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**Technical Report No. 88.216.18.091.01 part 2 of 2**
**Rev. 00**
**Dated 2018-05-23**

| | |
|---|---|
| Client: | Boson Robotics Ltd |
| Manufacturing place: | #921, Ziyu Villa, No.1, Purple Jade East Road, Chaoyang District, Beijing |
| Test subject: | Product: Mono Crystalline Silicon Photovoltaic (PV) Modules<br>Type: DS-M250(96) |
| Test specification: | IEC60904-1：2006 |
| Purpose of examination: | • According to the visual inspection test, EL test and IV character under outdoor condition of PV module, find the Influence of cleaning robot operation on photovoltaic modules |
| Test result: | The test results show that the presented product is in compliance with the specified requirements. |





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## 1 Description of the test subject

### 1.1 Function

Manufacturer's specification for intended use: The product is used to absorb sunlight and then transfer into electricity while its front surface faces to the sun.

*(no restrictions provided)*

### 1.2 Consideration of the foreseeable misuse

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

### 1.3 Technical Data

| | |
|---|---|
| Model: | CSUN270-60M |
| Crystalline type: | Poly silicon |
| Voc [V] | 38.3 |
| Vmp [V] | 31.2 |
| Isc [Adc] | 9.07 |
| Imax [Adc] | 8.65 |
| Rated output power at STC | 270W |
| Max. System voltage | 1000VDC |



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| No. | Manufacturer serial No. | Module type | Modulue size (mm) |
|---|---|---|---|
| 1 | CAAL216000189D | CSUN270-60M | 1580×1060×40 |
| 2 | CAAL216011616 | CSUN270-60M | 1580×1060×40 |
| 3 | CAAC217007891 | CSUN270-60M | 1580×1060×40 |
| 4 | CAAC217007948 | CSUN270-60M | 1580×1060×40 |
| 5 | CAAL216000465D | CSUN270-60M | 1580×1060×40 |

## 2 Order

### 2.1 Date of Purchase Order, Customer's Reference

2018-04-29

### 2.2 Receipt of Test Sample, Location

N/A

### 2.3 Date of Testing

2018-5-9~2018-5-10

### 2.4 Location of Testing

NO.40 Ailing Road Xiwang community, Jiangning district Nanjing City

### 2.5 Points of Non-compliance or Exceptions of the Test Procedure

None

## 3 Test Results

### 3.1 Test chart

After installing (as below photo), do the Visual inspection, IV and EL test before and after 5000 times cleaning. Comparing the test data before and after cleaning, to confirm whether cleaning 5000 times has adverse effects on PV module.



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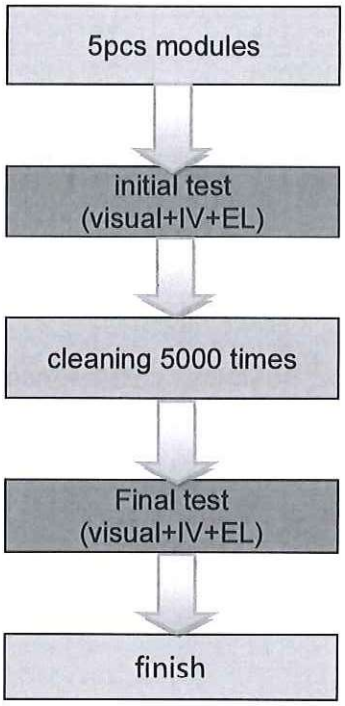
Remark: cleaning from left to right is one time, from right to left is second times, the cleaning is automatic, after cleaning do visual inspection, IV and EL test. Visual inspection is done under 1000Lux.









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### 3.2 Positive Test Results

| 10.1 | TABLE: Visual inspection (before 5000 cleaning) | P |
|---|---|---|
| Test Date [MM/DD/YYYY].....: | 5/9/2018 | — |
| Sample No. | Nature and position of initial findings – comments or attach photos | Verdict |
| CAAL216000189D | No defect | P |
| CAAL216011616 | No defect | P |
| CAAC217007891 | No defect | P |
| CAAC217007948 | No defect | P |
| CAAL216000465D | No defect | P |
| Supplementary information: N/A | | |

| 10.1 | TABLE: Visual inspection (after 5000 cleaning) | P |
|---|---|---|
| Test Date [MM/DD/YYYY].....: | 5/10/2018 | — |
| Sample No. | Nature and position of initial findings – comments or attach photos | Verdict |
| CAAL216000189D | No defect | P |
| CAAL216011616 | No defect | P |
| CAAC217007891 | No defect | P |
| CAAC217007948 | No defect | P |
| CAAL216000465D | No defect | P |
| Supplementary information: N/A | | |

| 10.2 | | TABLE: I-V characteristic at STC | | | | | | — |
|---|---|---|---|---|---|---|---|---|
| | Test Date [MM/DD/YYYY].....: | | 5/9/2018 | | | | | — |
| | Radiant Source.....: | | ☐ Solar simulator<br>☒ Natural Sunlight | | | | | |
| | Module temperature [°C] | | : | 25 | | | | — |
| | Irradiance [W/m²] | | : | 1000 | | | | — |
| Sample No. | Test condition | Voc [V] | Vmp [V] | Isc [A] | Imp [A] | Pmp [W] | Difference(%) | |





