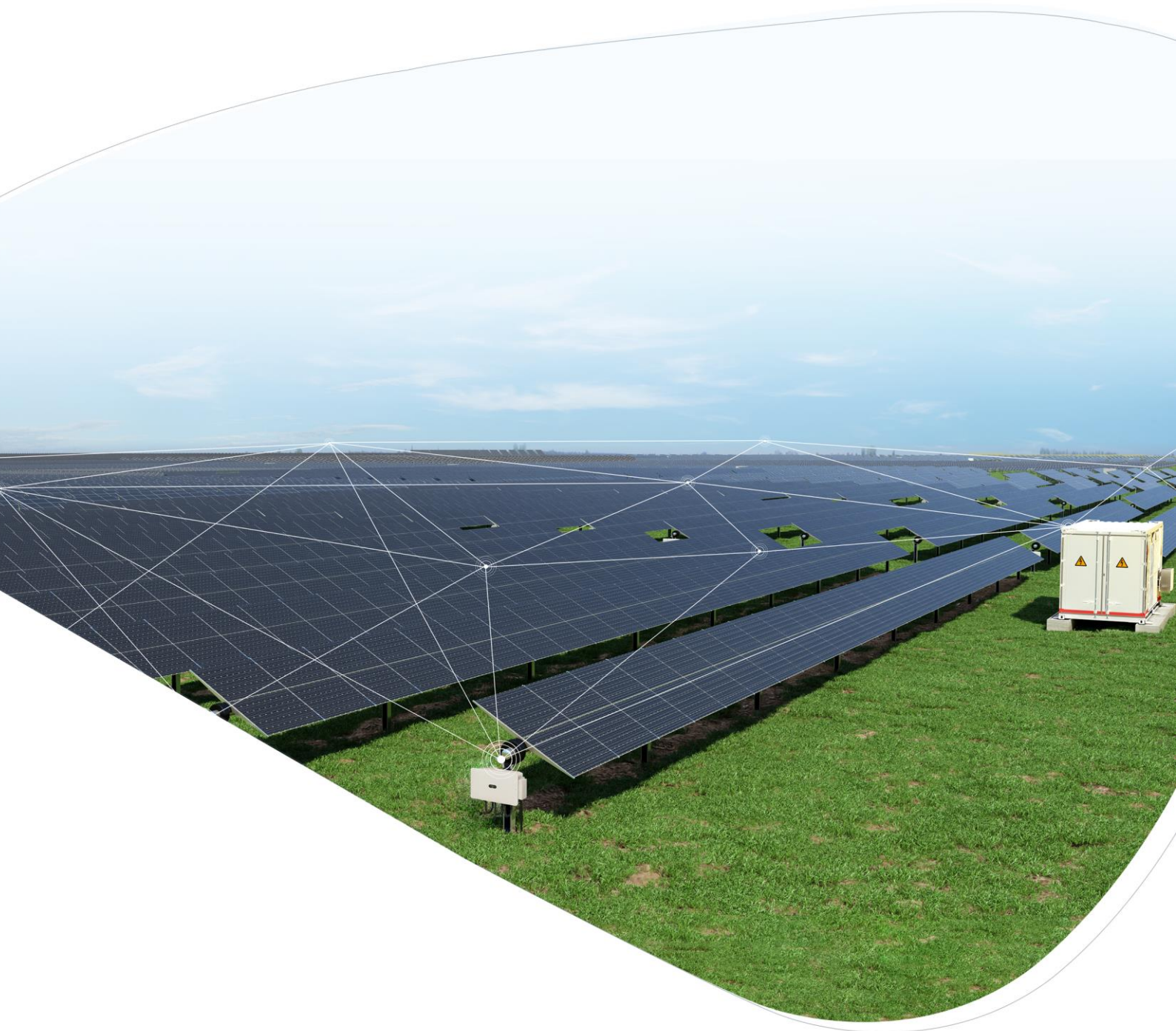




FusionSolar[®]

Smart I-V Curve Diagnosis Report

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1. Main Value: Improve yields, Lower OPEX, Guarantee plant safety

- **Altogether 9,496 strings in 49MW are analyzed of which 1,149 faults are detected**, in addition, **Diagnosis and O&M reports are automatically** provided to help customers rectify faults as soon as possible. And If all faults are rectified, there is opportunity to **increase yields by more than 1.5%**
- Smart I-V Curve Diagnosis takes **less than 10 minutes** to analyze the health of all PV strings **in the 49MW PV plant**
- Smart I-V Curve Diagnosis supports real-time full detection to detect PV string and security risks, facilitating timely troubleshooting and ensuring security.

2. Yield Analysis

- According to the below table calculation, **total impact on yields is between 0.64%~1.57%**.
- Although the number of hot spot panels are small, but in severe cases, panels may be burnt, causing insulation deterioration, accelerating aging, and so on.
- The diode short circuit panels' reliability is affected, and there are security risks (like electric shock or fire).

Fault & Cause	Faulty strings Qty.	Failure rate (Fault strings/ total strings)	Impact of this string failure on Yield(per string)	Overall Impact Rate
PV module output current abnormal (shade/glass breakage/hidden crack)	608	6.4%	Shade:1%~5% Breakage:~5% Hidden crack: uncertain	Shade:0.07%~0.32% Breakage:0.32%
Current mismatch in the PV string (shade/dust/PV module current inconsistent)	220	2.3%	Shade:1~5% dust:3%~30%	Shade:0.02%~0.12% Dust:0.07%~0.7%
PV string open circuit (PV string breakage/PV string configured by mistake)	211	Not connected: 0.55% Note: Onsite check shows that 1/4 strings were not connected, and 3/4 PV strings were configured by mistake.	100%	0.55%
Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)	87	0.9%	Hotspot:0.01% Hidden crack: uncertain breakage: ~5%	Hotspot:~0 Breakage: ~0.0045%
PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)	23	0.2%	Diode short circuit:1.4%	~0

Asia 49MW

Smart I-V Curve Diagnosis

Overview Report

Inspection Plant:_____

Inspection On:_____

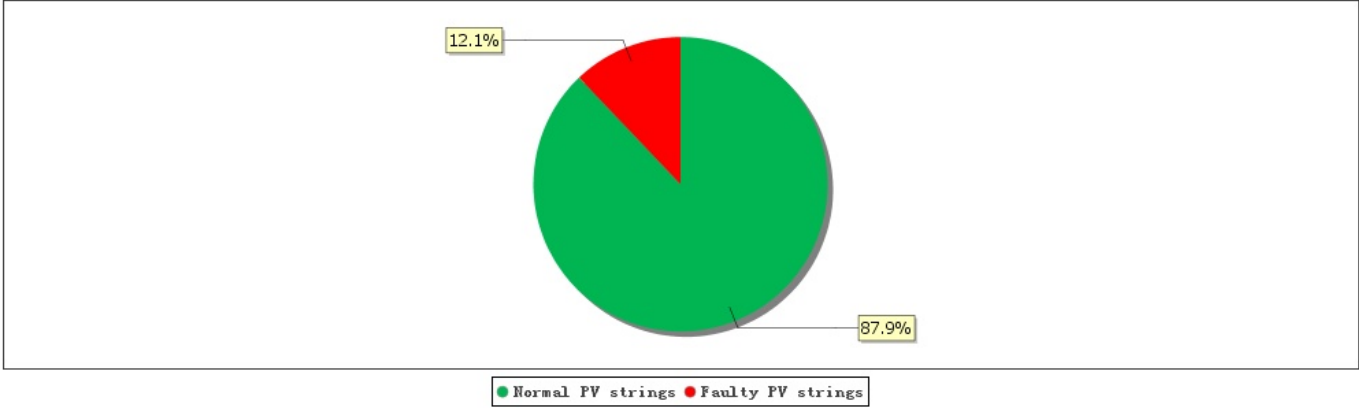
Inspection By:_____

Owner Company

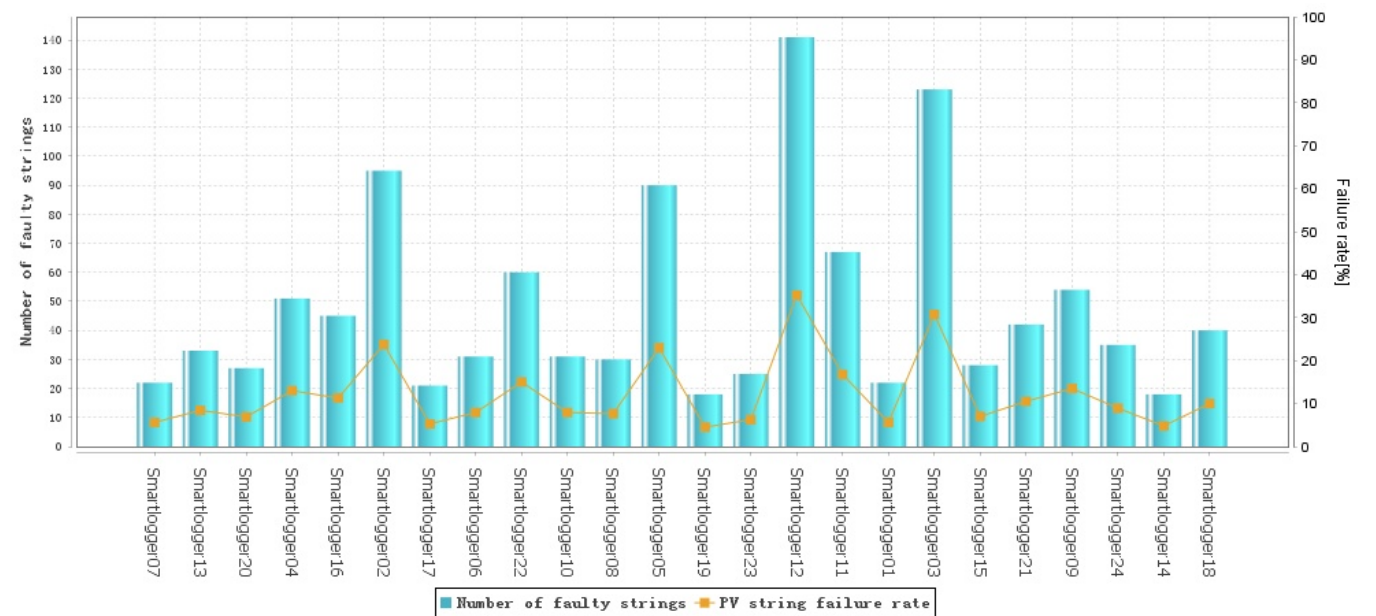
Project name:
Owner:
Design institute:
Construction company:
Acceptance organization:
Installation/Operation date:
Construction address:
GPS coordinates:
Altitude(m):
Total annual radiation(kWh/m²):
Annual average temperature(°C):
Highest extreme temperature(°C):
Lowest extreme temperature(°C):

1. Evaluation of the PV String Failure Rate

In total, 9496 PV strings are scanned in this task. Faulty PV strings: 1149Total failure rate: 12.1%



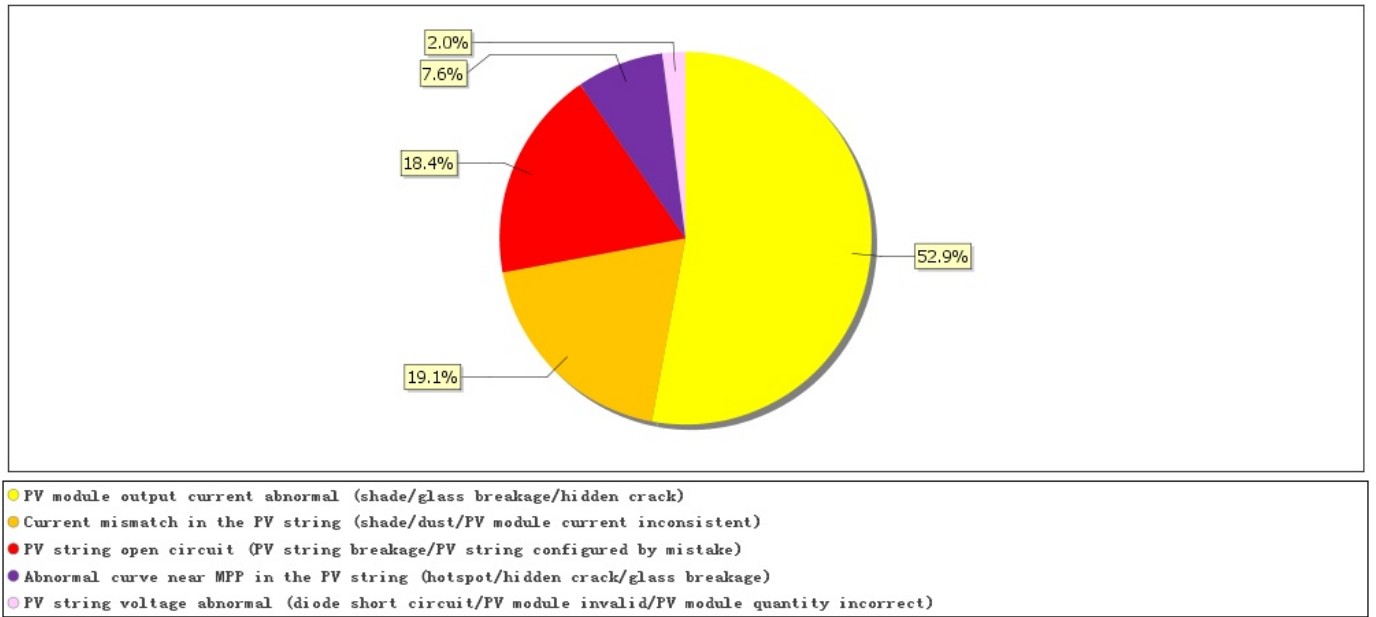
No.	SmartLogger Name	Manufacturer of Module	Module Type	Total number of strings	Number of faulty strings	Failure rate
1	Smartlogger07	XXXXXXXX	XXXXXXXX	392	22	5.6%
2	Smartlogger13	XXXXXXXX	XXXXXXXX	392	33	8.4%
3	Smartlogger20	XXXXXXXX	XXXXXXXX	392	27	6.9%
4	Smartlogger04	XXXXXXXX	XXXXXXXX	392	51	13.0%
5	Smartlogger16	XXXXXXXX	XXXXXXXX	400	45	11.2%
6	Smartlogger02	XXXXXXXX	XXXXXXXX	400	95	23.8%
7	Smartlogger17	XXXXXXXX	XXXXXXXX	400	21	5.2%
8	Smartlogger06	XXXXXXXX	XXXXXXXX	392	31	7.9%
9	Smartlogger22	XXXXXXXX	XXXXXXXX	400	60	15.0%
10	Smartlogger10	XXXXXXXX	XXXXXXXX	392	31	7.9%
11	Smartlogger08	XXXXXXXX	XXXXXXXX	392	30	7.7%
12	Smartlogger05	XXXXXXXX	XXXXXXXX	392	90	23.0%
13	Smartlogger19	XXXXXXXX	XXXXXXXX	400	18	4.5%
14	Smartlogger23	XXXXXXXX	XXXXXXXX	400	25	6.2%
15	Smartlogger12	XXXXXXXX	XXXXXXXX	400	141	35.2%
16	Smartlogger11	XXXXXXXX	XXXXXXXX	400	67	16.8%
17	Smartlogger01	XXXXXXXX	XXXXXXXX	392	22	5.6%
18	Smartlogger03	XXXXXXXX	XXXXXXXX	400	123	30.8%
19	Smartlogger15	XXXXXXXX	XXXXXXXX	400	28	7.0%
20	Smartlogger21	XXXXXXXX	XXXXXXXX	400	42	10.5%
21	Smartlogger09	XXXXXXXX	XXXXXXXX	400	54	13.5%
22	Smartlogger24	XXXXXXXX	XXXXXXXX	392	35	8.9%
23	Smartlogger14	XXXXXXXX	XXXXXXXX	376	18	4.8%
24	Smartlogger18	XXXXXXXX	XXXXXXXX	400	40	10.0%



