasonably accommodate requests by the module manufacturer to reproduce manufacturer-specified mounting configurations that could influence the electrical resistance between the module surfaces and ground. Specifically, if

1) the PV module is provided or is specified for use with an insulating structure for mounting, and

2) the module is designed and specified not to be connected to ground,

then such method of mounting the module shall be implemented to the extent possible. The base of that structure or portion designed to be mounted to a building structure or on the ground shall be thoroughly grounded and connected to the ground terminal of the DC voltage power supply during the course of the test.

c) Positive and negative electrical terminal wires (leads, tags, studs, screws, connectors) of the module shall be connected to one another and to the appropriate energized DC voltage terminal of the power supply with insulated wire rated for the intended test voltage.

d) Stresses are applied to the module in chamber according to the severities listed in 4.3.2.2 referencing the example profile in Figure 2. Recording of sensor data shall be commenced. The chamber temperature shall be ramped from ambient to the specified stress temperature. When the chamber air temperature and the module temperature reach the set point within tolerance, increase the relative humidity to arrive at the prescribed severity. When the temperature and relative humidity set points are reached within the prescribed tolerances, start the 12 h to 24 h stabilization period for the environmental conditions. At the end of this period, switch on the voltage to the prescribed stress level (rated maximum system voltage and polarity). The prescribed dwell period begins when the voltage has arrived at the prescribed severity.

e) For the cooling phase to ambient temperature (25 °C or less) at the end of the damp heat dwell, turn off the humidity generation and simultaneously begin to cool the chamber so that the modules reach the ambient temperature in a maximum of 1 h. The specified applied voltage shall be switched off when the module temperature reaches 25 °C ± 5 °C.

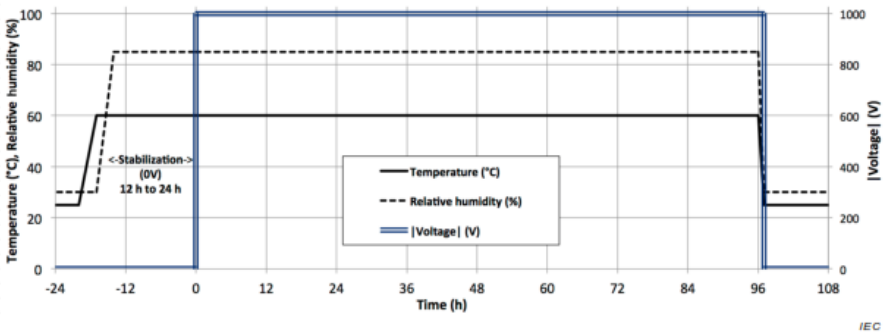


Figure 2 – Example test time-temperature-humidity-voltage profile for application of stress in an environmental chamber

POTENTIAL INDUCED DEGRADATION TEST				***P***
Voltage across the terminal & frame		1500		—
Chamber Temperature		85 ± 2 ºC		—
Chamber RH (%)		85 ± 3 %		—
Hours of exposure		**1st Cycle at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs**		—
Sample No.	Position in test sequence:	Voltage (V)	Resistance (Ω)	
4915527	**Negative connected to frame**	–	–	–
	Positive connected to shorted terminals	1500	500	–
4915528	**Negative connected to frame**	–	–	–
	Positive connected to shorted terminals	1500	500	–
Supplementary information: Test Date **[**MM/DD/YYYY**]** …… : 06/16/2022 to 06/20/2022.				

10.2	TABLE: MAXIMUM POWER DETERMINATION (POST PID TEST) – AFTER 1ST CYCLE	P
Test Date [MM/DD/YYYY]……..:	06/21/2022	—
Module temperature [°C]…….:	25	—
Irradiance [W/m²)…….:	1000	—

Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915522 (control)	49.79	41.61	13.76	13.15	547.05	80.0
4915527	49.57	41.54	13.82	13.19	548.12	80.0
4915528	49.65	41.51	13.81	13.30	551.89	80.0

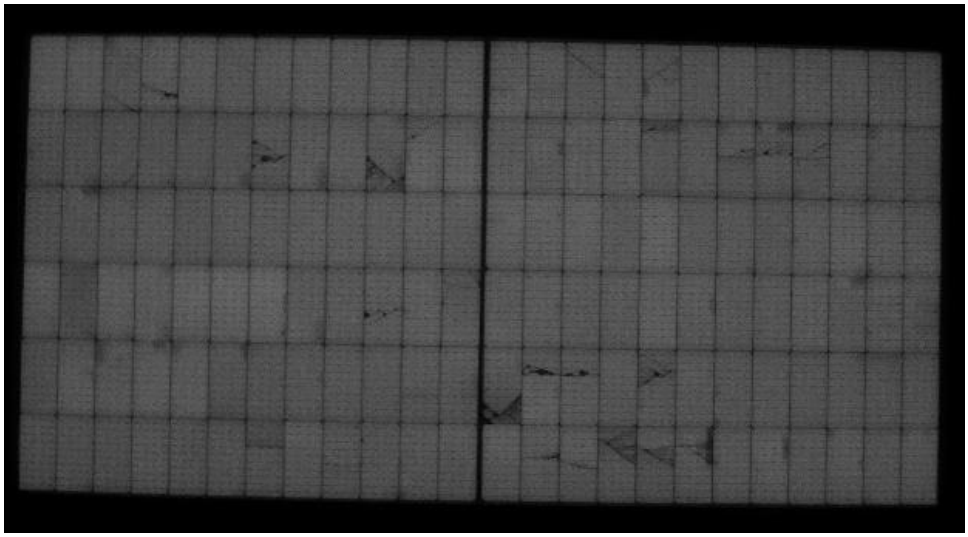
Supplementary information: Degradation Observed: 4915527: (-0.26), 4915528: (-0.48)

10.7 B	TABLE: PERFORMANCE AT LOW IRRADIANCE- (POST PID TEST) – AFTER 1ST CYCLE	P
Test Date [MM/DD/YYYY] ..... :	06/21/2022	—
Ambient air temperature [°C]..... :	25.0	—
Irradiance [W/m2](200 W/m2) ..... :	200	—
Module temperature [°C] ..... :	24.6	—
Test method ..... :	☒ Data corrected to a 25°C cell temperature and 200 W/m² irradiance ☐ Directly measured	—

Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915527	46.51	40.25	2.77	2.61	105.20	82.0
4915528	46.59	40.16	2.77	2.64	106.20	82.0

Supplementary information: N/A

10.15	TABLE: Wet leakage current test- (Post PID Test) – After 1st Cycle			P
Test Date [MM/DD/YYYY] ..... :		06/21/2022		—
Test Voltage applied [V] ..... :		1500		—
--		**Required**	**Measured**	---
Solution resistivity [Ω cm) ..... :		< 3,500 Ω-cm at 22 ± 3°C	1910	---
Solution temperature [°C] ..... :		23.5		---
Sample #	Measured [MΩ]	Limit [MΩ]		Result
4915527	3240	15.50		P
4915528	2700	15.50		P
Supplementary information: Size of module [m²]: 2.58				

Table	**ELECTROLUMINESCENCE IMAGES – (POST PID TEST) – AFTER 1ST CYCLE** Test Date [MM/DD/YYYY] …….. : 06/21/2022
Sample No.	Image At Isc
4915527	

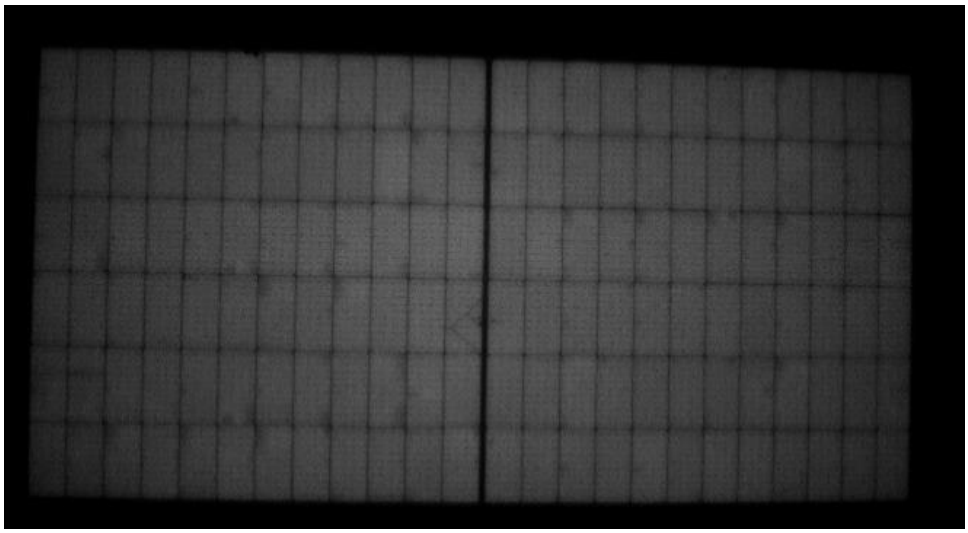
4915528	

Table 10.1	MST 01 – VISUAL INSPECTION – (Post PID Test) – AFTER 1ST CYCLE		P
Sample No.	Position in test sequence:	Test date ……. : 06/21/2022(MM/DD/YYYY)	
4915527	Horizontal	No visual defects were found	P
4915528	Horizontal	No visual defects were found	P

10.3 Insulation test (Post PID Test) – AFTER 1ST CYCLE				P
Test Date [MM/DD/YYYY]..... :			06/21/2022	—
Test Voltage applied [V] ..... :			IR=1500, Dielectric=8000	—
Sample #	Measured, MΩ	Required, MΩ	Dielectric breakdown; Yes (description)/ No	Result
4915527	7150	15.50	No	P
4915528	5300	15.50	No	P
Supplementary information: Size of module [m²]: 2.58				

Note and other observations from Lab: N/A

POTENTIAL INDUCED DEGRADATION TEST					P
	Voltage across the terminal & frame	1500			—
	Chamber Temperature	85 ± 2 ºC			—
	Chamber RH (%)	85 ± 3 %			—
	Hours of exposure	**2nd Cycle at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs**			—
Sample No.	Position in test sequence:	Voltage (V)	Resistance (Ω)		
4915527	**Negative connected to frame**	–	–		–
	Positive connected to shorted terminals	1500	500		–
4915528	**Negative connected to frame**	–	–		–
	Positive connected to shorted terminals	1500	500		–
Supplementary information: Test Date **[**MM/DD/YYYY**]** …… : 06/23/2022 to 06/27/2022.					