2. Fault Type Analysis

In total, 24 SmartLoggers are scanned in this task,1149 PV strings are faulty. The distribution is as follows: The common faults are:

- 1) PV module output current abnormal (shade/glass breakage/hidden crack), Percentage: 52.9%
 - 2) Current mismatch in the PV string (shade/dust/PV module current inconsistent), Percentage: 19.1%
 - 3) PV string open circuit (PV string breakage/PV string configured by mistake), Percentage: 18.4%
- First 3 common faults vs. total faults:90.4%



Fault type	Number of faulty strings	%
PV module output current abnormal (shade/glass breakage/hidden crack)	608	52.9%
Current mismatch in the PV string (shade/dust/PV module current inconsistent)	220	19.1%
PV string open circuit (PV string breakage/PV string configured by mistake)	211	18.4%
Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)	87	7.6%
PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)	23	2.0%

Asia 49MW
Smartlogger01
Smart I-V Curve Diagnosis

Inspection Plant:_____

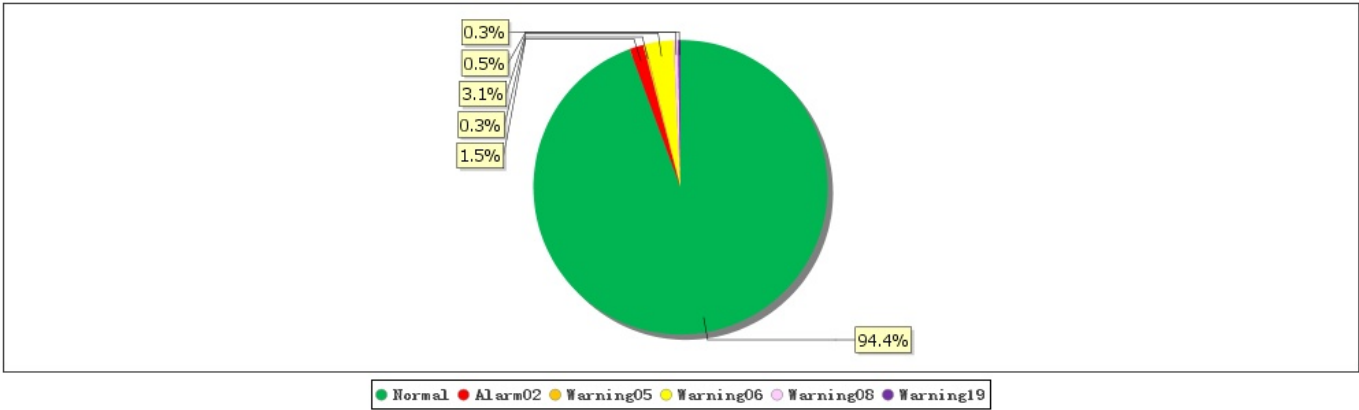
Inspection On:_____

Owner Company

1. Information of Task

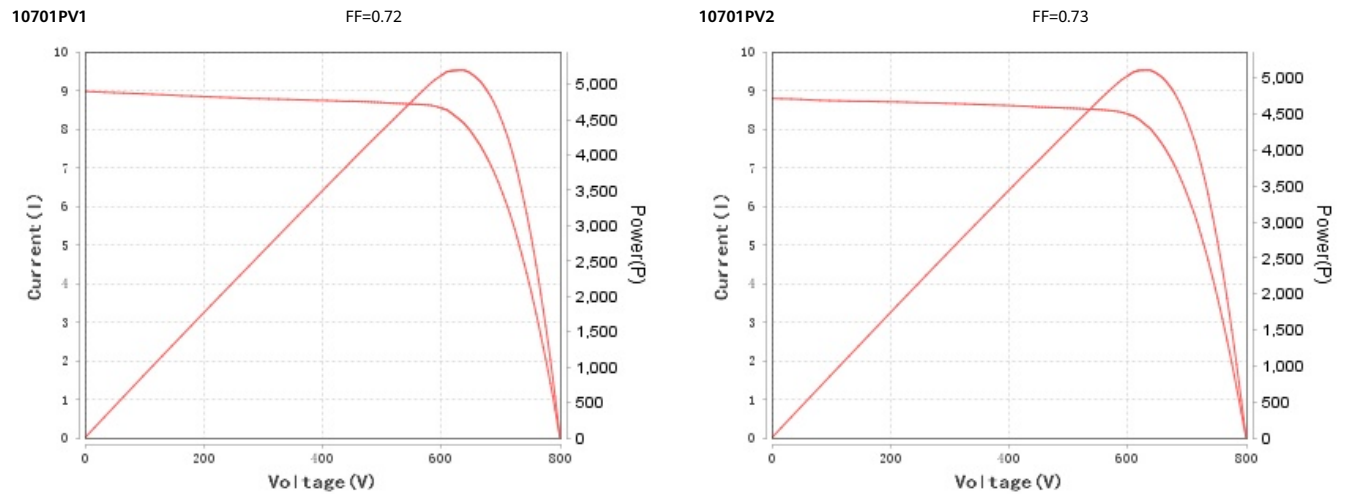
Task name	CASE2 Plant 49MW	Creation Time	2018-12-22 12:17:32
Cleaning status	Uncleaned	Task type	PV plant level diagnosis
Total number of strings	392	Number of faulty strings	22
Irradiance(W/m²)	967.15(Predictive value)	Temperature Of Panel(°C)	64.62(Predictive value)

2. Overview on Diagnosis



Legend	Quantity	Percentage	Description
Normal	370	94.4%	PV string normal
Alarm02	6	1.5%	PV string open circuit (PV string breakage/PV string configured by mistake)
Warning05	1	0.3%	Current mismatch in the PV string (shade/dust/PV module current inconsistent)
Warning06	12	3.1%	PV module output current abnormal (shade/glass breakage/hidden crack)
Warning08	2	0.5%	PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)
Warning19	1	0.3%	Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)

3. PV String I-V Curve Details

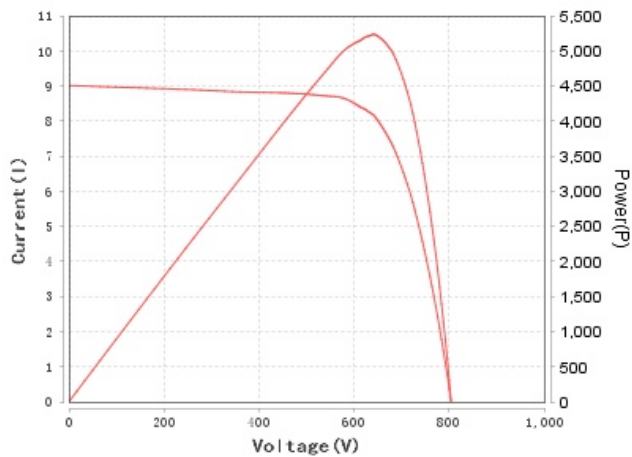


Isc[A]	8.97	Imp[A]	8.15	Pmax[W]	5199.98
Voc[V]	799.70	Vmp[V]	637.80	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

Isc[A]	8.79	Imp[A]	8.09	Pmax[W]	5110.63
Voc[V]	799.70	Vmp[V]	631.80	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10701PV3

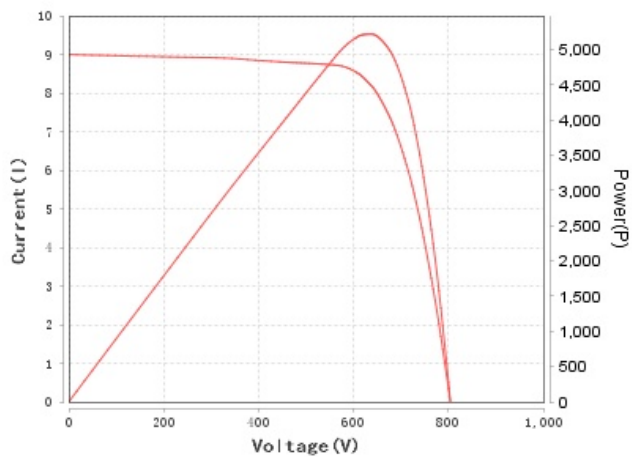
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Isc[A]	9.01	Imp[A]	8.17	Pmax[W]	5240.24
Voc[V]	804.30	Vmp[V]	641.40	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10701PV4

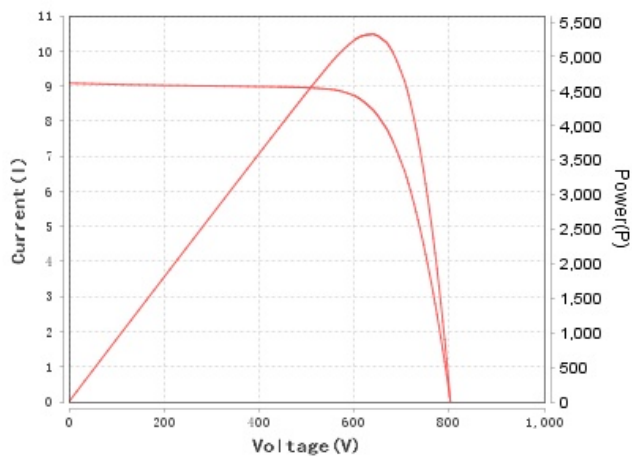
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Isc[A]	9.00	Imp[A]	8.24	Pmax[W]	5221.12
Voc[V]	804.30	Vmp[V]	633.40	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10701PV5

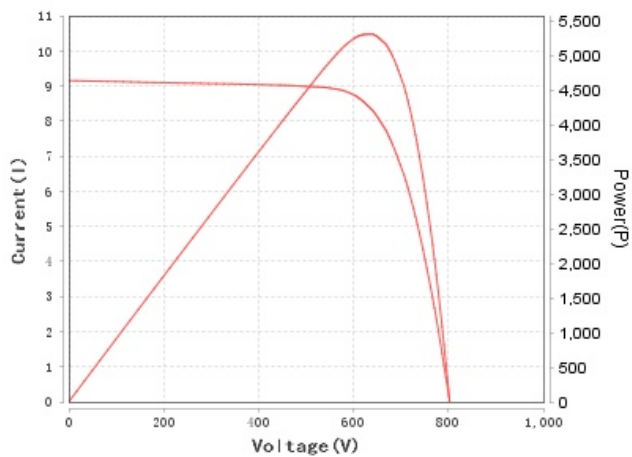
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Isc[A]	9.08	Imp[A]	8.32	Pmax[W]	5325.38
Voc[V]	802.90	Vmp[V]	640.30	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10701PV6

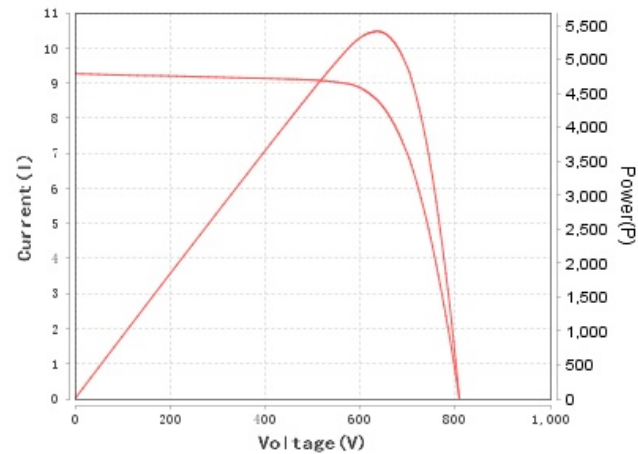
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Isc[A]	9.15	Imp[A]	8.31	Pmax[W]	5318.33
Voc[V]	802.90	Vmp[V]	640.30	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10201PV7

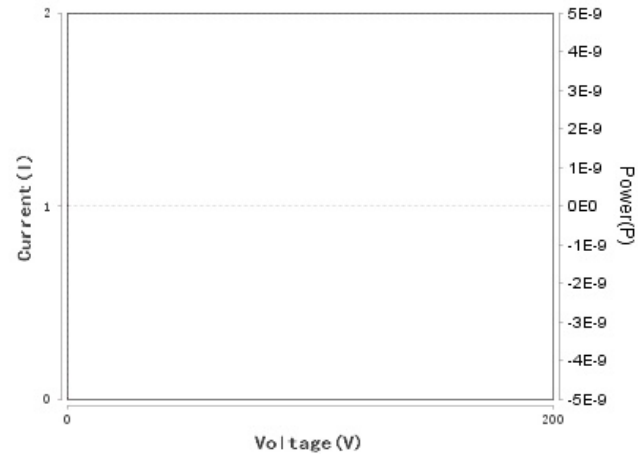
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Isc[A]	9.26	Imp[A]	8.50	Pmax[W]	5416.84
Voc[V]	809.10	Vmp[V]	637.20	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10201PV8

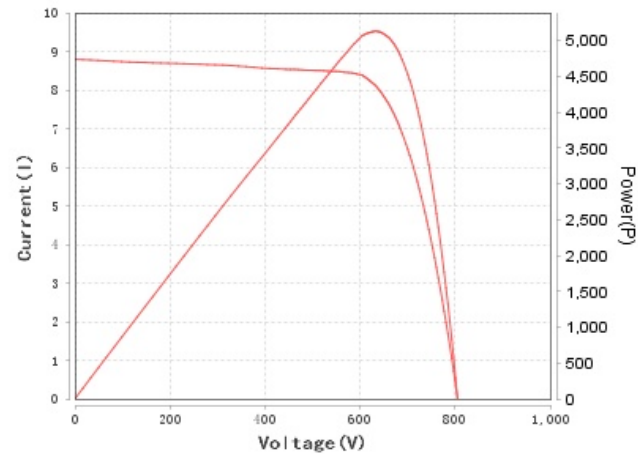
FF=-



Isc[A]	-	Imp[A]	-	Pmax[W]	-
Voc[V]	-	Vmp[V]	-	PV string open circuit (PV string breakage/PV string configured by mistake)	
Irr[W/m²]	0.00	Temp[°C]	0.00		

10702PV1

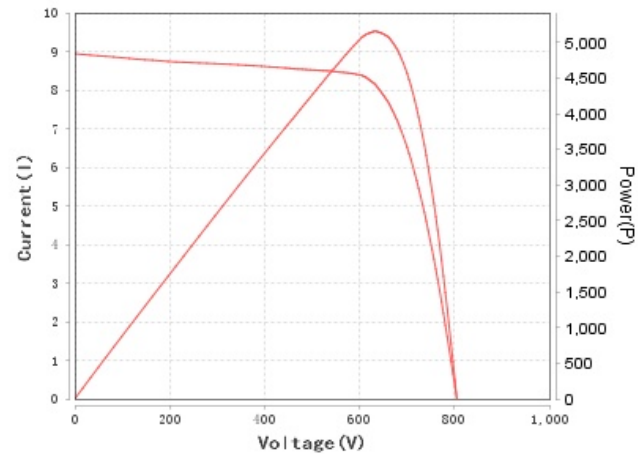
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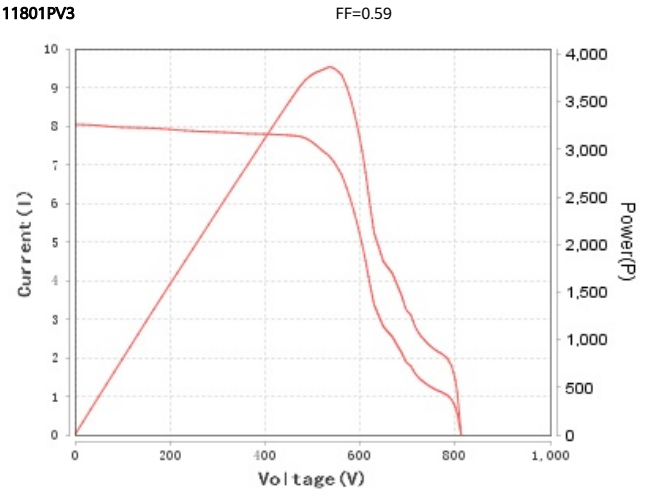
Isc[A]	8.79	Imp[A]	8.09	Pmax[W]	5132.41
Voc[V]	805.20	Vmp[V]	634.10	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10702PV2

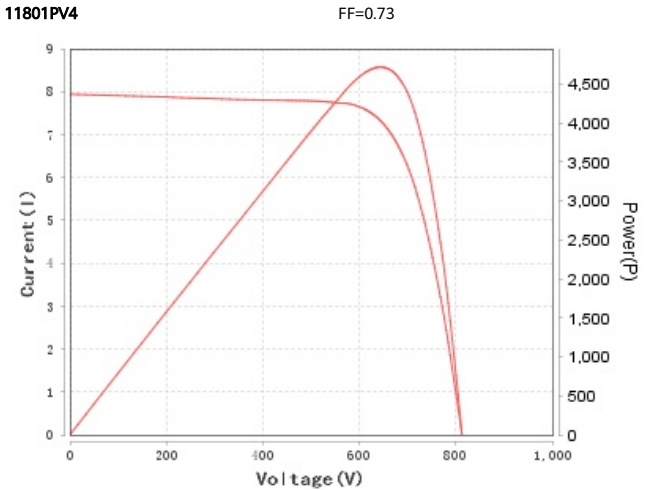
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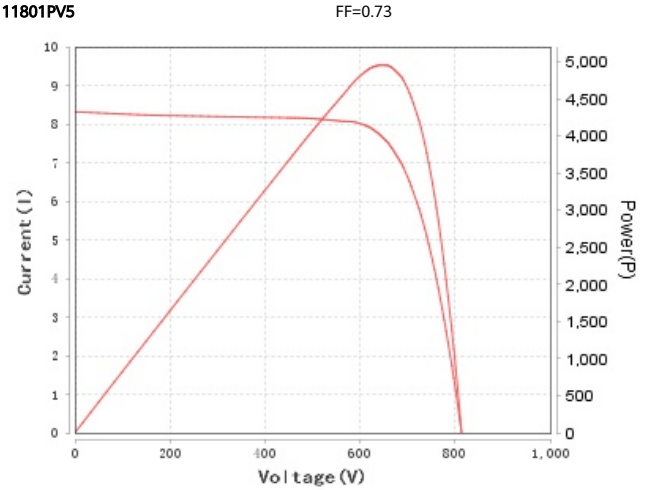
Isc[A]	8.94	Imp[A]	8.16	Pmax[W]	5156.67
Voc[V]	805.20	Vmp[V]	632.10	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		



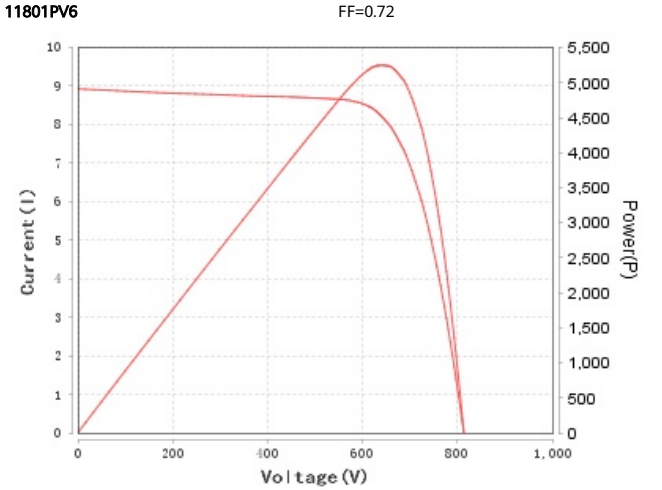
Isc[A]	8.04	Imp[A]	7.24	Pmax[W]	3863.64
Voc[V]	812.90	Vmp[V]	533.80	PV module output current abnormal (shade/glass breakage/hidden crack)	
Irr[W/m²]	967.15	Temp[°C]	64.62		



Isc[A]	7.94	Imp[A]	7.36	Pmax[W]	4713.79
Voc[V]	812.90	Vmp[V]	640.20	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		



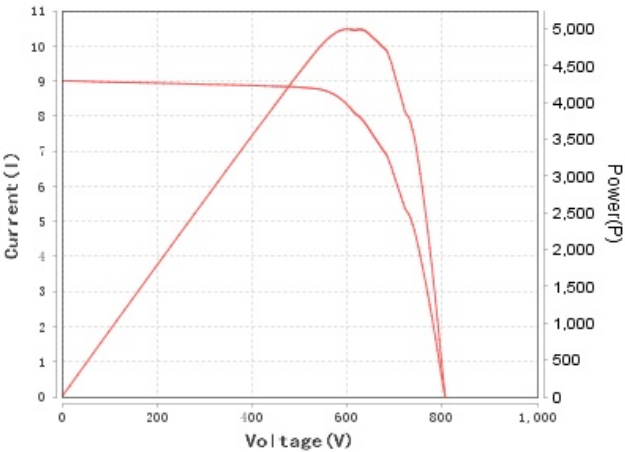
Isc[A]	8.31	Imp[A]	7.68	Pmax[W]	4954.77
Voc[V]	813.70	Vmp[V]	644.90	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		



Isc[A]	8.91	Imp[A]	8.19	Pmax[W]	5250.07
Voc[V]	813.70	Vmp[V]	640.80	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV3

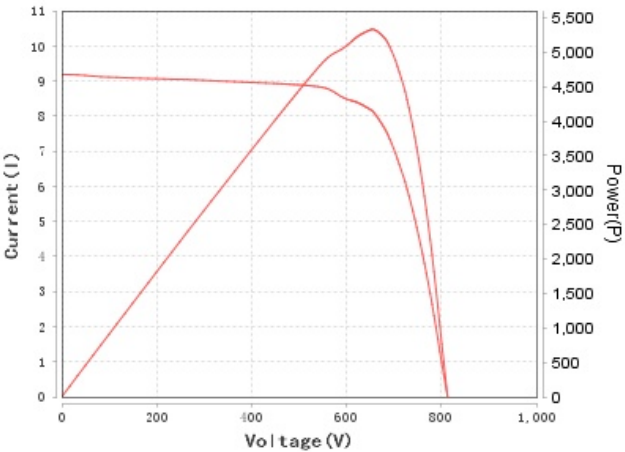
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Isc[A]	9.01	Imp[A]	8.34	Pmax[W]	4998.63
Voc[V]	806.50	Vmp[V]	599.50	PV module output current abnormal (shade/glass breakage/hidden crack)	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV4

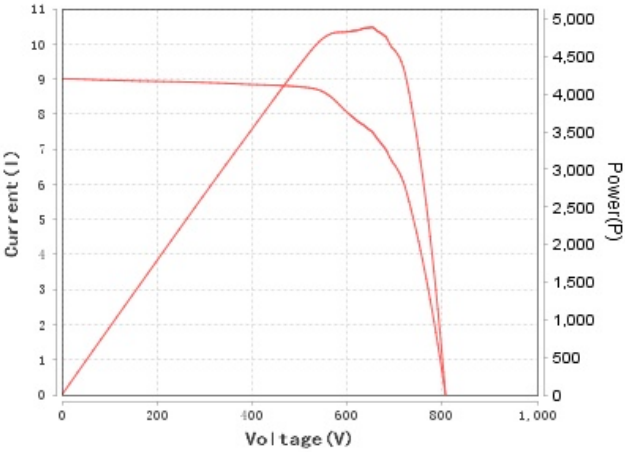
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Isc[A]	9.19	Imp[A]	8.15	Pmax[W]	5333.52
Voc[V]	813.10	Vmp[V]	654.50	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV5

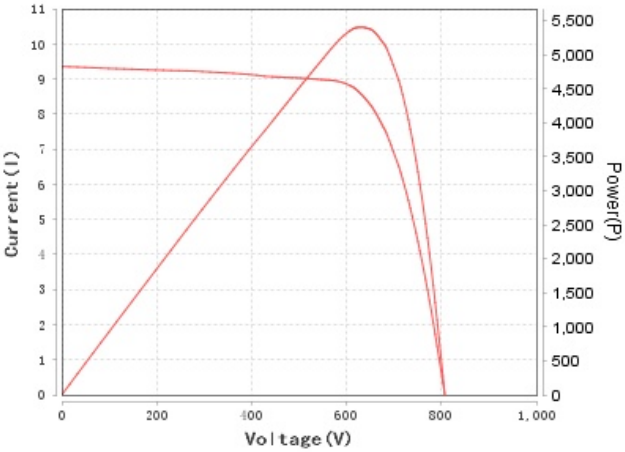
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Isc[A]	9.01	Imp[A]	7.49	Pmax[W]	4894.35
Voc[V]	807.20	Vmp[V]	653.80	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV6

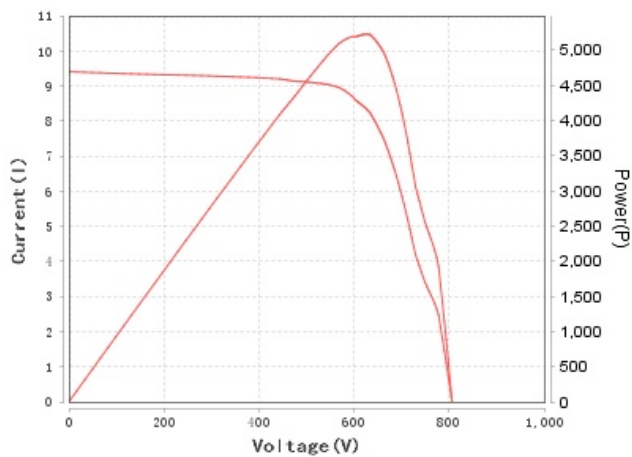
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Isc[A]	9.35	Imp[A]	8.53	Pmax[W]	5406.09
Voc[V]	807.20	Vmp[V]	633.70	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV7

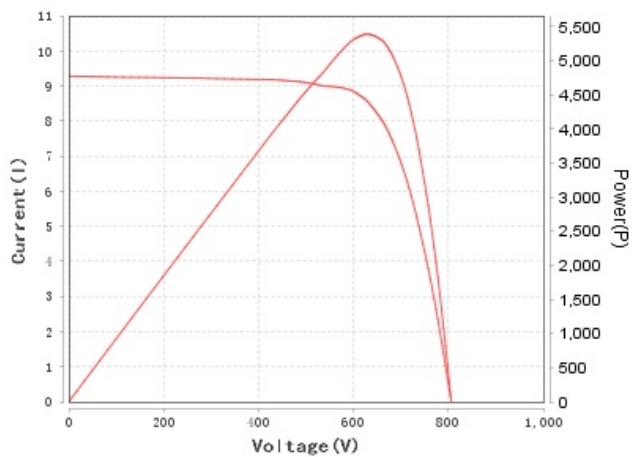
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Isc[A]	9.40	Imp[A]	8.36	Pmax[W]	5224.58
Voc[V]	806.20	Vmp[V]	624.80	PV module output current abnormal (shade/glass breakage/hidden crack)	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10801PV8

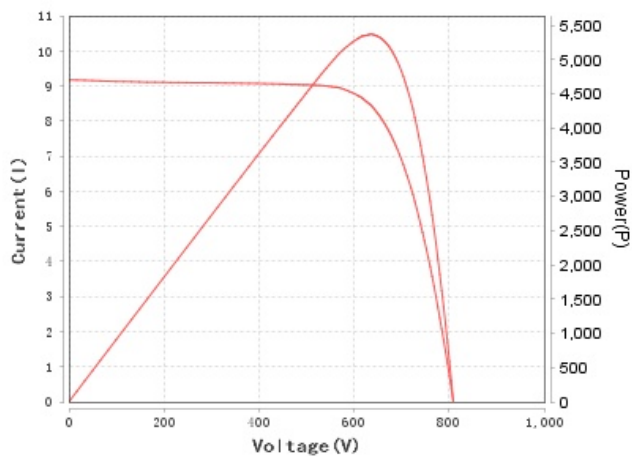
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Isc[A]	9.28	Imp[A]	8.62	Pmax[W]	5387.03
Voc[V]	806.20	Vmp[V]	624.80	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11101PV1