10.2	TABLE: MAXIMUM POWER DETERMINATION (POST PID TEST) – AFTER 2ND CYCLE					P
Test Date [MM/DD/YYYY]……..:	06/27/2022					—
Module temperature [°C]……:	25					—
Irradiance [W/m²)……..:	1000					—
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915522 (control)	49.76	41.39	13.76	13.22	547.26	80.0
4915527	49.70	41.50	13.83	13.17	546.74	80.0
4915528	49.73	41.40	13.82	13.26	548.94	80.0
Supplementary information: **Total Degradation Observed: initial to 2nd cycle:** 4915527: (-0.52) 4915528: (-1.02) **1st cycle to 2nd cycle:** 4915527: (-0.25) 4915528: (-0.53)						

10.7 B	TABLE: PERFORMANCE AT LOW IRRADIANCE- (POST PID TEST) – AFTER 2ND CYCLE	P
Test Date [MM/DD/YYYY] ..... :	06/27/2022	—
Ambient air temperature [°C] ..... :	25	—
Irradiance [W/m2](200 W/m2) ..... :	200	—
Module temperature [°C] ..... :	25	—
Test method ..... :	☒ Data corrected to a 25°C cell temperature and 200 W/m² irradiance ☐ Directly measured	—

Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915527	46.60	40.28	2.77	2.60	104.75	81.0
4915528	46.64	40.46	2.77	2.62	106.11	82.0

Supplementary information: N/A

10.15	TABLE: Wet leakage current test- (Post PID Test) – After 2nd Cycle		P
Test Date [MM/DD/YYYY] ..... :	06/27/2022		—
Test Voltage applied [V] ..... :	1500		—
--	**Required**	**Measured**	--
Solution resistivity [Ω cm) ..... :	< 3,500 Ω-cm at 22 ± 3°C	2130	--
Solution temperature [°C] ..... :	22.8		--

Sample #	Measured [MΩ]	Limit [MΩ]	Result
4915527	3420	15.50	P
4915528	3230	15.50	P

Supplementary information: Size of module [m²]: 2.58

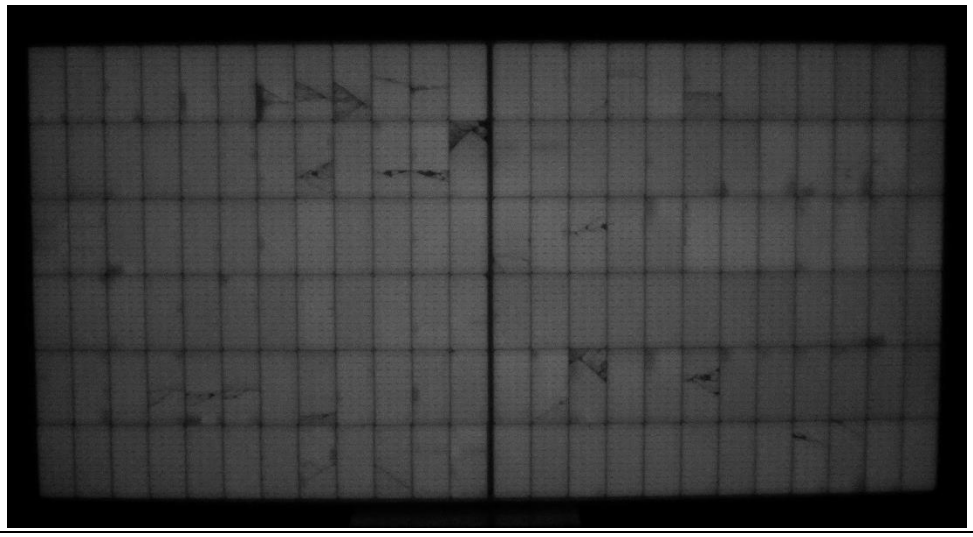
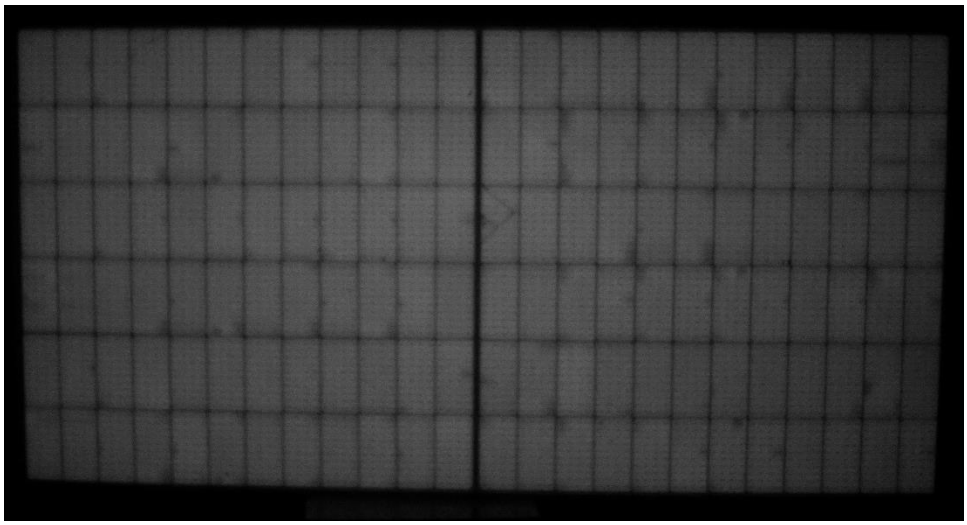
Table	ELECTROLUMINESCENCE IMAGES – (POST PID TEST) – AFTER 2ND CYCLE Test Date [MM/DD/YYYY] ……. : 06/27/2022
Sample No.	Image At Isc
4915527	
4915528	

Table 10.1	MST 01 – VISUAL INSPECTION – (Post PID Test) – AFTER 2ND CYCLE		*P*
Sample No.	Position in test sequence:	Test date …… : 06/27/2022 (MM/DD/YYYY)	
4915527	Horizontal	No visual defects were found	P
4915528	Horizontal	No visual defects were found	P

10.3 Insulation test (Post PID Test) – AFTER 2ND CYCLE				P
Test Date [MM/DD/YYYY]..... :			06/27/2022	—
Test Voltage applied [V] ..... :			IR=1500, Dielectric=8000	—
Sample #	Measured, MΩ	Required, MΩ	Dielectric breakdown; Yes (description)/ No	Result
4915527	9900	15.50	No	P
4915528	12100	15.50	No	P
Supplementary information: Size of module [m²]: 2.58				

Note and other observations from Lab: N/A

POTENTIAL INDUCED DEGRADATION TEST					*P*
	Voltage across the terminal & frame		1500		—
	Chamber Temperature		85 ± 2 ºC		—
	Chamber RH (%)		85 ± 3 %		—
	Hours of exposure		**3rd Cycle at 85ºC ± 2ºC, 85 ± 3% of RH for 96Hrs**		—
Sample No.		Position in test sequence:	Voltage (V)	Resistance (Ω)	
4915527		**Negative connected to frame**	–	–	–
		Positive connected to shorted terminals	1500	500	–
4915528		**Negative connected to frame**	–	–	–
		Positive connected to shorted terminals	1500	500	–
Supplementary information: Test Date [MM/DD/YYYY] …… : 06/30/2022 to 07/04/2022.					

10.2	TABLE: MAXIMUM POWER DETERMINATION (POST PID TEST) – AFTER 3RD CYCLE					P
Test Date [MM/DD/YYYY]……..:		07/04/2022				—
Module temperature [°C]…….:		25				—
Irradiance [W/m²)……:		1000				—
Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]

4915522 (control)	49.79	41.48	13.76	13.20	547.38	80.0
4915527	49.59	41.28	13.77	13.16	543.43	80.0
4915528	49.63	41.24	13.75	13.23	545.59	80.0

Supplementary information: Total Degradation Observed: Final Degradation:

Initial to 3rd cycle: 4915527: (-1.12) 4915528: (- 1.62)

2nd cycle to 3rd cycle: 4915527: (-0.60) 4915528: (- 0.61)

10.7 B	**TABLE: PERFORMANCE AT LOW IRRADIANCE- (POST PID TEST) – AFTER 3RD CYCLE**	**P**
Test Date [MM/DD/YYYY] ..... :	07/04/2022	—
Ambient air temperature [°C] ..... :	25	—
Irradiance [W/m2](200 W/m2) ..... :	200	—
Module temperature [°C] ..... :	25	—
Test method ..... :	☒ Data corrected to a 25°C cell temperature and 200 W/m² irradiance ☐ Directly measured	—

Sample #	Voc [V]	Vmp [V]	Isc [A]	Imp [A]	Pmp [W]	FF [%]
4915527	46.44	39.63	2.76	2.63	104.11	81.0
4915528	46.51	40.36	2.75	2.61	105.34	82.0

Supplementary information: N/A

10.15	**TABLE: Wet leakage current test- (Post PID Test) – After 3rd Cycle**		**P**
Test Date [MM/DD/YYYY] ..... :	07/05/2022		—
Test Voltage applied [V] ..... :	1500		—
--	**Required**	**Measured**	---
Solution resistivity [Ω cm) ..... :	< 3,500 Ω-cm at 22 ± 3°C	1860	---
Solution temperature [°C] ..... :	23.4		---

Sample #	Measured [MΩ]	Limit [MΩ]	Result
4915527	3400	15.50	P
4915528	2700	15.50	P

Supplementary information: Size of module [m²]: 2.58

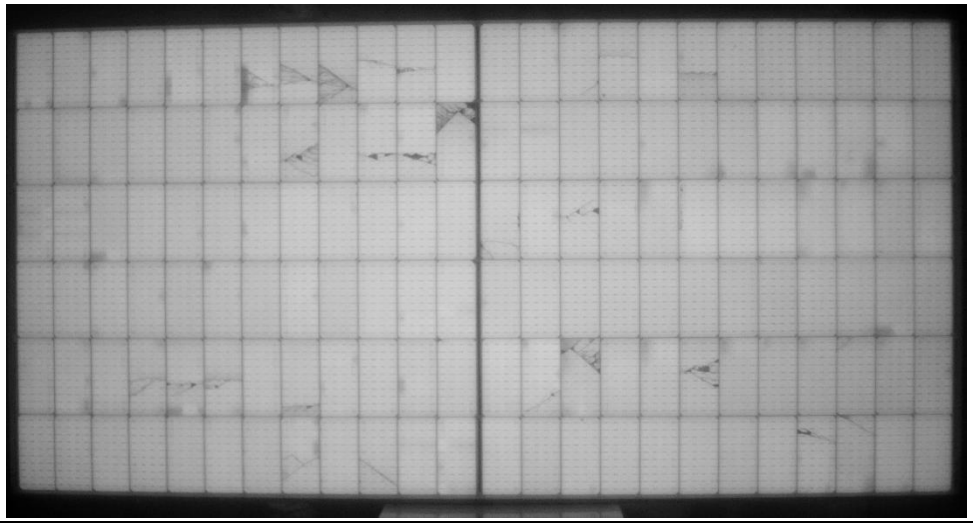
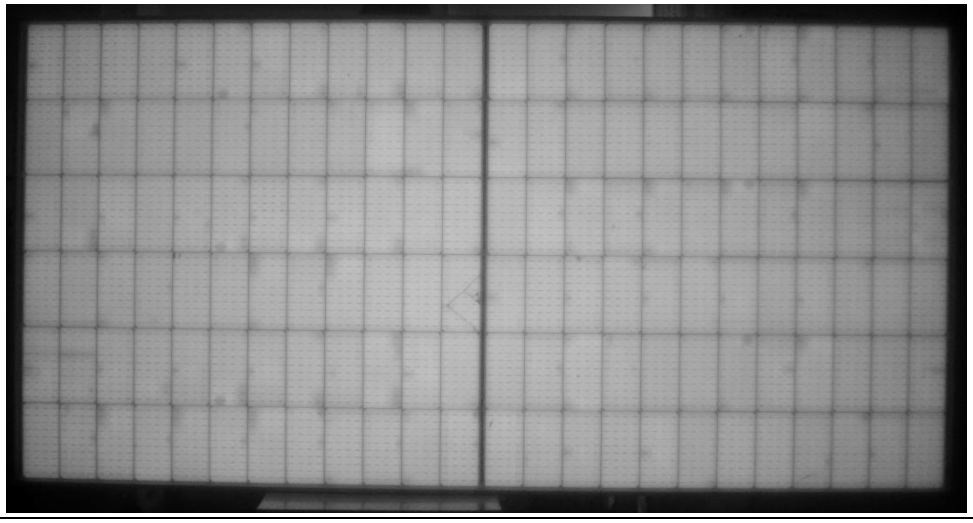
Table	ELECTROLUMINESCENCE IMAGES – (POST PID TEST) – AFTER 3RD CYCLE Test Date [MM/DD/YYYY] ……. : 07/04/2022
Sample No.	Image At Isc
4915527	
4915528	

Table 10.1	MST 01 – VISUAL INSPECTION – FINAL (Post PID Test) – AFTER 3RD CYCLE – FINAL CYCLE		*P*
Sample No.	Position in test sequence:	Test date …… : 07/04/2022(mm/dd/yyyy)	
4915527	Horizontal	No visual defects were found	P
4915528	Horizontal	No visual defects were found	P

10.3 Insulation test (Post PID Test)				**P**
Test Date [MM/DD/YYYY]..... :			07/05/2022	—
Test Voltage applied [V] ..... :			IR=1500, Dielectric=8000	—
Sample #	Measured, MΩ	Required, MΩ	Dielectric breakdown; Yes (description)/ No	Result
4915527	10100	15.50	No	P
4915528	13200	15.50	No	P
Supplementary information: Size of module [m²]: 2.58				

Note and other observations from Lab: N/A

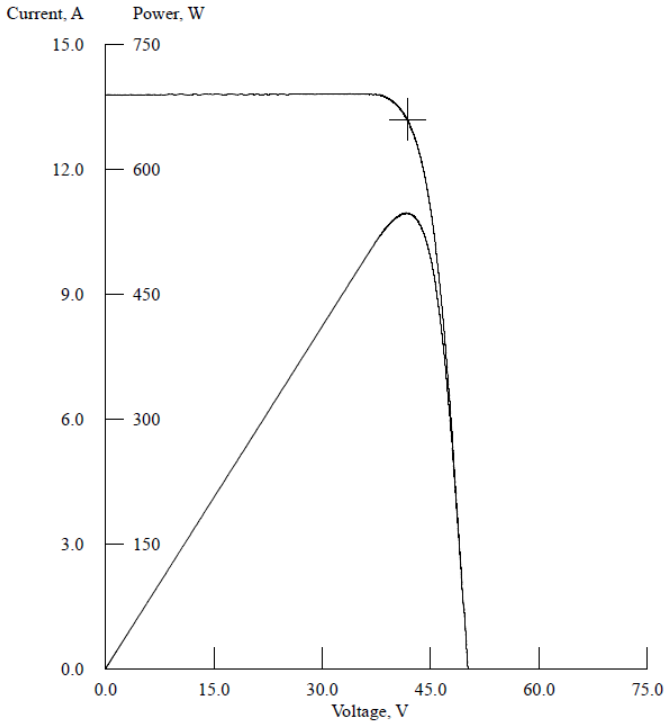
Test Observation (If any):- N/A

Appendix

Schematic Diagrams (If any):- N/A

Annexure-1 :

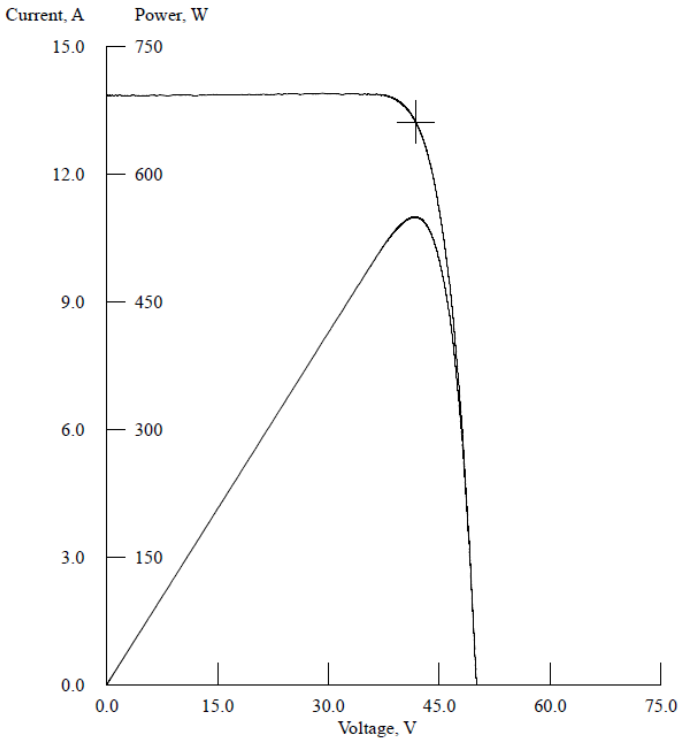
PIV graphs (Initial):-



5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV
Operator: Admin
ID: 4915522 (NOVABTMPVD00082)
Module Type: ModuleType1
11:25:16 13-06-2022
Measured Temperature = 25.2°C
Corrected Temperature = 25.0°C
Irr Meas = 99.9mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.84V
Isc = 13.77A
Pmax = 547.29W
Vpm = 41.46V
Ipm = 13.20A
FF = 0.80
Eff,m = 21.17%
Eff,c = 23.23%
Rs = 0.35 Ohm
Rsh = 278.05 Ohm

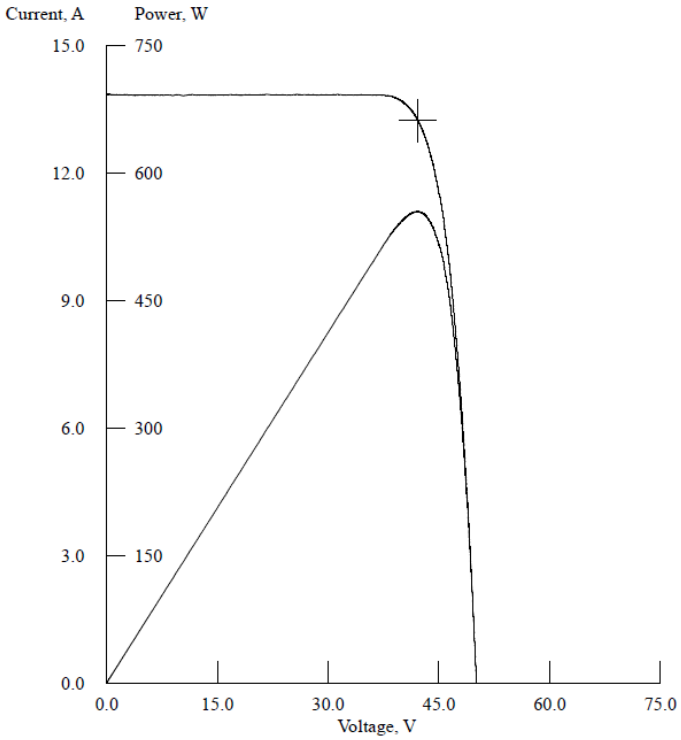
Load Voltage: 5.400 V
IV Points: 3721



5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV
Operator: Admin
ID: 4915527 (NOVABTMPVD00083)
Module Type: ModuleType1
11:28:20 13-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 99.9mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.66V
Isc = 13.85A
Pmax = 549.60W
Vpm = 41.52V
Ipm = 13.24A
FF = 0.80
Eff,m = 21.26%
Eff,c = 23.33%
Rs = 0.28 Ohm
Rsh = 315.34 Ohm