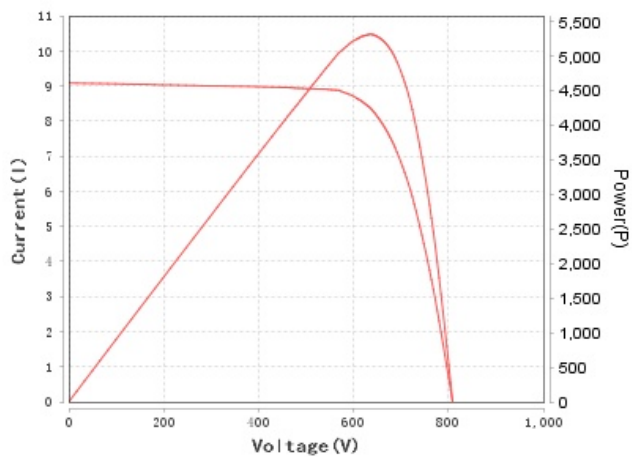
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Isc[A]	9.17	Imp[A]	8.46	Pmax[W]	5372.73
Voc[V]	808.90	Vmp[V]	635.00	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11101PV2

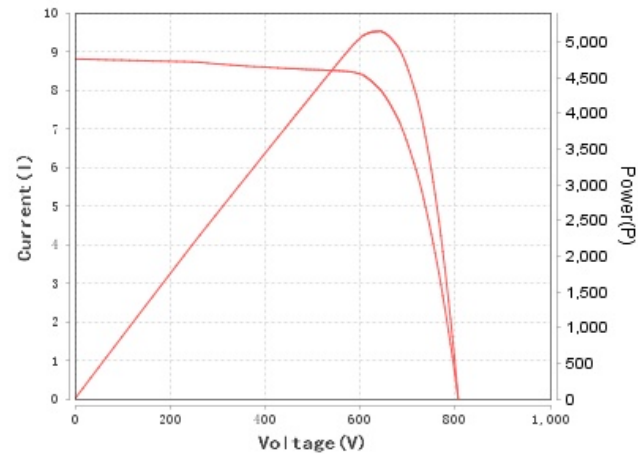
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Isc[A]	9.08	Imp[A]	8.38	Pmax[W]	5321.94
Voc[V]	808.90	Vmp[V]	635.00	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11701PV7

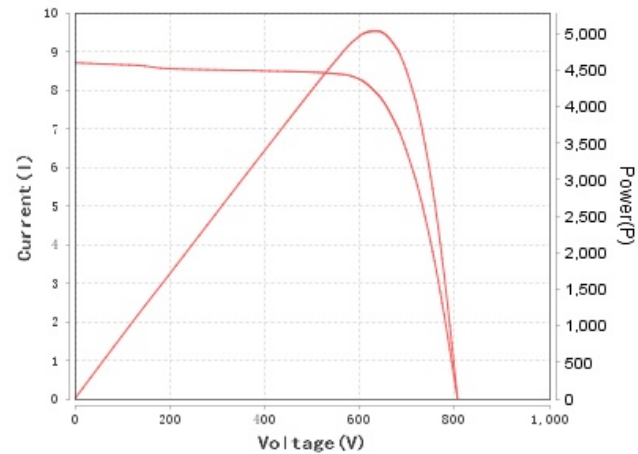
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Isc[A]	8.80	Imp[A]	8.00	Pmax[W]	5148.33
Voc[V]	806.60	Vmp[V]	643.30	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11701PV8

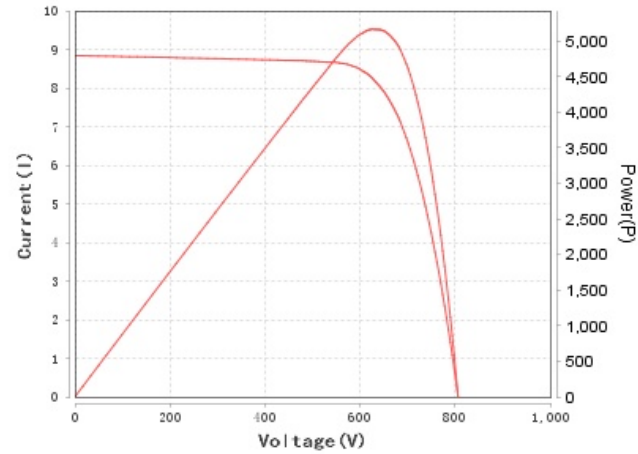
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Isc[A]	8.70	Imp[A]	7.95	Pmax[W]	5034.57
Voc[V]	806.60	Vmp[V]	633.20	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10802PV1

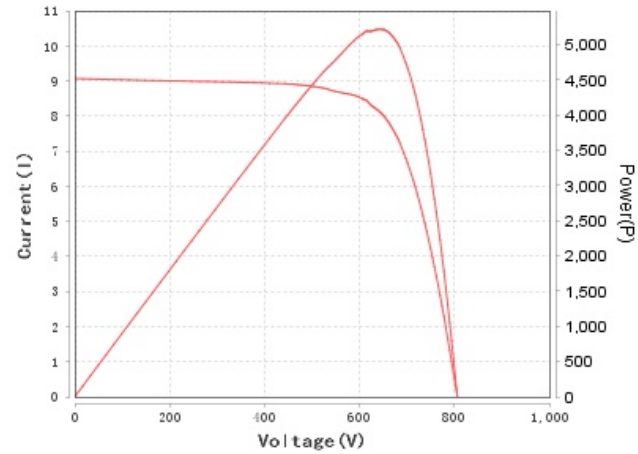
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Isc[A]	8.84	Imp[A]	8.27	Pmax[W]	5166.05
Voc[V]	806.30	Vmp[V]	624.90	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10802PV2

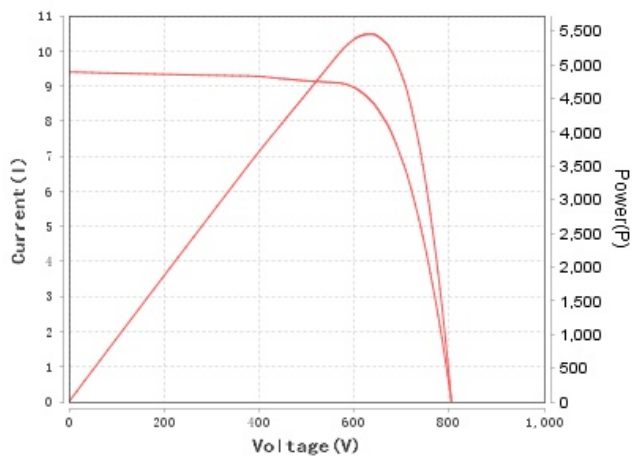
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Isc[A]	9.07	Imp[A]	8.12	Pmax[W]	5218.59
Voc[V]	806.30	Vmp[V]	643.00	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10901PV7

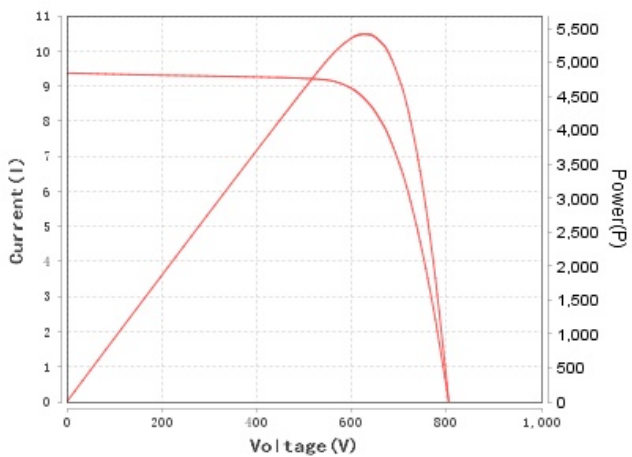
FF=0.72



Isc[A]	9.40	Imp[A]	8.60	Pmax[W]	5452.40
Voc[V]	805.10	Vmp[V]	634.00	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

10901PV8

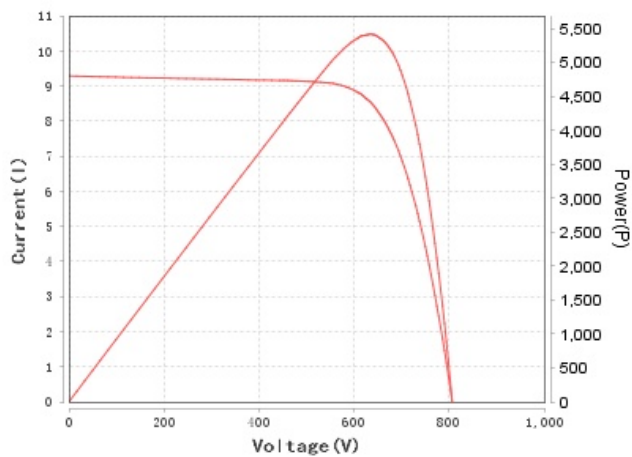
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Isc[A]	9.37	Imp[A]	8.68	Pmax[W]	5416.94
Voc[V]	805.10	Vmp[V]	624.00	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11401PV1

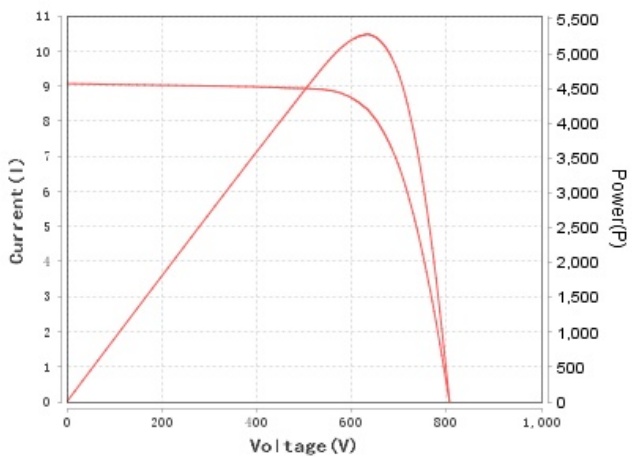
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Isc[A]	9.29	Imp[A]	8.56	Pmax[W]	5419.56
Voc[V]	806.60	Vmp[V]	633.20	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

11401PV2

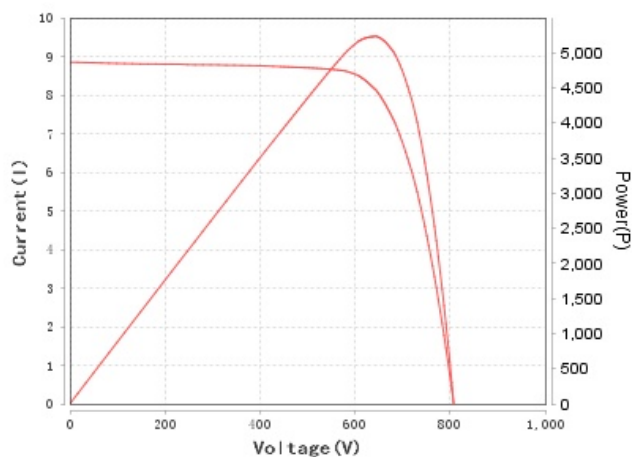
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Isc[A]	9.06	Imp[A]	8.34	Pmax[W]	5280.89
Voc[V]	806.60	Vmp[V]	633.20	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

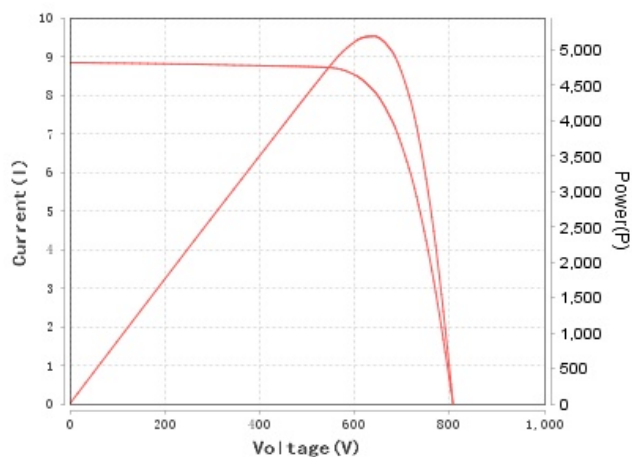
12102PV7

FF=0.73



12102PV8

FF=0.73



Isc[A]	8.85	Imp[A]	8.13	Pmax[W]	5235.24
Voc[V]	807.60	Vmp[V]	644.10	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

Isc[A]	8.84	Imp[A]	8.07	Pmax[W]	5197.24
Voc[V]	807.60	Vmp[V]	644.10	PV string normal	
Irr[W/m²]	967.15	Temp[°C]	64.62		

4. PV String Performance Data Details

Task time:2018-12-22 12:17:32

Note: The irradiance and PV module temperatures used by the STC conversion model are data deduced and converted based on the mathematical model. The data is of referential use only and cannot be used as basis for PV module evaluation.