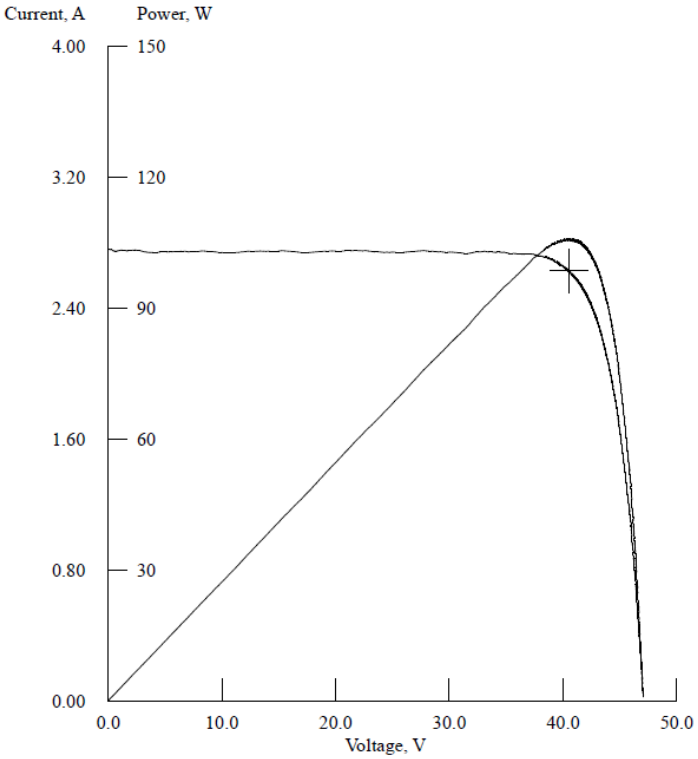
Load Voltage: 5.400 V
IV Points: 3792



5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV
Operator: Admin
ID: 4915528 (NOVABTMPVD00084)
Module Type: ModuleType1
11:20:43 13-06-2022
Measured Temperature = 25.0°C
Corrected Temperature = 25.0°C
Irr Meas = 99.9mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.77V
Isc = 13.84A
Pmax = 554.60W
Vpm = 41.87V
Ipm = 13.25A
FF = 0.81
Eff,m = 21.45%
Eff,c = 23.54%
Rs = 0.27 Ohm
Rsh = 191.50 Ohm

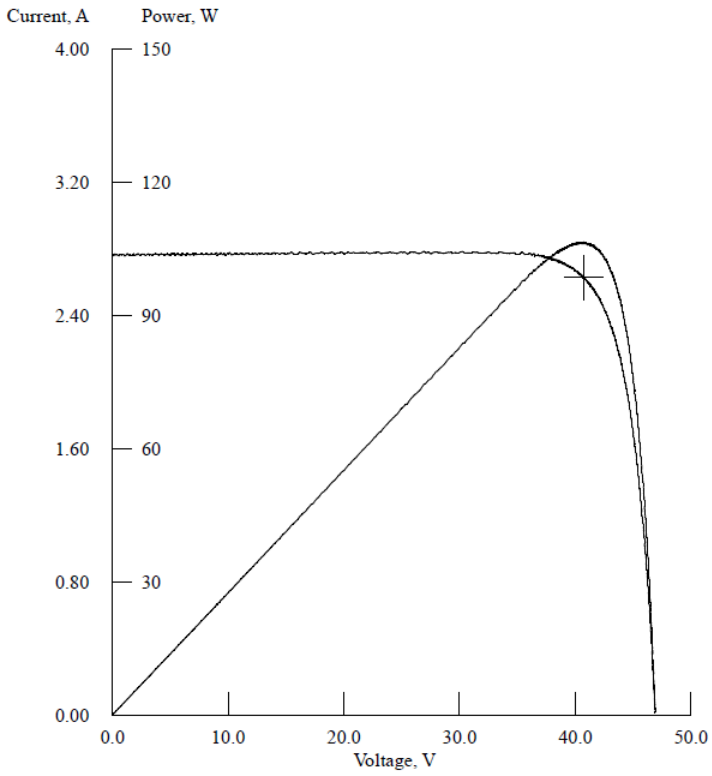
Load Voltage: 5.400 V
IV Points: 3793



5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV LOW IRR
Operator: Admin
ID: 4915522 (NOVABTMPVD00082)
Module Type: ModuleType1
11:25:56 13-06-2022
Measured Temperature = 25.0°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.76V
Isc = 2.76A
Pmax = 105.88W
Vpm = 40.26V
Ipm = 2.63A
FF = 0.82
Eff,m = 20.48%
Eff,c = 22.47%
Rs = 0.90 Ohm
Rsh = 2115.85 Ohm

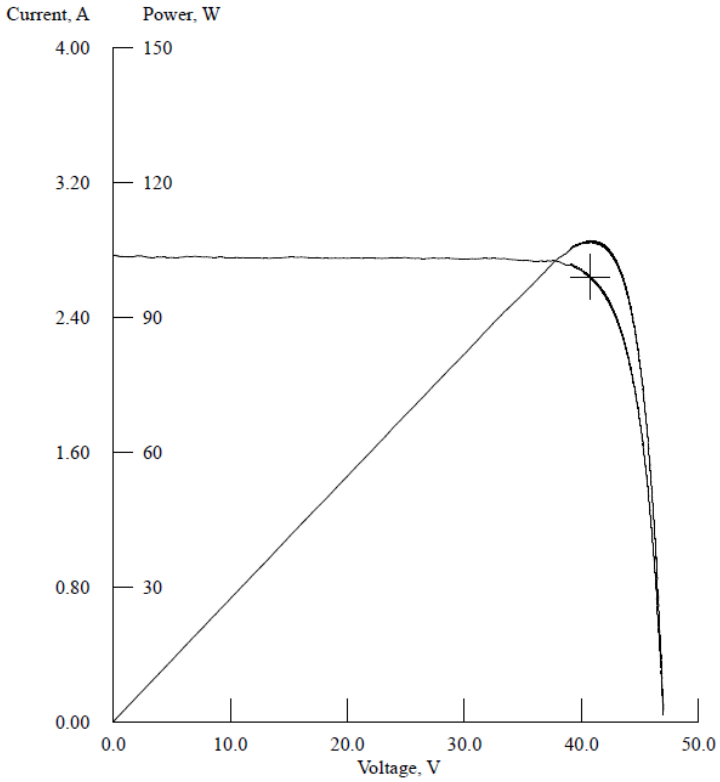
Load Voltage: 2.000 V
IV Points: 3787



5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV LOW IRR
Operator: Admin
ID: 4915527 (NOVABTMPVD00083)
Module Type: ModuleType1
11:29:58 13-06-2022
Measured Temperature = 24.6°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.61V
Isc = 2.77A
Pmax = 106.53W
Vpm = 40.48V
Ipm = 2.63A
FF = 0.82
Eff,m = 20.60%
Eff,c = 22.61%
Rs = 0.81 Ohm
Rsh = 307.38 Ohm

Load Voltage: 2.100 V
IV Points: 3719

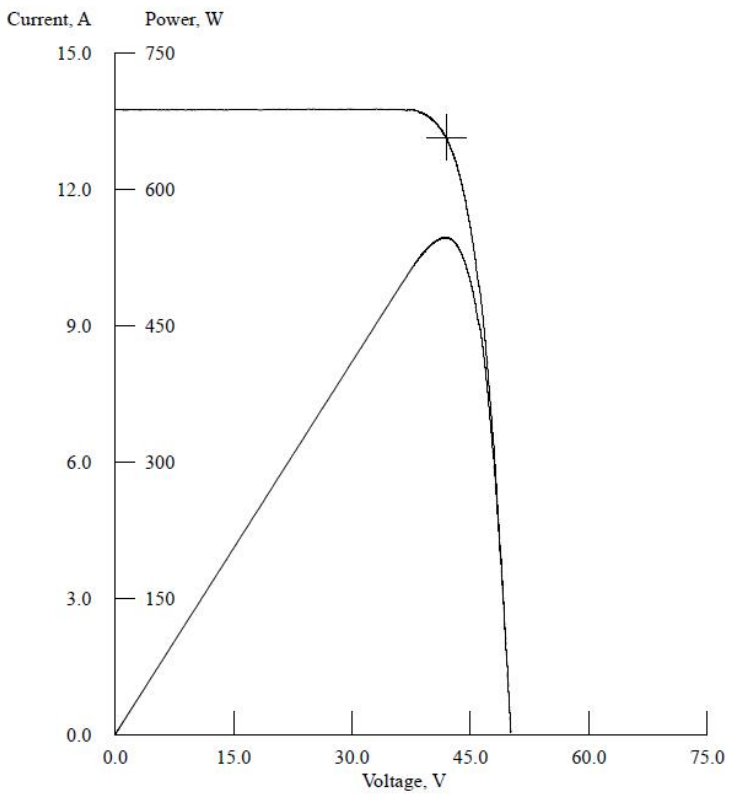


5600

Title: NOVASYS_4790378634
Comment: INITIAL PIV LOW IRR
Operator: Admin
ID: 4915528 (NOVABTMPVD00084)
Module Type: ModuleType1
11:21:58 13-06-2022
Measured Temperature = 25.0°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.74V
Isc = 2.77A
Pmax = 106.93W
Vpm = 40.45V
Ipm = 2.64A
FF = 0.83
Eff,m = 20.68%
Eff,c = 22.69%
Rs = 0.77 Ohm
Rsh = 1123.70 Ohm

Load Voltage: 2.000 V
IV Points: 3769

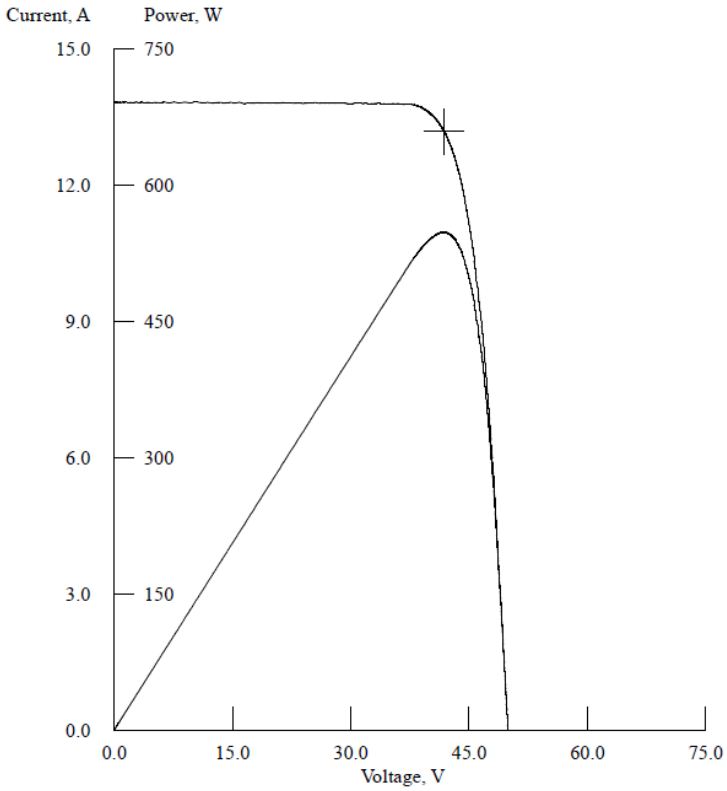
PIV graphs Post PID – 1st Cycle :