Inverter	String	Test Data						*STC Conversion						Irr[W/m²]	Temp[°C]	Determination
		Pmax[Wp]	Voc[V]	Isc[A]	FF	Vmp[V]	Imp[A]	Pmax[Wp]	Voc[V]	Isc[A]	FF	Vmp[V]	Imp[A]			
10701	PV1	5199.98	799.70	8.97	0.72	637.80	8.15	6105.92	912.56	9.09	0.74	737.85	8.28	967.15	64.62	✓
	PV2	5110.63	799.70	8.79	0.73	631.80	8.09	6004.24	913.40	8.90	0.74	731.78	8.21	967.15	64.62	✓
	PV3	5240.24	804.30	9.01	0.72	641.40	8.17	6149.45	917.63	9.13	0.73	741.46	8.29	967.15	64.62	✓
	PV4	5221.12	804.30	9.00	0.72	633.40	8.24	6136.82	917.71	9.11	0.73	733.54	8.37	967.15	64.62	✓
	PV5	5325.38	802.90	9.08	0.73	640.30	8.32	6252.09	915.73	9.20	0.74	740.51	8.44	967.15	64.62	✓
	PV6	5318.33	802.90	9.15	0.72	640.30	8.31	6245.66	915.42	9.27	0.74	740.50	8.43	967.15	64.62	✓
	PV7	5508.33	803.90	9.43	0.73	641.10	8.59	6473.97	915.36	9.55	0.74	741.60	8.73	967.15	64.62	✓
	PV8	5351.12	803.90	9.21	0.72	629.10	8.51	6300.29	916.29	9.33	0.74	729.50	8.64	967.15	64.62	✓
12401	PV1	5124.56	814.40	8.67	0.73	649.50	7.89	5995.79	930.73	8.78	0.73	749.28	8.00	967.15	64.62	✓
	PV2	5132.92	814.40	8.83	0.71	631.20	8.13	6032.23	929.98	8.95	0.73	731.22	8.25	967.15	64.62	✓
	PV3	5271.28	811.40	8.85	0.73	647.10	8.15	6174.44	926.47	8.96	0.74	747.14	8.26	967.15	64.62	✓
	PV4	5038.97	811.40	8.68	0.72	647.10	7.79	5899.05	927.26	8.79	0.72	746.77	7.90	967.15	64.62	✓
	PV5	5018.38	806.60	8.56	0.73	643.30	7.80	5876.54	922.33	8.67	0.73	742.98	7.91	967.15	64.62	✓
	PV6	5249.33	806.60	8.98	0.72	643.30	8.16	6156.77	920.42	9.09	0.74	743.35	8.28	967.15	64.62	✓
	PV7	5305.36	809.40	9.05	0.72	645.50	8.22	6221.41	923.27	9.17	0.73	745.61	8.34	967.15	64.62	✓
	PV8	5171.10	809.40	8.76	0.73	645.50	8.01	6057.05	924.62	8.87	0.74	745.40	8.13	967.15	64.62	✓
10502	PV1	5009.19	802.10	8.82	0.71	649.70	7.71	5864.97	915.97	8.94	0.72	749.30	7.83	967.15	64.62	✓
	PV2	5216.75	802.10	9.00	0.72	639.70	8.15	6123.80	915.18	9.11	0.73	739.75	8.28	967.15	64.62	✓
	PV3	5195.52	802.50	8.92	0.73	640.00	8.12	6096.64	915.98	9.04	0.74	740.01	8.24	967.15	64.62	✓
	PV4	5171.32	802.50	8.88	0.73	636.00	8.13	6072.30	916.17	8.99	0.74	736.02	8.25	967.15	64.62	✓
	PV5	5177.39	801.90	8.84	0.73	639.50	8.10	6073.97	915.67	8.95	0.74	739.49	8.21	967.15	64.62	✓
	PV6	5223.77	801.90	9.01	0.72	631.50	8.27	6142.81	914.89	9.13	0.74	731.67	8.40	967.15	64.62	✓
	PV7	5439.41	803.80	9.42	0.72	635.00	8.57	6401.18	915.28	9.54	0.73	735.47	8.70	967.15	64.62	✓
	PV8	5166.88	803.80	8.95	0.72	625.00	8.27	6083.10	917.32	9.07	0.73	725.16	8.39	967.15	64.62	✓
10301	PV1	5221.24	812.50	8.84	0.73	633.80	8.24	6132.40	927.80	8.95	0.74	733.93	8.36	967.15	64.62	✓
	PV2	5065.41	802.40	8.66	0.73	625.90	8.09	5955.65	917.06	8.77	0.74	725.88	8.20	967.15	64.62	✓
	PV3	5247.88	805.20	8.96	0.73	642.10	8.17	6156.05	918.91	9.07	0.74	742.17	8.29	967.15	64.62	✓
	PV4	5166.34	805.20	8.84	0.73	642.10	8.05	6057.89	919.43	8.96	0.74	742.04	8.16	967.15	64.62	✓
	PV5	5173.32	803.10	8.89	0.72	640.50	8.08	6069.33	916.80	9.01	0.73	740.47	8.20	967.15	64.62	✓
	PV6	5225.66	803.10	9.02	0.72	636.50	8.21	6138.68	916.25	9.13	0.73	736.60	8.33	967.15	64.62	✓
	PV7	5346.07	804.30	9.23	0.72	641.40	8.34	6278.70	916.67	9.35	0.73	741.63	8.47	967.15	64.62	✓
	PV8	5316.59	804.30	9.20	0.72	627.40	8.47	6261.63	916.82	9.31	0.73	727.77	8.60	967.15	64.62	✓
10302	PV1	5215.03	813.50	8.80	0.73	636.60	8.19	6120.77	929.08	8.92	0.74	736.68	8.31	967.15	64.62	✓
	PV2	5183.22	804.90	8.87	0.73	635.90	8.15	6086.16	918.95	8.99	0.74	735.94	8.27	967.15	64.62	✓
	PV3	5273.35	808.70	8.92	0.73	644.90	8.18	6181.29	923.08	9.03	0.74	744.97	8.30	967.15	64.62	✓
	PV4	5258.51	808.70	8.94	0.73	644.90	8.15	6164.43	923.00	9.05	0.74	744.95	8.28	967.15	64.62	✓
	PV5	5204.97	807.70	8.82	0.73	644.10	8.08	6099.98	922.38	8.93	0.74	744.07	8.20	967.15	64.62	✓
	PV6	5313.47	807.70	9.13	0.72	640.10	8.30	6239.59	921.00	9.24	0.73	740.30	8.43	967.15	64.62	✓
	PV7	5497.40	807.90	9.40	0.72	636.20	8.64	6467.03	920.03	9.52	0.74	736.74	8.78	967.15	64.62	✓
	PV8	5279.08	807.90	9.05	0.72	634.20	8.32	6205.03	921.57	9.16	0.73	734.42	8.45	967.15	64.62	✓
10202	PV1	5229.51	809.10	8.87	0.73	645.30	8.10	6128.28	923.78	8.98	0.74	745.29	8.22	967.15	64.62	✓
	PV2	5243.06	809.10	8.97	0.72	645.30	8.12	6146.81	923.30	9.08	0.73	745.32	8.25	967.15	64.62	✓

	PV3	5278.44	811.20	8.98	0.72	636.80	8.29	6199.11	925.66	9.09	0.74	736.98	8.41	967.15	64.62	✓	
	PV4	5160.87	811.20	8.93	0.71	626.70	8.23	6073.29	925.87	9.05	0.73	726.83	8.36	967.15	64.62	✓	
	PV5	5363.60	816.10	9.01	0.73	638.60	8.40	6297.11	931.13	9.12	0.74	738.89	8.52	967.15	64.62	✓	
	PV6	5184.21	809.60	8.94	0.72	627.40	8.26	6099.84	924.02	9.05	0.73	727.55	8.38	967.15	64.62	✓	
	PV7	5405.42	808.20	9.22	0.73	644.50	8.39	6343.87	921.16	9.34	0.74	744.79	8.52	967.15	64.62	✓	
	PV8	5339.74	808.20	9.20	0.72	634.40	8.42	6279.60	921.25	9.32	0.73	734.71	8.55	967.15	64.62	✓	
	PV1	5252.91	812.90	8.98	0.72	636.10	8.26	6170.11	927.60	9.09	0.73	736.25	8.38	967.15	64.62	✓	
	PV2	5178.45	803.10	8.93	0.72	626.40	8.27	6094.15	916.65	9.04	0.74	726.56	8.39	967.15	64.62	✓	
10401	PV3	5258.68	806.90	8.94	0.73	643.50	8.17	6166.40	920.94	9.05	0.74	743.56	8.29	967.15	64.62	✓	
	PV4	5168.21	806.90	8.83	0.73	637.50	8.11	6065.57	921.41	8.95	0.74	737.50	8.22	967.15	64.62	✓	
	PV5	5183.65	804.70	8.84	0.73	641.70	8.08	6078.64	918.85	8.96	0.74	741.67	8.20	967.15	64.62	✓	
	PV6	5300.18	804.70	9.24	0.71	629.70	8.42	6240.52	917.07	9.36	0.73	730.02	8.55	967.15	64.62	✓	
	PV7	5425.14	807.60	9.29	0.72	634.00	8.56	6382.52	920.16	9.41	0.74	734.46	8.69	967.15	64.62	✓	
	PV8	5240.46	807.60	9.15	0.71	615.80	8.51	6186.81	920.78	9.27	0.72	716.20	8.64	967.15	64.62	✓	
	PV1	5311.24	810.80	8.95	0.73	628.40	8.45	6247.78	925.35	9.06	0.75	728.74	8.57	967.15	64.62	✓	
	PV2	5093.95	810.80	8.60	0.73	638.50	7.98	5971.66	926.94	8.71	0.74	738.36	8.09	967.15	64.62	✓	
10101	PV3	5229.01	813.30	8.90	0.72	648.60	8.06	6124.58	928.40	9.02	0.73	748.55	8.18	967.15	64.62	✓	
	PV4	5269.06	818.30	8.88	0.73	648.50	8.12	6170.86	934.21	8.99	0.73	748.52	8.24	967.15	64.62	✓	
	PV5	5506.06	812.60	9.37	0.72	648.00	8.50	6460.84	925.51	9.49	0.74	748.40	8.63	967.15	64.62	✓	
	PV6	5177.52	812.60	8.81	0.72	648.00	7.99	6062.80	928.04	8.92	0.73	747.88	8.11	967.15	64.62	✓	
	PV7	5349.00	811.90	9.01	0.73	647.50	8.26	6268.80	926.30	9.13	0.74	747.65	8.38	967.15	64.62	✓	
	PV8	5126.90	811.90	8.70	0.73	647.50	7.92	6001.49	927.76	8.81	0.73	747.30	8.03	967.15	64.62	✓	
	PV1	5197.76	805.20	8.78	0.74	632.10	8.22	6105.60	919.73	8.89	0.75	732.21	8.34	967.15	64.62	✓	
	PV2	5152.93	805.20	8.82	0.73	628.10	8.20	6059.38	919.53	8.93	0.74	728.19	8.32	967.15	64.62	✓	
10201	PV3	5180.19	804.50	8.82	0.73	631.50	8.20	6086.88	918.74	8.93	0.74	731.59	8.32	967.15	64.62	✓	
	PV4	5165.39	804.50	8.99	0.71	619.50	8.34	6089.44	917.98	9.10	0.73	719.73	8.46	967.15	64.62	✓	
	PV5	5220.17	806.40	8.93	0.73	639.10	8.17	6126.70	920.41	9.04	0.74	739.16	8.29	967.15	64.62	✓	
	PV6	5291.12	806.40	9.06	0.72	637.10	8.30	6215.64	919.81	9.18	0.74	737.30	8.43	967.15	64.62	✓	
	PV7	5416.84	809.10	9.26	0.72	637.20	8.50	6367.76	922.01	9.38	0.74	737.60	8.63	967.15	64.62	✓	
	PV8	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!	
	10702	PV1	5132.41	805.20	8.79	0.72	634.10	8.09	6026.95	919.66	8.90	0.74	734.08	8.21	967.15	64.62	✓
		PV2	5156.67	805.20	8.94	0.72	632.10	8.16	6061.56	918.99	9.05	0.73	732.15	8.28	967.15	64.62	✓
PV3		5399.34	809.60	9.22	0.72	645.70	8.36	6335.16	922.76	9.34	0.74	745.96	8.49	967.15	64.62	✓	
PV4		5228.88	809.60	8.96	0.72	645.70	8.10	6129.42	923.92	9.07	0.73	745.69	8.22	967.15	64.62	✓	
PV5		5321.93	806.10	9.10	0.73	642.90	8.28	6245.19	919.30	9.21	0.74	743.07	8.40	967.15	64.62	✓	
PV6		5378.28	811.10	9.06	0.73	644.80	8.34	6307.78	925.15	9.18	0.74	745.04	8.47	967.15	64.62	✓	
PV7		5455.76	807.40	9.30	0.73	643.90	8.47	6405.44	919.91	9.42	0.74	744.27	8.61	967.15	64.62	✓	
PV8		5436.75	807.40	9.37	0.72	627.80	8.66	6406.37	919.62	9.48	0.73	728.36	8.80	967.15	64.62	✓	
10602	PV1	5247.92	802.20	9.11	0.72	629.70	8.33	6175.98	914.79	9.23	0.73	729.93	8.46	967.15	64.62	✓	
	PV2	5131.43	802.20	8.88	0.72	629.70	8.15	6033.66	915.82	9.00	0.73	729.74	8.27	967.15	64.62	✓	
	PV3	5225.36	804.70	9.00	0.72	641.70	8.14	6131.41	918.14	9.12	0.73	741.74	8.27	967.15	64.62	✓	
	PV4	5142.04	804.70	8.87	0.72	631.70	8.14	6043.26	918.72	8.98	0.73	731.73	8.26	967.15	64.62	✓	
	PV5	5165.75	802.20	8.80	0.73	639.80	8.07	6059.04	916.18	8.91	0.74	739.76	8.19	967.15	64.62	✓	
	PV6	5297.51	802.20	9.18	0.72	621.70	8.52	6246.57	914.49	9.30	0.73	722.12	8.65	967.15	64.62	✓	
	PV7	5459.73	806.30	9.36	0.72	635.00	8.60	6423.34	918.40	9.47	0.74	735.50	8.73	967.15	64.62	✓	
	PV8	5314.15	806.30	9.17	0.72	624.90	8.50	6261.42	919.23	9.28	0.73	725.30	8.63	967.15	64.62	✓	
10601	PV1	5288.98	809.60	9.00	0.73	627.40	8.43	6224.41	923.73	9.12	0.74	727.72	8.55	967.15	64.62	✓	
	PV2	5206.45	809.60	9.07	0.71	625.40	8.32	6131.95	923.41	9.19	0.72	725.62	8.45	967.15	64.62	✓	
	PV3	5373.60	809.30	9.15	0.73	645.40	8.33	6303.80	922.71	9.27	0.74	745.62	8.45	967.15	64.62	✓	
	PV4	5292.28	809.30	9.02	0.73	645.40	8.20	6205.39	923.31	9.13	0.74	745.49	8.32	967.15	64.62	✓	
	PV5	5334.13	809.60	8.91	0.74	645.70	8.26	6251.02	924.16	9.02	0.75	745.85	8.38	967.15	64.62	✓	
	PV6	5312.82	809.60	9.07	0.72	645.70	8.23	6230.33	923.42	9.19	0.73	745.82	8.35	967.15	64.62	✓	
	PV7	5404.88	807.70	9.41	0.71	626.00	8.63	6372.60	919.76	9.53	0.73	726.54	8.77	967.15	64.62	✓	
	PV8	5386.73	807.70	9.28	0.72	626.00	8.61	6348.08	920.31	9.40	0.73	726.50	8.74	967.15	64.62	✓	
10501	PV1	5159.05	804.30	8.90	0.72	623.30	8.28	6074.92	918.12	9.02	0.73	723.47	8.40	967.15	64.62	✓	
	PV2	5140.98	804.30	8.86	0.72	623.30	8.25	6052.53	918.33	8.97	0.73	723.44	8.37	967.15	64.62	✓	
	PV3	5130.56	802.70	8.81	0.73	640.20	8.01	6017.53	916.74	8.92	0.74	740.10	8.13	967.15	64.62	✓	
	PV4	5161.05	801.20	8.90	0.72	624.90	8.26	6074.98	914.61	9.01	0.74	725.05	8.38	967.15	64.62	✓	
	PV5	5290.54	806.10	9.09	0.72	638.80	8.28	6213.50	919.34	9.20	0.73	738.98	8.41	967.15	64.62	✓	
	PV6	5167.55	798.80	8.98	0.72	621.10	8.32	6089.77	911.49	9.10	0.73	721.31	8.44	967.15	64.62	✓	
	PV7	5530.02	807.60	9.47	0.72	636.00	8.70	6507.14	919.41	9.59	0.74	736.60	8.83	967.15	64.62	✓	
	PV8	5364.59	807.60	9.23	0.72	625.90	8.57	6320.89	920.43	9.35	0.73	726.37	8.70	967.15	64.62	✓	