5600

Title: NOVASYS_4790378634
Comment: POST PID-1
Operator: Admin
ID: 4915522
Module Type: ModuleType1
12:42:30 21-06-2022
Measured Temperature = 24.8°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.79V
Isc = 13.76A
Pmax = 547.05W
Vpm = 41.61V
Ipm = 13.15A
FF = 0.80
Eff,m = 21.16%
Eff,c = 23.22%
Rs = 0.32 Ohm
Rsh = 191.32 Ohm

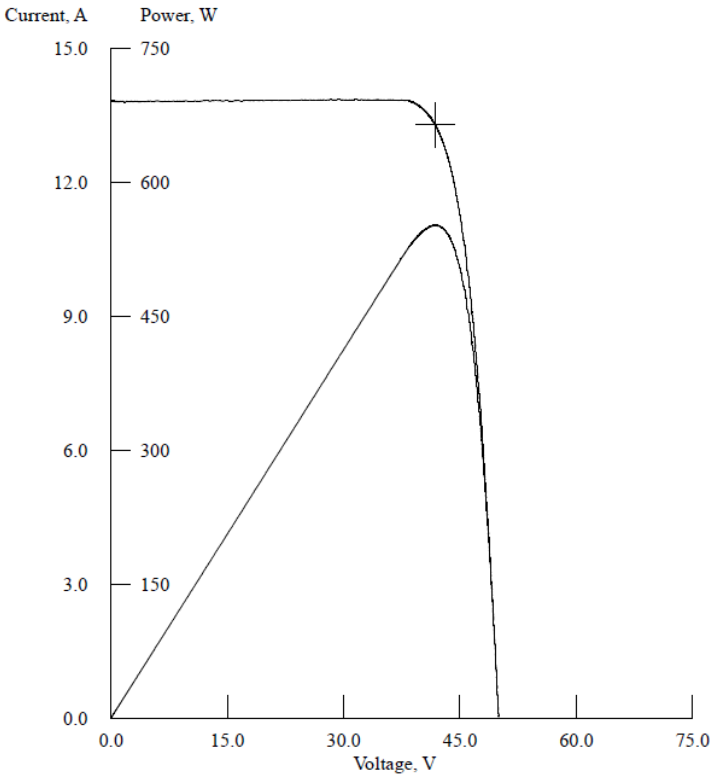
Load Voltage: 5.400 V
IV Points: 3712



5600

Title: NOVASYS_4790378634
Comment: POST PID-1
Operator: Admin
ID: 4915527
Module Type: ModuleType1
12:37:09 21-06-2022
Measured Temperature = 24.6°C
Corrected Temperature = 25.0°C
Irr Meas = 99.9mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.57V
Isc = 13.82A
Pmax = 548.12W
Vpm = 41.54V
Ipm = 13.19A
FF = 0.80
Eff,m = 21.20%
Eff,c = 23.26%
Rs = 0.30 Ohm
Rsh = 278.20 Ohm

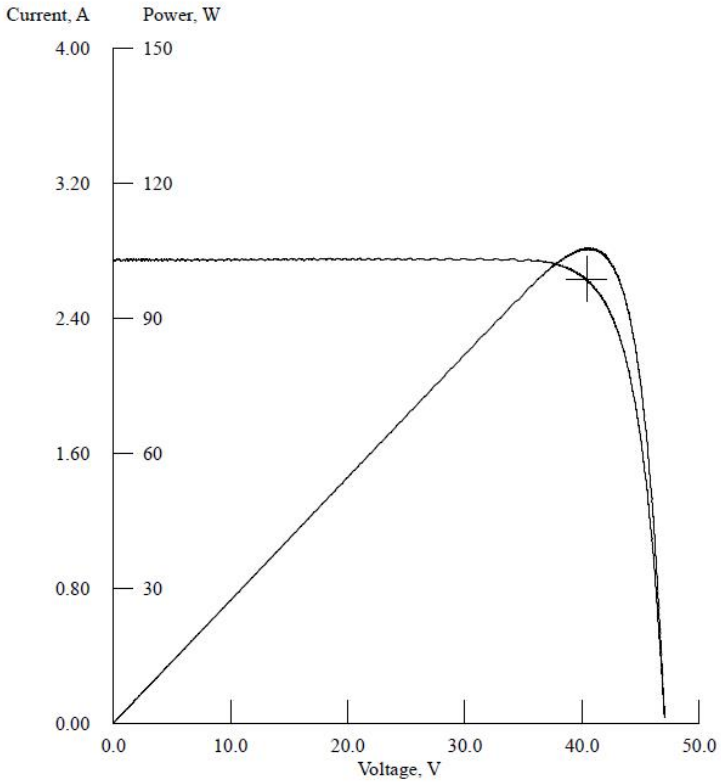
Load Voltage: 5.400 V
IV Points: 3780



5600

Title: NOVASYS_4790378634
Comment: POST PID-1
Operator: Admin
ID: 4915528
Module Type: ModuleType1
12:31:26 21-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 99.9mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.65V
Isc = 13.81A
Pmax = 551.89W
Vpm = 41.51V
Ipm = 13.30A
FF = 0.80
Eff,m = 21.35%
Eff,c = 23.42%
Rs = 0.28 Ohm
Rsh = 132.05 Ohm

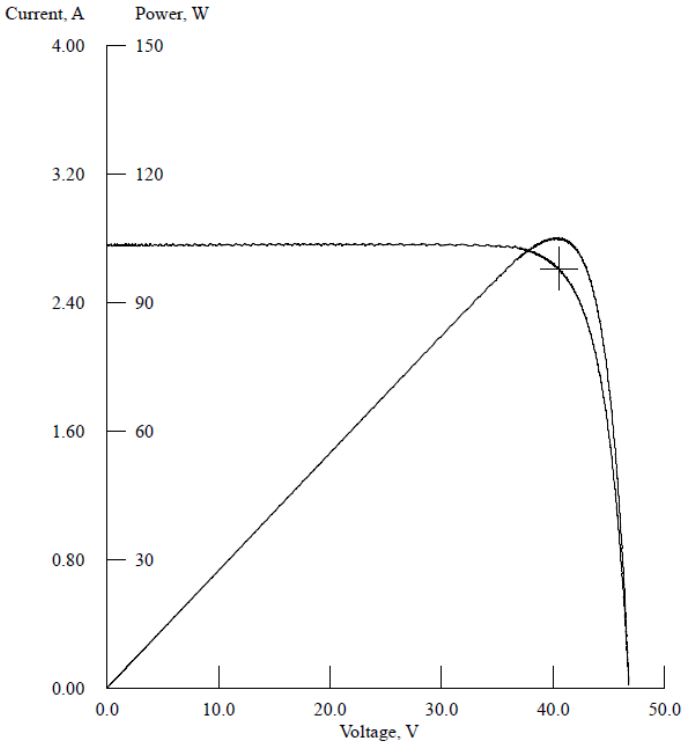
Load Voltage: 5.400 V
IV Points: 3773



5600

Title: NOVASYS_4790378634
Comment: POST PID-1 LOW IRR
Operator: Admin
ID: 4915522
Module Type: ModuleType1
12:43:57 21-06-2022
Measured Temperature = 24.8°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.75V
Isc = 2.76A
Pmax = 105.61W
Vpm = 40.11V
Ipm = 2.63A
FF = 0.82
Eff,m = 20.42%
Eff,c = 22.41%
Rs = 0.93 Ohm
Rsh = 140.36 Ohm

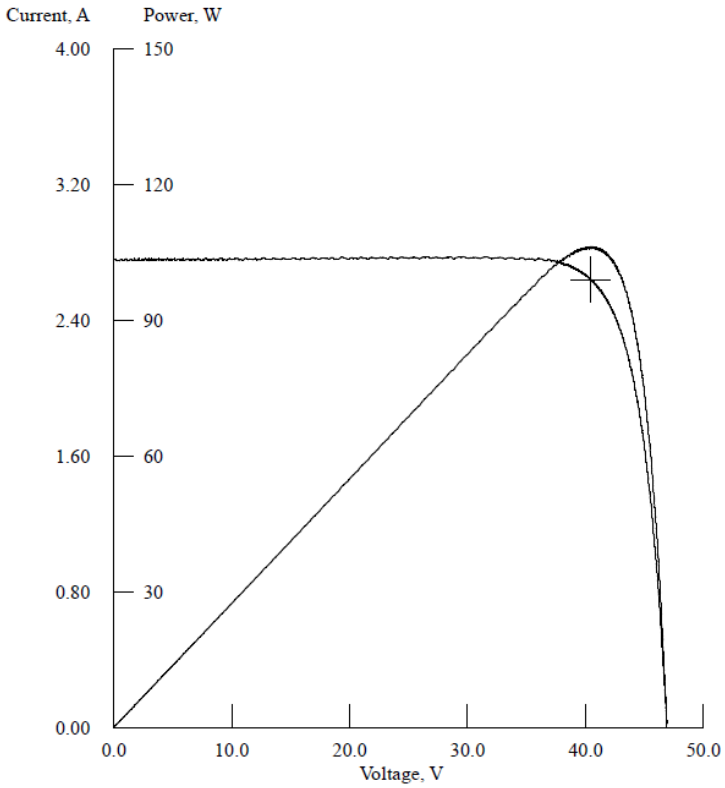
Load Voltage: 2.100 V
IV Points: 3755



5600

Title: NOVASYS_4790378634
Comment: POST PID-1 LOW IRR
Operator: Admin
ID: 4915527
Module Type: ModuleType1
12:38:23 21-06-2022
Measured Temperature = 24.6°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.51V
Isc = 2.77A
Pmax = 105.20W
Vpm = 40.25V
Ipm = 2.61A
FF = 0.82
Eff,m = 20.34%
Eff,c = 22.32%
Rs = 0.84 Ohm
Rsh = 127.83 Ohm