	PV7	5362.23	801.30	9.28	0.72	629.00	8.53	6315.08	913.05	9.39	0.74	729.42	8.66	967.15	64.62	√
	PV8	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!
11201	PV1	5412.68	807.80	9.26	0.72	634.10	8.54	6366.85	920.55	9.37	0.74	734.53	8.67	967.15	64.62	√
	PV2	5233.23	807.80	8.96	0.72	634.10	8.25	6149.07	921.88	9.07	0.74	734.24	8.37	967.15	64.62	√
	PV3	5393.74	814.20	9.14	0.72	649.30	8.31	6322.14	928.34	9.26	0.74	749.50	8.44	967.15	64.62	√
	PV4	5076.37	814.90	8.50	0.73	649.90	7.81	5934.75	932.11	8.61	0.74	749.59	7.92	967.15	64.62	√
	PV5	5274.54	806.50	9.11	0.72	627.10	8.41	6210.60	919.70	9.23	0.73	727.41	8.54	967.15	64.62	√
	PV6	5256.11	807.30	9.01	0.72	637.80	8.24	6172.54	921.06	9.13	0.73	737.93	8.36	967.15	64.62	√
	PV7	5563.73	812.60	9.42	0.73	648.00	8.59	6529.45	925.30	9.54	0.74	748.49	8.72	967.15	64.62	√
	PV8	5169.74	812.60	8.66	0.73	648.00	7.98	6049.86	928.75	8.77	0.74	747.86	8.09	967.15	64.62	√
11801	PV1	5031.91	813.40	8.42	0.74	640.60	7.86	5891.85	930.82	8.52	0.74	740.33	7.96	967.15	64.62	√
	PV2	4891.31	813.40	8.29	0.73	650.70	7.52	5712.87	931.42	8.40	0.73	750.10	7.62	967.15	64.62	√
	PV3	3863.64	812.90	8.04	0.59	533.80	7.24	4638.33	932.12	8.14	0.61	632.91	7.33	967.15	64.62	!
	PV4	4713.79	812.90	7.94	0.73	640.20	7.36	5508.89	932.64	8.04	0.73	739.43	7.45	967.15	64.62	√
	PV5	4954.77	813.70	8.31	0.73	644.90	7.68	5794.07	931.66	8.42	0.74	744.46	7.78	967.15	64.62	√
	PV6	5250.07	813.70	8.91	0.72	640.80	8.19	6159.01	928.84	9.02	0.74	740.88	8.31	967.15	64.62	√
	PV7	5262.89	818.50	8.68	0.74	663.00	7.94	6140.99	935.38	8.79	0.75	762.82	8.05	967.15	64.62	√
	PV8	5106.20	818.50	8.54	0.73	652.80	7.82	5967.03	936.05	8.65	0.74	752.50	7.93	967.15	64.62	√
10801	PV1	5224.38	804.40	8.97	0.72	641.50	8.14	6129.74	917.93	9.09	0.73	741.54	8.27	967.15	64.62	√
	PV2	5064.55	804.40	9.26	0.68	661.60	7.66	5927.11	916.67	9.37	0.69	761.16	7.79	967.15	64.62	√
	PV3	4998.63	806.50	9.01	0.69	599.50	8.34	5920.75	920.17	9.12	0.71	699.73	8.46	967.15	64.62	!
	PV4	5333.52	813.10	9.19	0.71	654.50	8.15	6246.60	926.89	9.30	0.72	754.55	8.28	967.15	64.62	√
	PV5	4894.35	807.20	9.01	0.67	653.80	7.49	5731.38	920.96	9.12	0.68	753.19	7.61	967.15	64.62	√
	PV6	5406.09	807.20	9.35	0.72	633.70	8.53	6362.16	919.44	9.47	0.73	734.13	8.67	967.15	64.62	√
	PV7	5224.58	806.20	9.40	0.69	624.80	8.36	6162.34	918.08	9.52	0.70	725.07	8.50	967.15	64.62	!
	PV8	5387.03	806.20	9.28	0.72	624.80	8.62	6349.93	918.63	9.40	0.74	725.32	8.75	967.15	64.62	√
11101	PV1	5372.73	808.90	9.17	0.72	635.00	8.46	6316.73	922.17	9.29	0.74	735.36	8.59	967.15	64.62	√
	PV2	5321.94	808.90	9.08	0.72	635.00	8.38	6255.04	922.56	9.20	0.74	735.28	8.51	967.15	64.62	√
	PV3	5497.48	812.10	9.34	0.73	647.60	8.49	6450.36	925.10	9.45	0.74	747.99	8.62	967.15	64.62	√
	PV4	5256.74	815.70	8.84	0.73	648.50	8.11	6155.46	931.43	8.95	0.74	748.50	8.22	967.15	64.62	√
	PV5	5205.03	812.90	8.71	0.73	642.20	8.11	6099.64	928.83	8.82	0.74	742.19	8.22	967.15	64.62	√
	PV6	5133.77	812.90	8.67	0.73	654.40	7.84	6000.63	929.03	8.78	0.74	754.13	7.96	967.15	64.62	√
	PV7	5219.43	806.90	8.89	0.73	643.50	8.11	6119.30	921.17	9.00	0.74	743.50	8.23	967.15	64.62	√
	PV8	5014.42	806.90	8.62	0.72	653.60	7.67	5861.34	922.40	8.73	0.73	753.16	7.78	967.15	64.62	√
11701	PV1	5135.74	816.30	8.62	0.73	646.90	7.94	6010.70	933.13	8.73	0.74	746.72	8.05	967.15	64.62	√
	PV2	4886.57	807.10	8.59	0.70	637.60	7.66	5730.11	922.77	8.70	0.71	737.15	7.77	967.15	64.62	√
	PV3	5214.51	810.50	8.79	0.73	646.40	8.07	6107.51	925.72	8.90	0.74	746.36	8.18	967.15	64.62	√
	PV4	5080.70	810.50	8.74	0.72	646.40	7.86	5950.18	925.94	8.86	0.73	746.15	7.97	967.15	64.62	√
	PV5	5266.63	807.50	8.98	0.73	644.00	8.18	6176.11	921.44	9.09	0.74	744.07	8.30	967.15	64.62	√
	PV6	5094.68	807.50	8.64	0.73	644.00	7.91	5966.82	922.98	8.75	0.74	743.80	8.02	967.15	64.62	√
	PV7	5148.33	806.60	8.80	0.73	643.30	8.00	6034.34	921.21	8.91	0.73	743.19	8.12	967.15	64.62	√
	PV8	5034.57	806.60	8.70	0.72	633.20	7.95	5911.33	921.67	8.81	0.73	733.04	8.06	967.15	64.62	√
10802	PV1	5166.05	806.30	8.84	0.72	624.90	8.27	6079.42	920.70	8.95	0.74	725.05	8.38	967.15	64.62	√
	PV2	5218.59	806.30	9.07	0.71	643.00	8.12	6123.52	919.67	9.18	0.73	743.01	8.24	967.15	64.62	√
	PV3	5431.25	810.70	9.24	0.72	646.50	8.40	6372.05	923.91	9.36	0.74	746.80	8.53	967.15	64.62	√
	PV4	5322.63	810.70	9.13	0.72	646.50	8.23	6242.30	924.41	9.25	0.73	746.63	8.36	967.15	64.62	√
	PV5	5342.42	810.00	9.06	0.73	646.00	8.27	6264.27	923.92	9.18	0.74	746.16	8.40	967.15	64.62	√
	PV6	5337.47	810.00	9.10	0.72	644.00	8.29	6262.04	923.74	9.22	0.74	744.18	8.41	967.15	64.62	√
	PV7	5398.37	802.90	9.42	0.71	640.30	8.43	6346.17	914.25	9.54	0.73	740.64	8.57	967.15	64.62	√
	PV8	5155.34	802.90	9.21	0.70	612.20	8.42	6092.96	915.17	9.33	0.71	712.52	8.55	967.15	64.62	√
10901	PV1	4830.95	805.30	8.94	0.67	614.00	7.87	5702.39	919.10	9.05	0.69	713.77	7.99	967.15	64.62	!
	PV2	4766.16	805.30	8.94	0.66	632.20	7.54	5604.37	919.12	9.05	0.67	731.64	7.66	967.15	64.62	!
	PV3	5380.02	807.90	9.28	0.72	632.20	8.51	6331.81	920.54	9.40	0.73	732.61	8.64	967.15	64.62	√
	PV4	5316.29	815.40	9.01	0.72	646.20	8.23	6232.29	930.29	9.13	0.73	746.32	8.35	967.15	64.62	√
	PV5	5309.53	815.60	9.01	0.72	646.40	8.21	6224.12	930.52	9.13	0.73	746.51	8.34	967.15	64.62	√
	PV6	5167.96	808.60	8.97	0.71	657.00	7.87	6045.23	922.72	9.09	0.72	756.76	7.99	967.15	64.62	√
	PV7	5452.40	805.10	9.40	0.72	634.00	8.60	6417.10	916.87	9.52	0.74	734.50	8.74	967.15	64.62	√
	PV8	5416.94	805.10	9.37	0.72	624.00	8.68	6388.44	916.98	9.49	0.73	724.58	8.82	967.15	64.62	√
11401	PV1	5419.56	806.60	9.29	0.72	633.20	8.56	6376.90	919.05	9.40	0.74	733.66	8.69	967.15	64.62	√
	PV2	5280.89	806.60	9.06	0.72	633.20	8.34	6208.83	920.02	9.18	0.74	733.43	8.47	967.15	64.62	√
	PV3	5369.34	808.30	9.14	0.73	630.50	8.52	6317.97	921.63	9.26	0.74	730.91	8.64	967.15	64.62	√
	PV4	4876.04	808.30	8.37	0.72	660.80	7.38	5685.90	925.20	8.48	0.72	760.06	7.48	967.15	64.64	