Load Voltage: 2.100 V
IV Points: 3774

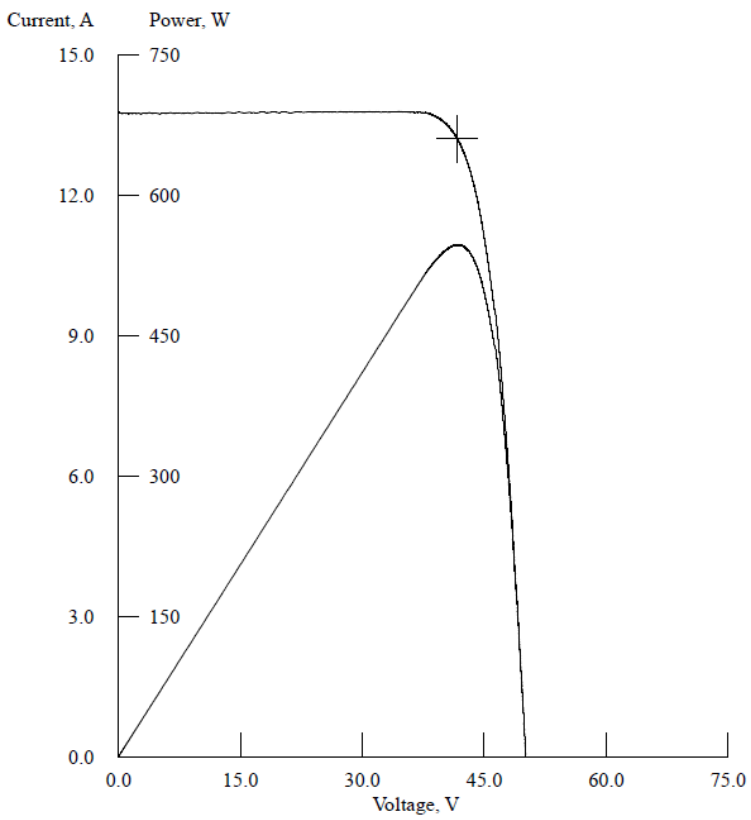


5600

Title: NOVASYS_4790378634
Comment: POST PID-1 LOW IRR
Operator: Admin
ID: 4915528
Module Type: ModuleType1
12:33:13 21-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.59V
Isc = 2.77A
Pmax = 106.20W
Vpm = 40.16V
Ipm = 2.64A
FF = 0.82
Eff,m = 20.54%
Eff,c = 22.54%
Rs = 0.91 Ohm
Rsh = 213.79 Ohm

Load Voltage: 2.100 V
IV Points: 3786

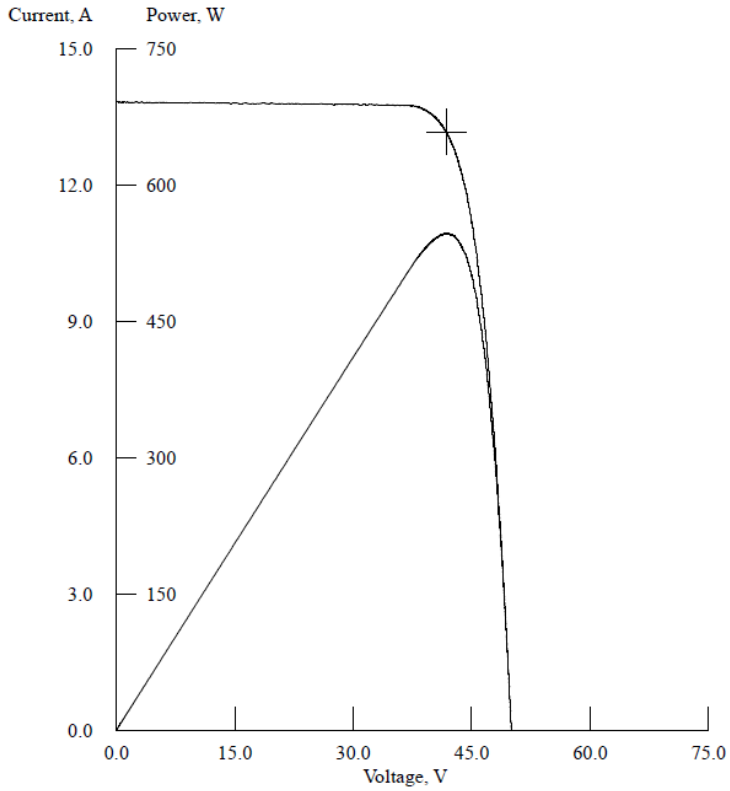
PIV graphs Post PID – 2nd Cycle :



5600

Title: NOVASYS_4790378634
Comment: POST PID-2
Operator: Admin
ID: 4915522
Module Type: ModuleType1
18:22:04 27-06-2022
Measured Temperature = 24.8°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.76V
Isc = 13.76A
Pmax = 547.26W
Vpm = 41.39V
Ipm = 13.22A
FF = 0.80
Eff,m = 21.17%
Eff,c = 23.23%
Rs = 0.31 Ohm
Rsh = 132.96 Ohm

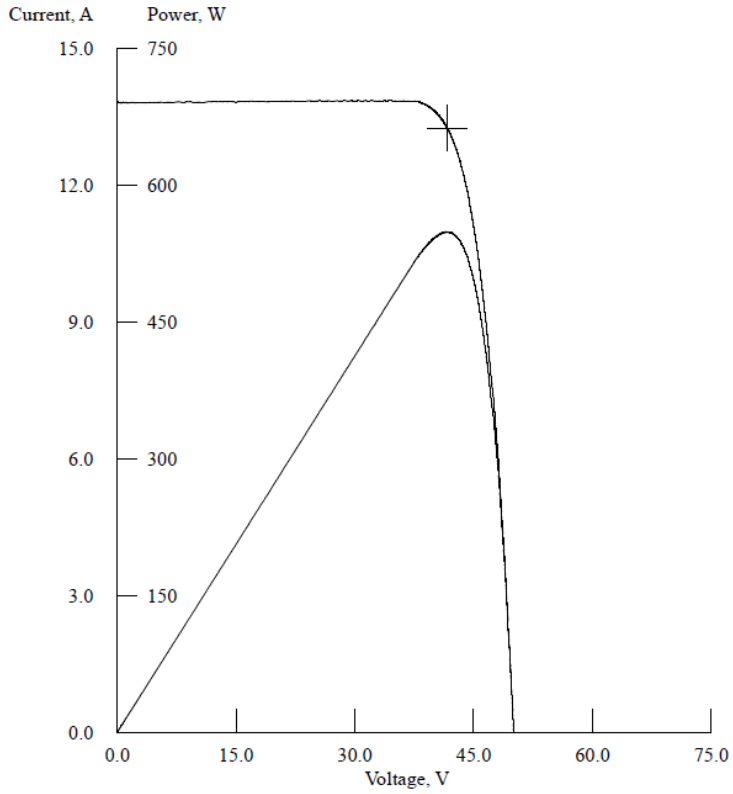
Load Voltage: 5.400 V
IV Points: 3730



5600

Title: NOVASYS_4790378634
Comment: POST PID-2
Operator: Admin
ID: 4915527
Module Type: ModuleType1
18:12:03 27-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.70V
Isc = 13.83A
Pmax = 546.74W
Vpm = 41.50V
Ipm = 13.17A
FF = 0.80
Eff,m = 21.15%
Eff,c = 23.20%
Rs = 0.29 Ohm
Rsh = 152.33 Ohm

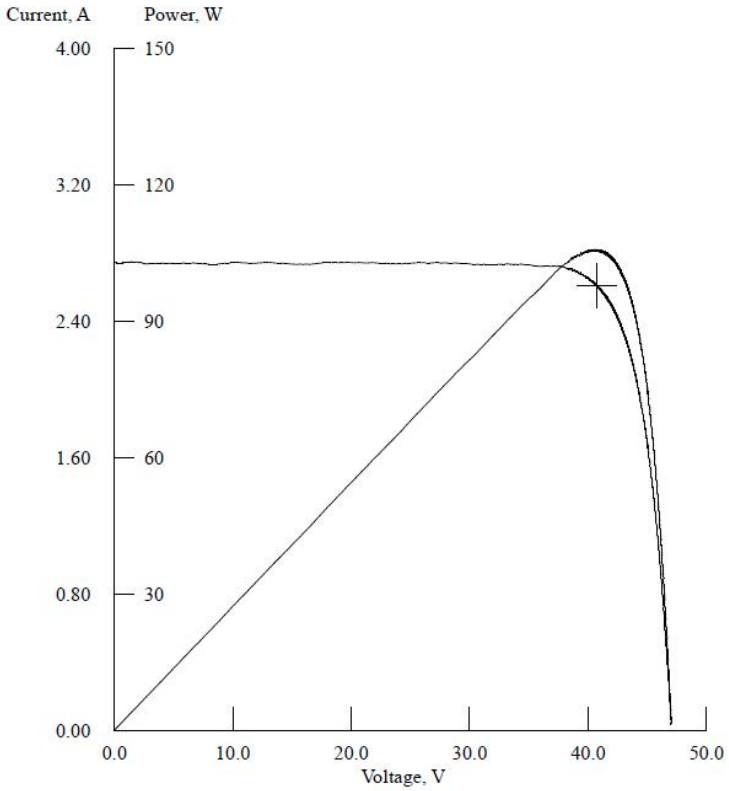
Load Voltage: 5.400 V
IV Points: 3781



5600

Title: NOVASYS_4790378634
Comment: POST PID-2
Operator: Admin
ID: 4915528
Module Type: ModuleType1
18:16:46 27-06-2022
Measured Temperature = 24.9°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.73V
Isc = 13.82A
Pmax = 548.94W
Vpm = 41.40V
Ipm = 13.26A
FF = 0.80
Eff,m = 21.23%
Eff,c = 23.30%
Rs = 0.29 Ohm
Rsh = 200.19 Ohm

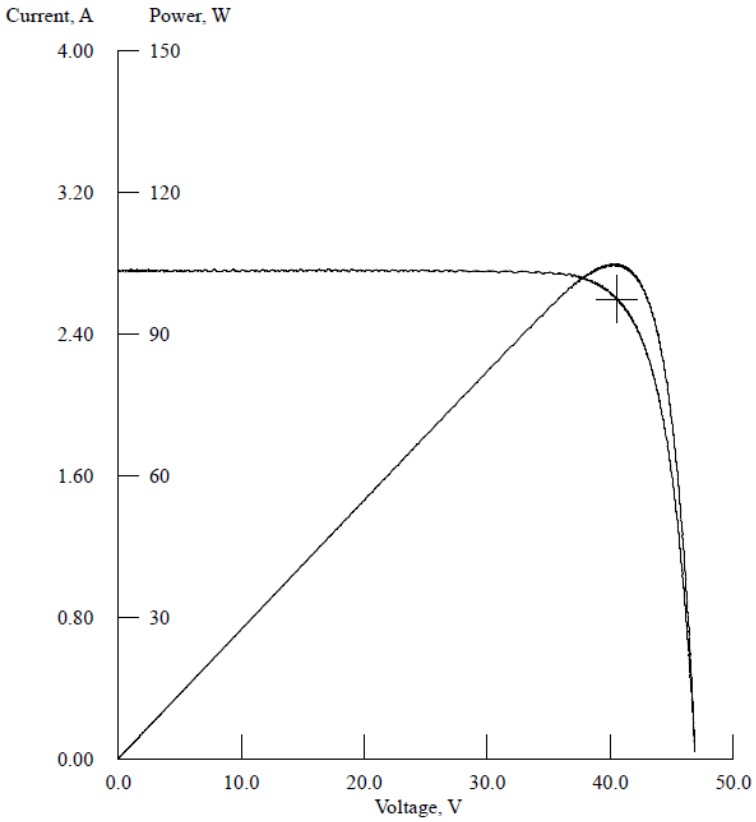
Load Voltage: 5.400 V
IV Points: 3782



5600

Title: NOVASYS_4790378634
Comment: POST PID-2 LOW IRR
Operator: Admin
ID: 4915522
Module Type: ModuleType1
18:22:50 27-06-2022
Measured Temperature = 24.8°C
Corrected Temperature = 25.0°C
Irr Meas = 20.1mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.73V
Isc = 2.75A
Pmax = 105.72W
Vpm = 40.48V
Ipm = 2.61A
FF = 0.82
Eff,m = 20.45%
Eff,c = 22.44%
Rs = 0.87 Ohm
Rsh = 2271.78 Ohm

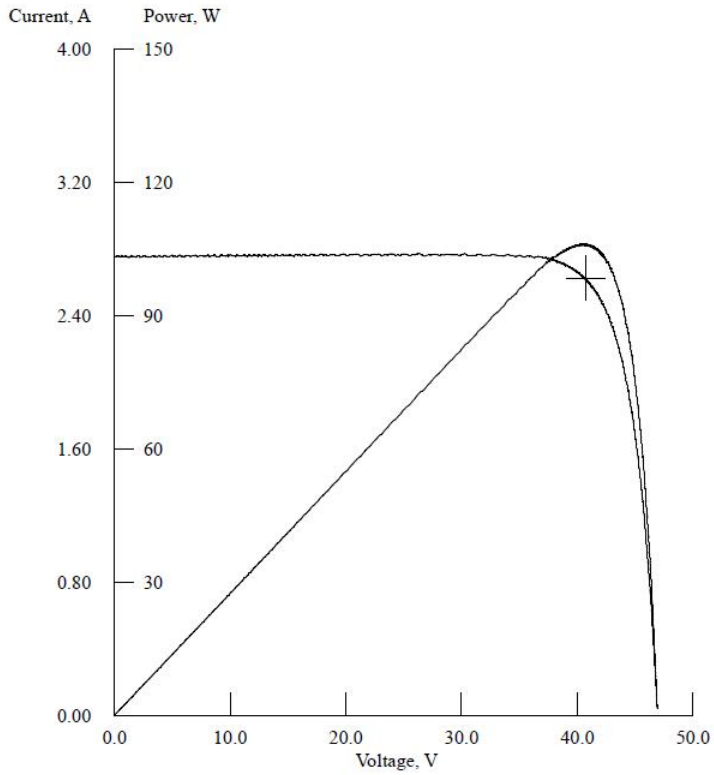
Load Voltage: 2.000 V
IV Points: 3780



5600

Title: NOVASYS_4790378634
Comment: POST PID-2 LOW IRR
Operator: Admin
ID: 4915527
Module Type: ModuleType1
18:13:26 27-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.60V
Isc = 2.77A
Pmax = 104.75W
Vpm = 40.28V
Ipm = 2.60A
FF = 0.81
Eff,m = 20.26%
Eff,c = 22.23%
Rs = 0.95 Ohm
Rsh = 112.83 Ohm

Load Voltage: 2.100 V
IV Points: 3749

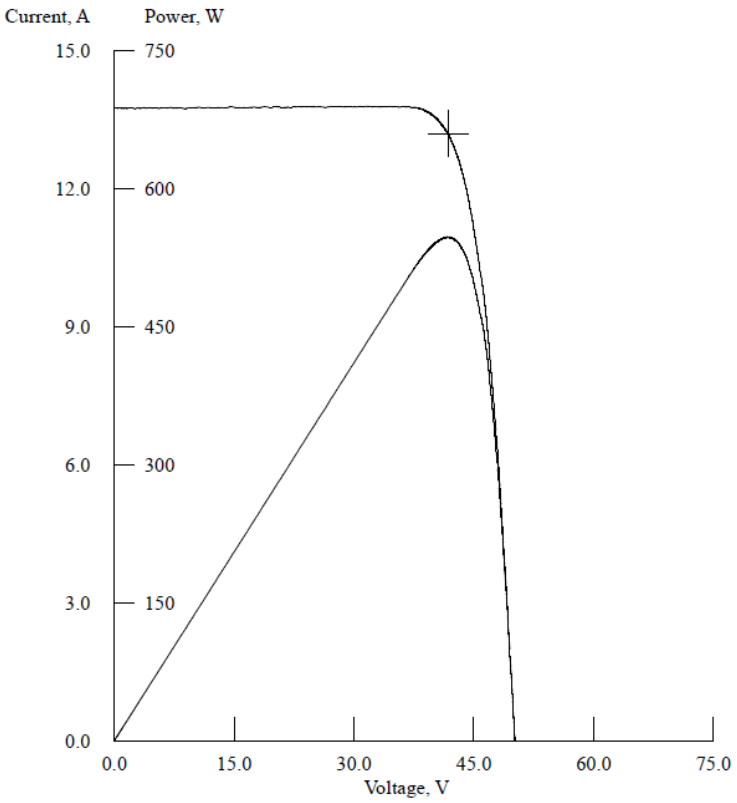


5600

Title: NOVASYS_4790378634
Comment: POST PID-2 LOW IRR
Operator: Admin
ID: 4915528
Module Type: ModuleType1
18:18:15 27-06-2022
Measured Temperature = 24.7°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.64V
Isc = 2.77A
Pmax = 106.11W
Vpm = 40.46V
Ipm = 2.62A
FF = 0.82
Eff,m = 20.52%
Eff,c = 22.52%
Rs = 0.77 Ohm
Rsh = 270.27 Ohm

Load Voltage: 2.100 V
IV Points: 3627

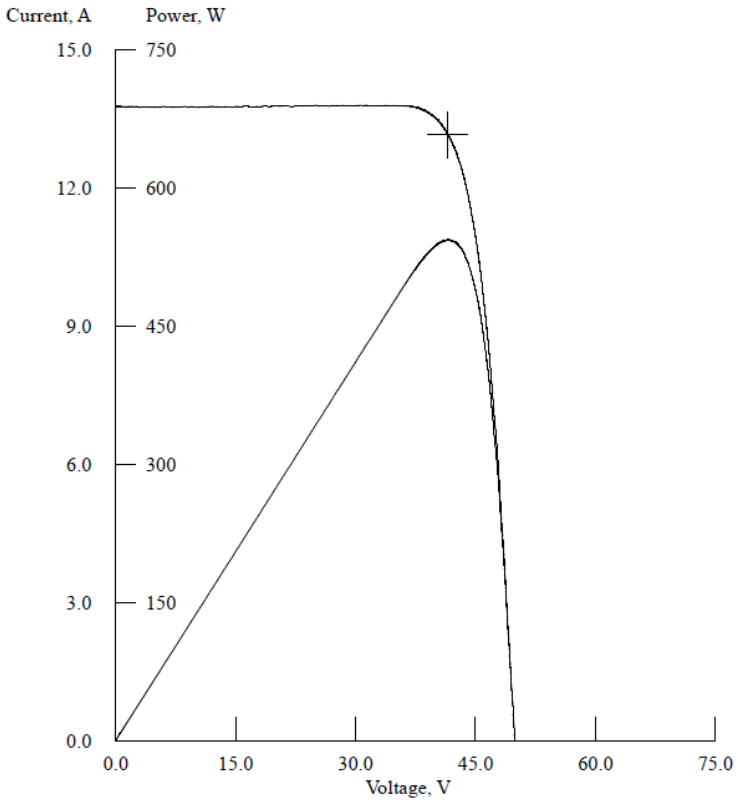
PIV graphs Post PID – 3rd Cycle :



5600

Title: NOVASYS_4790378634
Comment: POST PID-3
Operator: Admin
ID: 4915522
Module Type: ModuleType1
18:02:03 04-07-2022
Measured Temperature = 25.1°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.79V
Isc = 13.76A
Pmax = 547.38W
Vpm = 41.48V
Ipm = 13.20A
FF = 0.80
Eff,m = 21.17%
Eff,c = 23.23%
Rs = 0.33 Ohm
Rsh = 164.58 Ohm