	PV3	5245.56	811.50	8.83	0.73	647.20	8.11	6143.78	926.67	8.94	0.74	747.19	8.22	967.15	64.62	✓
	PV4	5200.90	811.50	8.78	0.73	647.20	8.04	6090.46	926.89	8.90	0.74	747.12	8.15	967.15	64.62	✓
	PV5	5263.54	811.90	8.91	0.73	639.40	8.23	6176.58	926.77	9.02	0.74	739.52	8.35	967.15	64.62	✓
	PV6	5161.51	811.90	8.92	0.71	631.30	8.18	6067.78	926.72	9.03	0.72	731.37	8.30	967.15	64.62	✓
	PV7	5190.85	809.20	8.79	0.73	635.20	8.17	6093.99	924.22	8.91	0.74	735.26	8.29	967.15	64.62	✓
	PV8	4999.50	809.20	8.62	0.72	655.50	7.63	5841.85	925.02	8.73	0.72	755.01	7.74	967.15	64.62	✓
	PV1	5454.35	811.80	9.27	0.72	647.40	8.43	6398.62	925.03	9.39	0.74	747.72	8.56	967.15	64.62	✓
	PV2	5298.32	811.80	9.01	0.72	647.40	8.18	6209.79	926.19	9.13	0.73	747.48	8.31	967.15	64.62	✓
11102	PV3	5557.90	812.60	9.42	0.73	648.00	8.58	6522.51	925.32	9.54	0.74	748.48	8.71	967.15	64.62	✓
	PV4	5061.53	812.60	8.55	0.73	648.00	7.81	5920.91	929.26	8.66	0.74	747.69	7.92	967.15	64.62	✓
	PV5	5216.40	815.20	8.75	0.73	644.00	8.10	6111.72	931.26	8.86	0.74	743.99	8.21	967.15	64.62	✓
	PV6	5147.08	808.50	8.76	0.73	636.70	8.08	6039.96	923.59	8.87	0.74	736.67	8.20	967.15	64.62	✓
	PV7	5141.00	808.00	8.74	0.73	634.30	8.11	6035.32	923.12	8.85	0.74	734.29	8.22	967.15	64.62	✓
	PV8	5017.52	808.00	8.71	0.71	616.10	8.14	5913.29	923.25	8.82	0.73	716.13	8.26	967.15	64.62	✓
	PV1	5245.73	813.20	8.87	0.73	638.40	8.22	6155.96	928.45	8.98	0.74	738.51	8.34	967.15	64.62	✓
	PV2	5163.09	813.20	8.69	0.73	644.50	8.01	6047.19	929.28	8.80	0.74	744.40	8.12	967.15	64.62	✓
12201	PV3	5309.94	809.90	8.96	0.73	645.90	8.22	6223.80	924.27	9.07	0.74	746.01	8.34	967.15	64.62	✓
	PV4	5175.60	809.90	8.75	0.73	645.90	8.01	6061.71	925.21	8.86	0.74	745.80	8.13	967.15	64.62	✓
	PV5	5083.00	805.00	8.73	0.72	631.90	8.04	5970.23	919.73	8.84	0.73	731.83	8.16	967.15	64.62	✓
	PV6	5233.14	812.60	8.82	0.73	644.00	8.13	6132.96	927.99	8.93	0.74	744.01	8.24	967.15	64.62	✓
	PV7	5162.18	804.70	8.82	0.73	637.70	8.10	6057.96	918.96	8.93	0.74	737.68	8.21	967.15	64.62	✓
	PV8	5171.48	810.70	8.75	0.73	642.50	8.05	6061.12	926.12	8.86	0.74	742.44	8.16	967.15	64.62	✓
	PV1	5306.83	819.80	8.88	0.73	645.60	8.22	6218.60	935.92	8.99	0.74	745.71	8.34	967.15	64.62	✓
	PV2	5069.06	819.80	8.63	0.72	672.20	7.54	5904.33	937.08	8.74	0.72	771.63	7.65	967.15	64.62	✓
12202	PV3	5330.82	820.30	8.86	0.73	650.10	8.20	6240.52	936.57	8.98	0.74	750.19	8.32	967.15	64.62	✓
	PV4	5209.27	812.50	8.83	0.73	648.00	8.04	6100.49	927.81	8.94	0.74	747.93	8.16	967.15	64.62	✓
	PV5	5155.10	818.70	8.64	0.73	642.70	8.02	6038.85	935.80	8.75	0.74	742.61	8.13	967.15	64.62	✓
	PV6	5018.26	818.70	8.58	0.71	634.50	7.91	5887.61	936.06	8.69	0.72	734.29	8.02	967.15	64.62	✓
	PV7	5450.49	819.00	9.15	0.73	649.10	8.40	6388.83	933.78	9.27	0.74	749.39	8.53	967.15	64.62	✓
	PV8	5166.69	808.60	8.80	0.73	630.70	8.19	6071.62	923.51	8.91	0.74	730.78	8.31	967.15	64.62	✓
	PV1	5105.77	811.60	8.54	0.74	639.10	7.99	5983.24	928.14	8.65	0.74	738.97	8.10	967.15	64.62	✓
	PV2	5342.24	811.60	9.10	0.72	639.10	8.36	6273.97	925.55	9.22	0.74	739.35	8.49	967.15	64.62	✓
11301	PV3	5341.44	807.50	9.10	0.73	642.00	8.32	6269.31	920.87	9.22	0.74	742.22	8.45	967.15	64.62	✓
	PV4	5397.52	807.50	9.32	0.72	625.80	8.62	6362.05	919.90	9.44	0.73	726.32	8.76	967.15	64.62	✓
	PV5	5157.14	817.40	8.56	0.74	647.80	7.96	6032.88	934.70	8.67	0.74	747.64	8.07	967.15	64.62	✓
	PV6	5279.73	810.20	9.01	0.72	632.00	8.35	6207.63	924.38	9.12	0.74	732.25	8.48	967.15	64.62	✓
	PV7	5388.59	808.50	9.19	0.73	644.80	8.36	6323.08	921.62	9.31	0.74	745.05	8.49	967.15	64.62	✓
	PV8	5319.74	808.50	9.17	0.72	632.70	8.41	6257.57	921.74	9.28	0.73	733.00	8.54	967.15	64.62	✓
	PV1	5221.93	810.40	8.80	0.73	636.20	8.21	6129.36	925.54	8.92	0.74	736.30	8.32	967.15	64.62	✓
	PV2	5189.36	810.40	8.81	0.73	628.10	8.26	6101.82	925.52	8.92	0.74	728.25	8.38	967.15	64.62	✓
10102	PV3	5204.02	809.40	8.88	0.72	645.50	8.06	6098.68	924.05	8.99	0.73	745.45	8.18	967.15	64.62	✓
	PV4	5242.59	809.40	9.05	0.72	643.50	8.15	6150.65	923.26	9.17	0.73	743.54	8.27	967.15	64.62	✓
	PV5	5296.13	805.60	9.17	0.72	642.50	8.24	6217.49	918.40	9.29	0.73	742.64	8.37	967.15	64.62	✓
	PV6	5188.70	805.60	8.99	0.72	628.40	8.26	6105.10	919.23	9.10	0.73	728.55	8.38	967.15	64.62	✓
	PV7	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!
	PV8	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!
	PV1	5142.48	810.80	8.67	0.73	638.50	8.05	6029.99	926.64	8.78	0.74	738.44	8.17	967.15	64.62	✓
	PV2	4908.79	810.80	8.51	0.71	638.50	7.69	5752.81	927.41	8.61	0.72	738.07	7.79	967.15	64.62	!
11602	PV3	5144.81	808.00	8.71	0.73	634.30	8.11	6039.12	923.24	8.82	0.74	734.30	8.22	967.15	64.62	✓
	PV4	5092.30	808.00	8.67	0.73	642.40	7.93	5966.55	923.44	8.78	0.74	742.21	8.04	967.15	64.62	✓
	PV5	5066.78	807.70	8.65	0.73	654.20	7.75	5922.24	923.20	8.76	0.73	753.83	7.86	967.15	64.62	✓
	PV6	5144.78	807.70	8.80	0.72	636.10	8.09	6039.00	922.49	8.91	0.73	736.08	8.20	967.15	64.62	✓
	PV7	5101.78	808.30	8.58	0.74	638.60	7.99	5980.15	924.18	8.69	0.74	738.47	8.10	967.15	64.62	✓
	PV8	5222.81	808.30	8.93	0.72	640.60	8.15	6127.90	922.58	9.04	0.73	740.64	8.27	967.15	64.62	✓
	PV1	5214.88	821.50	8.68	0.73	657.20	7.93	6091.88	938.83	8.79	0.74	757.02	8.05	967.15	64.62	✓
	PV2	5015.45	821.50	8.59	0.71	655.10	7.66	5860.14	939.22	8.70	0.72	754.65	7.77	967.15	64.62	!
11901	PV3	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!
	PV4	4659.74	811.70	8.83	0.65	629.10	7.41	5480.80	926.92	8.94	0.66	728.41	7.52	967.15	64.62	!
	PV5	4988.58	819.70	8.52	0.71	627.10	7.96	5860.47	937.53	8.63	0.72	726.94	8.06	967.15	64.62	!
	PV6	5112.14	819.70	8.59	0.73	664.00	7.70	5962.31	937.17	8.70	0.73	763.58	7.81	967.15	64.62	✓
	PV7	4877.51	813.10	8.79	0.68	604.40	8.07	5765.89	928.71	8.90	0.70	704.36	8.19	967.15	64.62	!
	PV8	5090.12	813.10	8.56	0.73	644.40	7.90	5958.99	929.75	8.67	0.74	744.18	8.01	967.15	64.62	✓
	PV1	5128.34	805.70	8.71	0.73	626.40	8.19	6030.10	920.59	8.83	0.74	726.47	8.30	967.15		

	PV7	5498.30	805.50	9.47	0.72	642.40	8.56	6461.48	917.02	9.59	0.73	742.86	8.70	967.15	64.62	✓
	PV8	5321.07	805.50	9.25	0.71	628.30	8.47	6267.07	917.95	9.37	0.73	728.67	8.60	967.15	64.62	✓
11001	PV1	5290.38	805.90	9.05	0.73	626.60	8.44	6228.22	919.31	9.16	0.74	726.94	8.57	967.15	64.62	✓
	PV2	5233.50	805.90	8.95	0.73	632.60	8.27	6151.15	919.75	9.06	0.74	732.76	8.39	967.15	64.62	✓
	PV3	5244.46	805.00	8.96	0.73	636.00	8.25	6160.02	918.64	9.08	0.74	736.14	8.37	967.15	64.62	✓
	PV4	5304.60	806.00	9.05	0.73	638.80	8.30	6228.92	919.41	9.16	0.74	739.00	8.43	967.15	64.62	✓
	PV5	5476.69	808.80	9.27	0.73	645.00	8.49	6427.84	921.62	9.39	0.74	745.39	8.62	967.15	64.62	✓
	PV6	5335.01	808.80	9.12	0.72	639.00	8.35	6265.93	922.31	9.23	0.74	739.24	8.48	967.15	64.62	✓
	PV7	5528.60	808.40	9.43	0.73	640.70	8.63	6498.12	920.50	9.54	0.74	741.23	8.77	967.15	64.62	✓
	PV8	5170.09	808.40	8.84	0.72	634.60	8.15	6071.68	923.08	8.96	0.73	734.64	8.26	967.15	64.62	✓
11702	PV1	5072.76	814.10	8.75	0.71	659.40	7.69	5925.91	930.03	8.86	0.72	758.98	7.81	967.15	64.62	✓
	PV2	5217.83	814.10	8.86	0.72	659.40	7.91	6097.39	929.53	8.97	0.73	759.20	8.03	967.15	64.62	✓
	PV3	5028.71	809.60	8.51	0.73	645.70	7.79	5884.27	926.03	8.61	0.74	745.37	7.89	967.15	64.62	✓
	PV4	5128.15	809.60	8.72	0.73	645.70	7.94	6005.79	925.02	8.83	0.74	745.53	8.06	967.15	64.62	✓
	PV5	5208.35	819.90	8.82	0.72	666.20	7.82	6077.49	936.33	8.93	0.73	765.91	7.93	967.15	64.62	✓
	PV6	5047.27	807.90	8.68	0.72	630.20	8.01	5929.22	923.29	8.79	0.73	730.09	8.12	967.15	64.62	✓
	PV7	5145.56	806.70	8.76	0.73	633.30	8.12	6042.58	921.51	8.87	0.74	733.31	8.24	967.15	64.62	✓
	PV8	4888.26	806.70	8.46	0.72	645.40	7.57	5719.60	922.95	8.57	0.72	744.86	7.68	967.15	64.62	✓
11601	PV1	4975.15	808.40	8.42	0.73	644.70	7.72	5820.78	925.07	8.53	0.74	744.30	7.82	967.15	64.62	✓
	PV2	4753.14	807.50	8.72	0.68	589.50	8.06	5637.38	922.63	8.83	0.69	689.45	8.18	967.15	64.62	!
	PV3	4765.77	809.20	8.86	0.66	590.70	8.07	5654.03	923.92	8.97	0.68	690.66	8.19	967.15	64.62	!
	PV4	4995.85	809.20	8.77	0.70	635.20	7.87	5865.10	924.35	8.88	0.71	734.95	7.98	967.15	64.62	✓
	PV5	5305.70	811.00	8.89	0.74	646.80	8.20	6216.05	925.82	9.00	0.75	746.89	8.32	967.15	64.62	✓
	PV6	5084.05	811.00	8.81	0.71	626.50	8.12	5980.45	926.19	8.92	0.72	726.50	8.23	967.15	64.62	✓
	PV7	5256.00	809.70	8.98	0.72	645.70	8.14	6161.62	923.94	9.09	0.73	745.73	8.26	967.15	64.62	✓
	PV8	5242.61	809.70	8.97	0.72	655.90	7.99	6133.34	923.99	9.08	0.73	755.79	8.12	967.15	64.62	✓
12101	PV1	5353.48	815.60	9.01	0.73	646.40	8.28	6275.32	930.54	9.12	0.74	746.58	8.41	967.15	64.62	✓
	PV2	5230.52	815.60	8.76	0.73	650.40	8.04	6120.56	931.67	8.87	0.74	750.33	8.16	967.15	64.62	✓
	PV3	5268.41	820.30	8.80	0.73	650.10	8.10	6166.07	936.87	8.91	0.74	750.09	8.22	967.15	64.62	✓
	PV4	5214.67	810.10	8.90	0.72	646.10	8.07	6110.76	924.78	9.01	0.73	746.06	8.19	967.15	64.62	✓
	PV5	5162.89	816.50	8.67	0.73	661.40	7.81	6026.41	933.13	8.78	0.74	761.09	7.92	967.15	64.62	✓
	PV6	5143.05	816.50	8.79	0.72	661.40	7.78	6006.53	932.55	8.91	0.72	761.07	7.89	967.15	64.62	✓
	PV7	5119.16	812.90	8.66	0.73	650.30	7.87	5988.11	929.09	8.77	0.74	750.06	7.98	967.15	64.62	✓
	PV8	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	!
11002	PV1	5228.17	805.80	9.21	0.70	662.80	7.89	6114.83	918.45	9.33	0.71	762.59	8.02	967.15	64.62	✓
	PV2	5255.76	805.80	9.13	0.71	634.60	8.28	6179.33	918.80	9.25	0.73	734.78	8.41	967.15	64.62	✓
	PV3	5281.26	809.20	8.99	0.73	639.30	8.26	6199.48	923.32	9.10	0.74	739.45	8.38	967.15	64.62	✓
	PV4	5329.32	809.20	9.18	0.72	629.20	8.47	6273.75	922.48	9.30	0.73	729.57	8.60	967.15	64.62	✓
	PV5	5403.83	810.90	9.20	0.72	646.70	8.36	6338.61	924.33	9.31	0.74	746.95	8.49	967.15	64.62	✓
	PV6	5361.33	810.90	9.15	0.72	644.70	8.32	6290.22	924.56	9.26	0.73	744.91	8.44	967.15	64.62	✓
	PV7	5410.10	807.00	9.25	0.72	643.60	8.41	6351.24	919.66	9.37	0.74	743.91	8.54	967.15	64.62	✓
	PV8	5258.05	807.00	9.03	0.72	633.50	8.30	6180.70	920.65	9.14	0.73	733.69	8.42	967.15	64.62	✓
12301	PV1	5083.79	817.70	8.51	0.73	654.20	7.77	5938.53	935.28	8.62	0.74	753.85	7.88	967.15	64.62	✓
	PV2	5152.53	817.70	8.68	0.73	641.90	8.03	6037.84	934.47	8.79	0.74	741.81	8.14	967.15	64.62	✓
	PV3	5362.80	818.50	9.00	0.73	648.70	8.27	6282.99	933.91	9.11	0.74	748.86	8.39	967.15	64.62	✓
	PV4	5176.75	811.10	8.80	0.73	632.70	8.18	6080.85	926.36	8.91	0.74	732.77	8.30	967.15	64.62	✓
	PV5	5078.54	813.30	8.50	0.73	648.60	7.83	5938.85	930.28	8.61	0.74	748.31	7.94	967.15	64.62	✓
	PV6	5262.68	813.30	9.02	0.72	646.60	8.14	6169.23	927.89	9.13	0.73	746.63	8.26	967.15	64.62	✓
	PV7	5257.50	810.80	8.91	0.73	646.60	8.13	6160.62	925.49	9.03	0.74	746.62	8.25	967.15	64.62	✓
	PV8	5310.53	810.80	8.94	0.73	646.60	8.21	6223.11	925.39	9.05	0.74	746.70	8.33	967.15	64.62	✓
11202	PV1	5226.11	815.00	8.77	0.73	668.30	7.82	6094.52	930.95	8.88	0.74	768.01	7.94	967.15	64.62	✓
	PV2	5060.59	815.00	8.43	0.74	641.80	7.88	5924.24	932.58	8.54	0.74	741.56	7.99	967.15	64.62	✓
	PV3	5035.25	811.10	8.57	0.72	657.00	7.66	5880.46	927.42	8.68	0.73	756.55	7.77	967.15	64.62	✓
	PV4	5147.72	811.10	8.74	0.73	636.70	8.09	6040.33	926.63	8.85	0.74	736.67	8.20	967.15	64.62	✓
	PV5	5126.26	815.50	8.55	0.74	660.60	7.76	5981.46	932.58	8.66	0.74	760.24	7.87	967.15	64.62	✓
	PV6	5111.91	815.50	8.53	0.73	642.20	7.96	5986.33	932.65	8.64	0.74	742.04	8.07	967.15	64.62	✓
	PV7	5346.11	813.60	8.97	0.73	648.80	8.24	6262.69	928.44	9.08	0.74	748.93	8.36	967.15	64.62	✓
	PV8	5065.18	813.60	8.56	0.73	648.80	7.81	5924.45	930.36	8.67	0.73	748.49	7.92	967.15	64.62	✓
11802	PV1	5211.44	811.70	8.91	0.72	649.40	8.03	6103.41	926.52	9.03	0.73	749.32	8.15	967.15	64.62	✓
	PV2	5099.51	811.70	8.74	0.72	637.20	8.00	5983.18	927.34	8.85	0.73	737.09	8.12	967.15	64.62	✓
	PV3	5116.36	814.00	8.80	0.71	632.90	8.08	6009.78	929.69	8.91	0.73	732.87	8.20	967.15	64.62	✓
	PV4	5178.97	819.40	8.68	0.73	641.20	8.08	6069.50	936.43	8.79	0.74	741.16	8.19	967.15</		