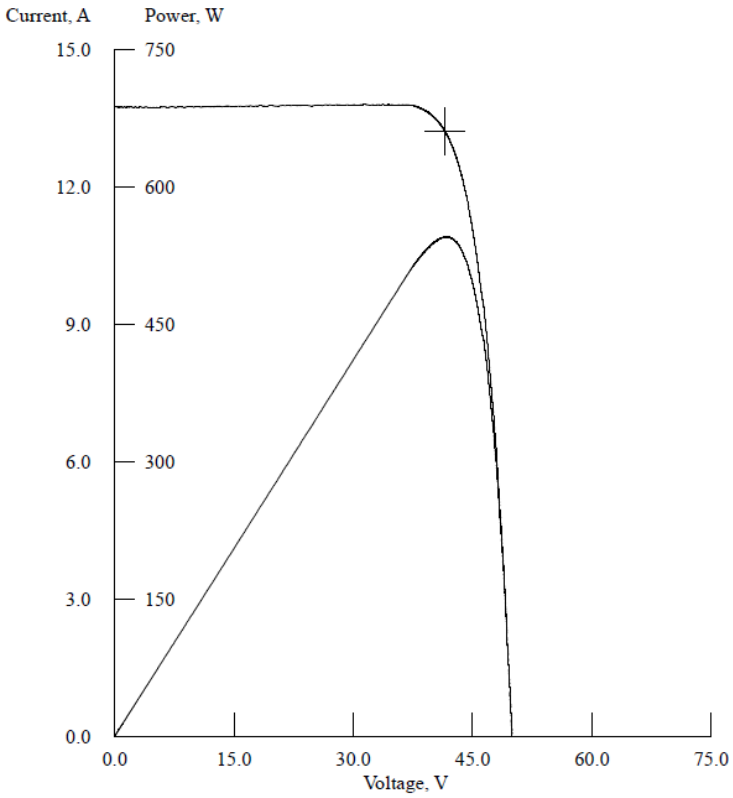
Load Voltage: 5.400 V
IV Points: 3739



5600

Title: NOVASYS_4790378634
Comment: POST PID-3
Operator: Admin
ID: 4915527
Module Type: ModuleType1
18:06:58 04-07-2022
Measured Temperature = 24.3°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.59V
Isc = 13.77A
Pmax = 543.43W
Vpm = 41.28V
Ipm = 13.16A
FF = 0.80
Eff,m = 21.02%
Eff,c = 23.06%
Rs = 0.34 Ohm
Rsh = 116.62 Ohm

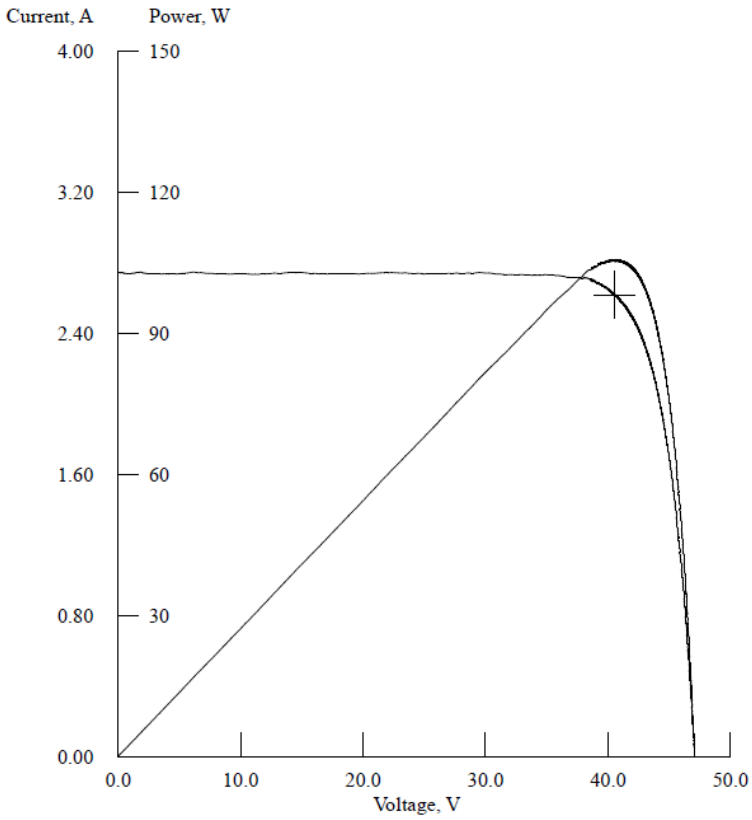
Load Voltage: 5.400 V
IV Points: 3729



5600

Title: NOVASYS_4790378634
Comment: POST PID-3
Operator: Admin
ID: 4915528
Module Type: ModuleType1
18:11:14 04-07-2022
Measured Temperature = 24.9°C
Corrected Temperature = 25.0°C
Irr Meas = 100.0mW/cm²
Irr Corr = 100.0mW/cm²
Voc = 49.63V
Isc = 13.75A
Pmax = 545.59W
Vpm = 41.24V
Ipm = 13.23A
FF = 0.80
Eff,m = 21.10%
Eff,c = 23.16%
Rs = 0.29 Ohm
Rsh = 211.06 Ohm

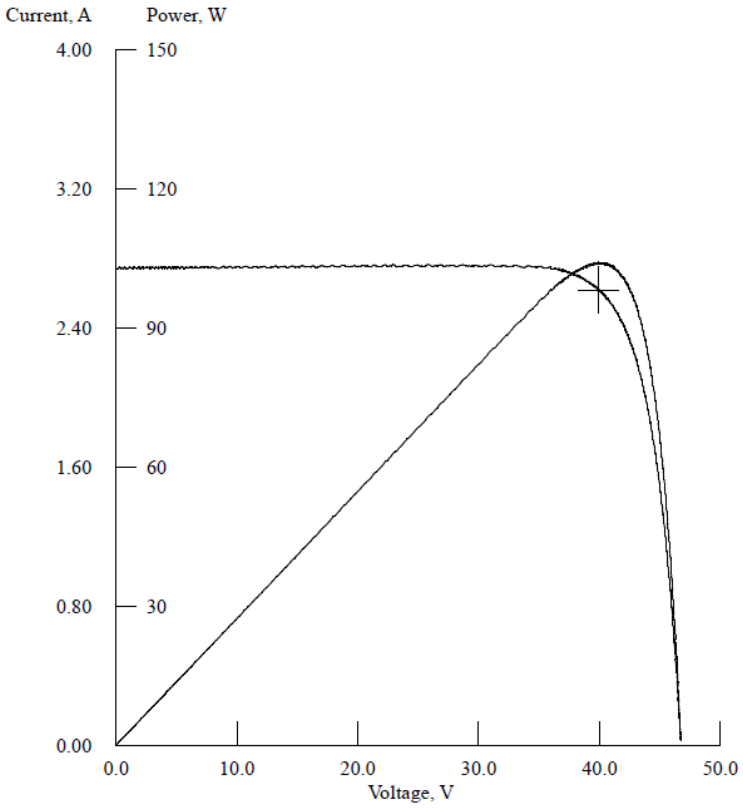
Load Voltage: 5.400 V
IV Points: 3727



5600

Title: NOVASYS_4790378634
Comment: POST PID-3 LOW IRR
Operator: Admin
ID: 4915522
Module Type: ModuleType1
18:02:53 04-07-2022
Measured Temperature = 25.1°C
Corrected Temperature = 25.0°C
Irr Meas = 20.1mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.77V
Isc = 2.75A
Pmax = 105.64W
Vpm = 40.26V
Ipm = 2.62A
FF = 0.82
Eff,m = 20.43%
Eff,c = 22.42%
Rs = 0.95 Ohm
Rsh = 1516.22 Ohm

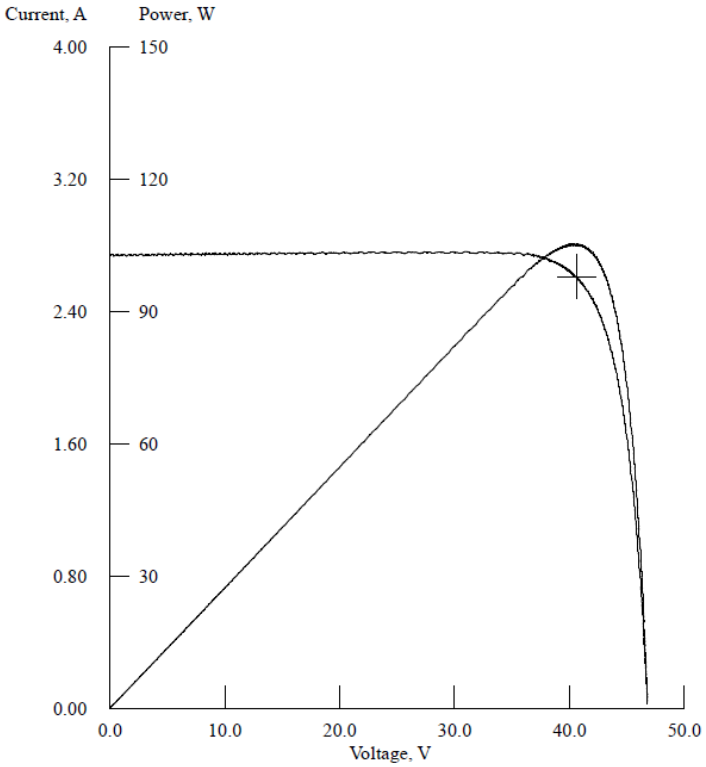
Load Voltage: 2.000 V
IV Points: 3810



5600

Title: NOVASYS_4790378634
Comment: POST PID-3 LOW IRR
Operator: Admin
ID: 4915527
Module Type: ModuleType1
18:07:58 04-07-2022
Measured Temperature = 24.2°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.44V
Isc = 2.76A
Pmax = 104.11W
Vpm = 39.63V
Ipm = 2.63A
FF = 0.81
Eff,m = 20.13%
Eff,c = 22.09%
Rs = 0.93 Ohm
Rsh = 201.34 Ohm

Load Voltage: 2.100 V
IV Points: 3750



5600

Title: NOVASYS_4790378634
Comment: POST PID-3 LOW IRR
Operator: Admin
ID: 4915528
Module Type: ModuleType1
18:12:53 04-07-2022
Measured Temperature = 24.9°C
Corrected Temperature = 25.0°C
Irr Meas = 20.0mW/cm²
Irr Corr = 20.0mW/cm²
Voc = 46.51V
Isc = 2.75A
Pmax = 105.34W
Vpm = 40.36V
Ipm = 2.61A
FF = 0.82
Eff,m = 20.37%
Eff,c = 22.35%
Rs = 0.75 Ohm
Rsh = 286.21 Ohm

Load Voltage: 2.100 V
IV Points: 3656