	PV3	5123.39	806.30	8.71	0.73	637.00	8.04	6010.58	921.31	8.82	0.74	736.93	8.16	967.15	64.62	✓
	PV4	5081.77	806.30	8.73	0.72	653.10	7.78	5943.20	921.19	8.84	0.73	752.77	7.90	967.15	64.62	✓
	PV5	5062.59	807.80	8.55	0.73	650.30	7.79	5919.50	923.75	8.66	0.74	749.97	7.89	967.15	64.62	✓
	PV6	5052.54	807.80	8.60	0.73	636.10	7.94	5926.04	923.55	8.71	0.74	735.93	8.05	967.15	64.62	✓
	PV7	5118.02	807.70	8.63	0.73	644.10	7.95	5993.66	923.26	8.74	0.74	743.93	8.06	967.15	64.62	✓
	PV8	4991.27	808.40	8.52	0.72	644.70	7.74	5842.21	924.58	8.63	0.73	744.33	7.85	967.15	64.62	✓
	PV1	5329.71	807.30	9.16	0.72	635.70	8.38	6265.27	920.38	9.28	0.73	735.98	8.51	967.15	64.62	✓
	PV2	5373.57	807.30	9.35	0.71	635.70	8.45	6321.27	919.57	9.47	0.73	736.05	8.59	967.15	64.62	✓
11502	PV3	5292.08	805.80	9.05	0.73	638.60	8.29	6214.46	919.19	9.16	0.74	738.78	8.41	967.15	64.62	✓
	PV4	5220.22	805.80	8.97	0.72	634.60	8.23	6133.67	919.52	9.09	0.73	734.72	8.35	967.15	64.62	✓
	PV5	5142.05	806.80	8.81	0.72	643.40	7.99	6027.09	921.40	8.92	0.73	743.28	8.11	967.15	64.62	✓
	PV6	5180.66	806.80	8.87	0.72	643.40	8.05	6073.81	921.11	8.99	0.73	743.34	8.17	967.15	64.62	✓
	PV7	5209.19	804.70	9.19	0.70	651.80	7.99	6104.94	917.32	9.30	0.72	751.69	8.12	967.15	64.62	✓
	PV8	5033.39	804.70	8.70	0.72	631.70	7.97	5911.58	919.54	8.81	0.73	731.55	8.08	967.15	64.62	✓
	PV1	5345.51	821.60	8.99	0.72	647.00	8.26	6264.69	937.49	9.10	0.73	747.15	8.38	967.15	64.62	✓
	PV2	4808.63	782.00	8.65	0.71	610.00	7.88	5674.24	893.78	8.76	0.72	709.77	7.99	967.15	64.62	!
12002	PV3	5316.05	824.60	8.87	0.73	643.20	8.27	6232.18	941.44	8.98	0.74	743.35	8.38	967.15	64.62	✓
	PV4	5072.20	815.50	8.66	0.72	662.60	7.66	5919.44	932.02	8.78	0.72	762.14	7.77	967.15	64.62	✓
	PV5	5058.54	823.40	8.55	0.73	650.70	7.77	5914.24	930.17	8.66	0.73	750.36	7.88	967.15	64.62	✓
	PV6	5204.79	814.20	8.78	0.73	649.30	8.02	6092.33	930.00	8.89	0.74	749.20	8.13	967.15	64.62	✓
	PV7	4963.34	791.50	8.70	0.72	623.30	7.96	5840.17	904.43	8.81	0.73	723.15	8.08	967.15	64.62	!
	PV8	5188.45	822.40	8.74	0.72	641.50	8.09	6081.98	939.53	8.86	0.73	741.47	8.20	967.15	64.62	✓
	PV1	5235.05	820.50	8.79	0.73	654.30	8.00	6121.95	937.12	8.91	0.73	754.19	8.12	967.15	64.62	✓
	PV2	5103.51	820.50	8.66	0.72	656.40	7.78	5962.74	937.77	8.77	0.73	756.06	7.89	967.15	64.62	✓
12001	PV3	5202.35	821.60	8.78	0.72	642.90	8.12	6118.29	938.47	8.89	0.73	742.91	8.24	967.15	64.62	✓
	PV4	5150.12	814.70	8.70	0.73	641.60	8.03	6035.96	930.94	8.81	0.74	741.51	8.14	967.15	64.62	✓
	PV5	5130.86	821.70	8.63	0.72	647.10	7.93	6004.92	939.27	8.74	0.73	746.91	8.04	967.15	64.62	✓
	PV6	5196.77	821.70	8.71	0.73	645.00	8.06	6086.58	938.87	8.83	0.73	744.94	8.17	967.15	64.62	✓
	PV7	5231.23	814.50	8.84	0.73	649.60	8.05	6124.45	930.04	8.96	0.74	749.54	8.17	967.15	64.62	✓
	PV8	5268.26	814.50	8.93	0.72	649.60	8.11	6169.77	929.66	9.04	0.73	749.60	8.23	967.15	64.62	✓
	PV1	5206.55	812.80	9.00	0.71	627.90	8.29	6126.99	927.39	9.11	0.72	728.08	8.42	967.15	64.62	✓
	PV2	5268.66	812.80	8.93	0.73	640.10	8.23	6182.26	927.70	9.05	0.74	740.22	8.35	967.15	64.62	✓
12501	PV3	5303.19	810.70	9.02	0.73	638.40	8.31	6227.01	924.91	9.13	0.74	738.60	8.43	967.15	64.62	✓
	PV4	5176.15	810.70	8.80	0.73	638.40	8.11	6072.83	925.91	8.91	0.74	738.40	8.22	967.15	64.62	✓
	PV5	5289.90	808.60	9.03	0.72	636.80	8.31	6213.85	922.45	9.15	0.74	737.00	8.43	967.15	64.62	✓
	PV6	5096.31	808.60	8.59	0.73	636.80	8.00	5976.28	924.47	8.70	0.74	736.69	8.11	967.15	64.62	✓
	PV7	5249.08	810.30	9.04	0.72	646.20	8.12	6154.46	924.36	9.15	0.73	746.22	8.25	967.15	64.62	✓
	PV8	5200.31	815.70	8.89	0.72	644.40	8.07	6095.94	931.19	9.00	0.73	744.36	8.19	967.15	64.62	✓
	PV1	5139.40	820.30	8.78	0.71	654.20	7.86	6010.19	936.98	8.89	0.72	753.95	7.97	967.15	64.62	!
	PV2	5102.11	820.30	8.55	0.73	654.20	7.80	5960.81	938.07	8.66	0.73	753.88	7.91	967.15	64.62	✓
12102	PV3	5167.45	817.10	8.68	0.73	661.90	7.81	6031.22	933.80	8.79	0.74	761.59	7.92	967.15	64.62	✓
	PV4	5324.96	817.10	8.93	0.73	643.50	8.28	6243.69	932.61	9.04	0.74	743.67	8.40	967.15	64.62	✓
	PV5	5323.09	822.90	8.87	0.73	652.10	8.16	6229.07	939.53	8.98	0.74	752.15	8.28	967.15	64.62	✓
	PV6	5060.75	816.20	8.58	0.72	653.00	7.75	5914.84	933.24	8.69	0.73	752.63	7.86	967.15	64.62	✓
	PV7	5235.24	807.60	8.85	0.73	644.10	8.13	6136.08	922.13	8.96	0.74	744.12	8.25	967.15	64.62	✓
	PV8	5197.24	807.60	8.84	0.73	644.10	8.07	6091.42	922.18	8.95	0.74	744.06	8.19	967.15	64.62	✓

Asia 49MW Smartlogger01 PV string O&M report

Inspection Plant:_____

Inspection On:_____

Inspection By:_____

Owner Company

1. Information of Task

Task name	CASE2 Plant 49MW	Creation Time	2018-12-22 12:17:32
Cleaning status	Uncleaned	Task type	PV plant level diagnosis
Total number of strings	392	Number of faulty strings	22
Irradiance(W/m ²)	967.15(Predictive value)	Temperature Of Panel(°C)	64.62(Predictive value)

2. Overview on Diagnosis

NO.	Inverter	Inverter (SN)	String	Voc[V]	Isc[A]	Defective type	Locate	Position of Faulty PV Module
1	10201	XX730246THB900XXX	PV8	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
2	11402	XX730246THB900XXX	PV6	802.70	9.37	PV module output current abnormal (shade/glass breakage/hidden crack)		
3			PV8	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
4	11801	XX730246THB900XXX	PV3	812.90	8.04	PV module output current abnormal (shade/glass breakage/hidden crack)		
5	10801	XX730246THB901XXX	PV3	806.50	9.01	PV module output current abnormal (shade/glass breakage/hidden crack)		
6			PV7	806.20	9.40	PV module output current abnormal (shade/glass breakage/hidden crack)		
7	10901	XX730246THB901XXX	PV1	805.30	8.94	PV module output current abnormal (shade/glass breakage/hidden crack)		
8			PV2	805.30	8.94	Current mismatch in the PV string (shade/dust/PV module current inconsistent)		
9	10102	XX730246THB901XXX	PV7	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
10			PV8	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
11	11602	XX730246THB901XXX	PV2	810.80	8.51	Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)		
12	11901	XXX730246THB901XXX	PV2	821.50	8.59	PV module output current abnormal (shade/glass breakage/hidden crack)		
13			PV3	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
14			PV4	811.70	8.83	PV module output current abnormal (shade/glass breakage/hidden crack)		
15			PV5	819.70	8.52	PV module output current abnormal (shade/glass breakage/hidden crack)		
16			PV7	813.10	8.79	PV module output current abnormal (shade/glass breakage/hidden crack)		
17	11601	XX730246THB9020XXX	PV2	807.50	8.72	PV module output current abnormal (shade/glass breakage/hidden crack)		
18			PV3	809.20	8.86	PV module output current abnormal (shade/glass breakage/hidden crack)		
19	12101	XX730246THB901XXX	PV8	-	-	PV string open circuit (PV string breakage/PV string configured by mistake)		
20	12002	XX730246THB901XXX	PV2	782.00	8.65	PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)		
21			PV7	791.50	8.70	PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)		
22	12102	XX730246TJB900XXX	PV1	820.30	8.78	PV module output current abnormal (shade/glass breakage/hidden crack)		

3. Following advise

NO.	Description	Following advise
1	PV string open circuit (PV string breakage/PV string configured by mistake)	Step 1: Check if the strings are connected correctly, if connections are loose, or not connected. Step 2: If the strings are connected to inverter, then switch off the inverter and pull off the connector between strings and inverter; then measure Voc of the strings with a multimeter and check whether the Voc is within correct parameters. Step 3: If the Voc is within correct parameters, then check whether the connector between string and inverter is broken; if everything is ok, then check if there is a broken circuit inside of inverter. Step 4: If the Voc is abnormal, then check if there is a broken circuit in strings.
2	PV module output current abnormal (shade/glass breakage/hidden crack)	Step 1: Observe the PV string for shade. If there is shade, eliminate the shade and measure again. Step 2: If there is no shadow on panel, check if there are foreign matters or dirt on the surface of the panel; if yes, then measure again after removing the foreign matters. Step 3: If there is no shadow on the surface of panel, please check if there is broken glass; if yes, please measure again after replacing with same model of PV module. Step 4: If no PV module has a broken glass panel, check whether the PV string has been cleaned. If not, clean the PV string and then measure again after the PV module surface is dry. Step 5: If the PV string has been cleaned, scan the PV string using an infrared thermal imager to locate the abnormal PV module. Step 6: If there is no fault, please identify the module with abnormal current by IV tester.
3	Current mismatch in the PV string (shade/dust/PV module current inconsistent)	Step 1: Please check if the scanning is done at a sunny day, current mismatch may occur when the irradiance changes dramatically. Step 2: Check if there is shadow; if yes, please measure again after removing the shadow. Step 3: If no, please check string was cleaned. Step 4: If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. Step 5: If string was cleaned, please check if there are panels with low Isc or from other power class by IV testing of each panel.
4	Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)	Step 1: Please check if the scan was done in a sunny day, the rapid change of irradiance may induce IV curve become abnormal. Step 2: Please check if the string was cleaned. Step 3: If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. Step 4: Scan the PV string using an infrared thermal imager to locate the abnormal PV module. Step 5: If no abnormal temperature was found, please use IV test to identify the module with abnormal output current.
5	PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)	Step 1: Check whether the number of PV modules connected to the PV string is correct. Step 2: Observe whether there are traces of burning at the interconnection strip, backsheet, and wiring box. If so, replace the PV module with the same model. Step 3: If none of the above exists, please use IR camera to check if there is short circuited diode or broken ribbon for interconnection. Step 4: If there is no abnormal found on the module with IR camera, please use voltage meter to check the voltage of the strings (from same MPPT), to see if it is too low. And if yes, please measure the temperature of panels in string to check whether there is abnormal temperature distribution.



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HUAWEI TECHNOLOGIES DÜSSELDORF GMBH

Südwestpark 60, 90449 Nürnberg, Germany

Hotline: +80 03 38 88 888

Email: eu_inverter_support@huawei.com

HUAWEI TECHNOLOGIES CO.,LTD

Huawei Industrial Base Bantian Longgang Shenzhen 518129, P.R.China

Tel.: 400-822-9999 Version No.: 01-(20181112)

solar.huawei.com