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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CAAL216000189D | before | 37.93 | 31.58 | 8.91 | 8.34 | 263.37 | 1.63 |
| | after | 37.75 | 31.05 | 9.25 | 8.62 | 267.65 | |
| CAAL216011616 | Before | 38.35 | 31.72 | 8.93 | 8.31 | 263.51 | 0.73 |
| | after | 38.32 | 31.47 | 8.96 | 8.44 | 265.44 | |
| CAAC217007891 | Before | 38.10 | 31.36 | 9.16 | 8.50 | 266.51 | 0.40 |
| | after | 38.17 | 31.19 | 9.22 | 8.58 | 267.57 | |
| CAAC217007948 | Before | 37.92 | 31.19 | 8.86 | 8.39 | 261.49 | 0.37 |
| | after | 38.37 | 31.36 | 8.95 | 8.37 | 262.47 | |
| CAAL216000465D | Before | 38.19 | 31.41 | 8.93 | 8.36 | 262.70 | 0.63 |
| | after | 37.97 | 31.65 | 9.04 | 8.35 | 264.35 | |
| Supplementary information: the test data is corrected to STC | | | | | | | |

### 3.3 EL test

| No. | Serial number | Before/ after cleaning | crack or not? |
|---|---|---|---|
| 1 | CAAL216000189D | Before | No crack |
| | | After | No crack |
| 2 | CAAL216011616 | Before | No crack |
| | | After | No crack |
| 3 | CAAC217007891 | Before | No crack |
| | | After | No crack |
| 4 | CAAC217007948 | Before | No crack |
| | | After | No crack |
| 5 | CAAL216000465D | Before | No crack |
| | | After | No crack |



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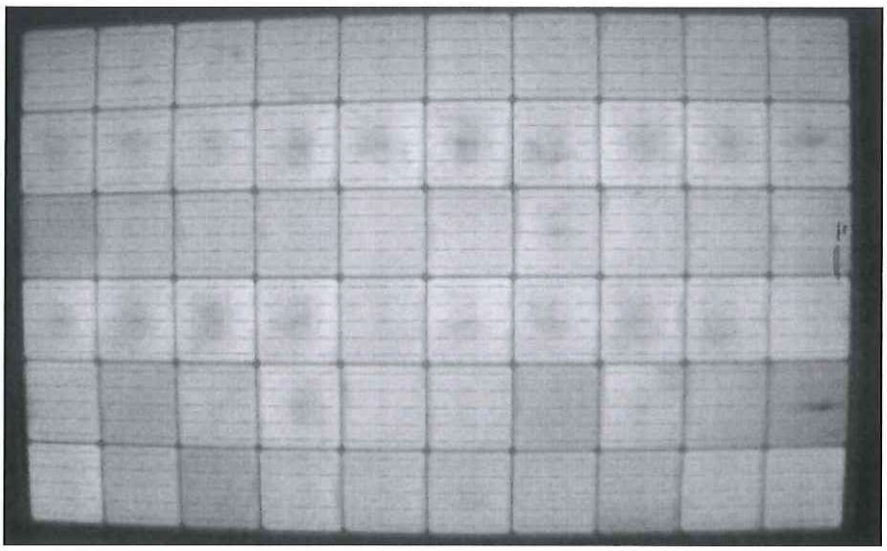
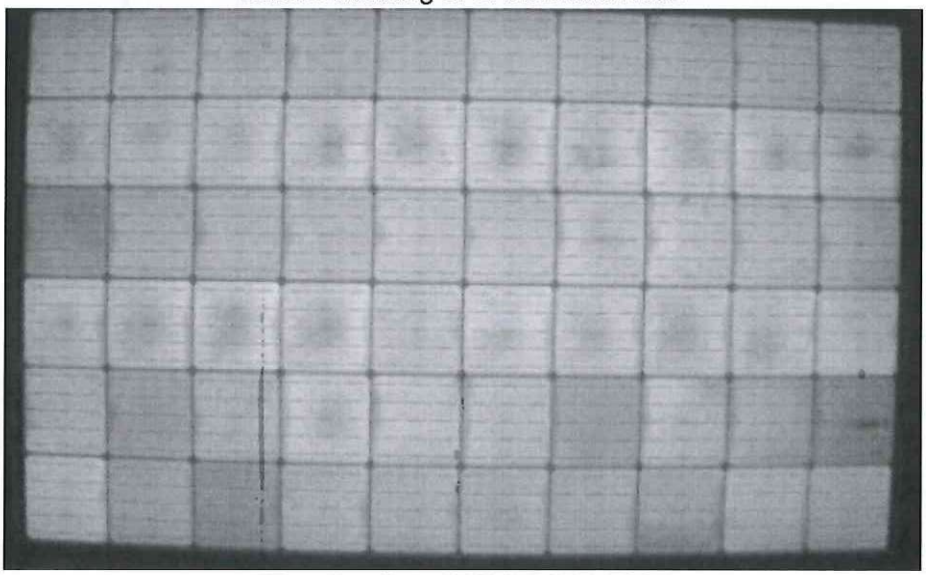
**EL picture**



Before cleaning of CAAL216000189D



After cleaning of CAAL216000189D





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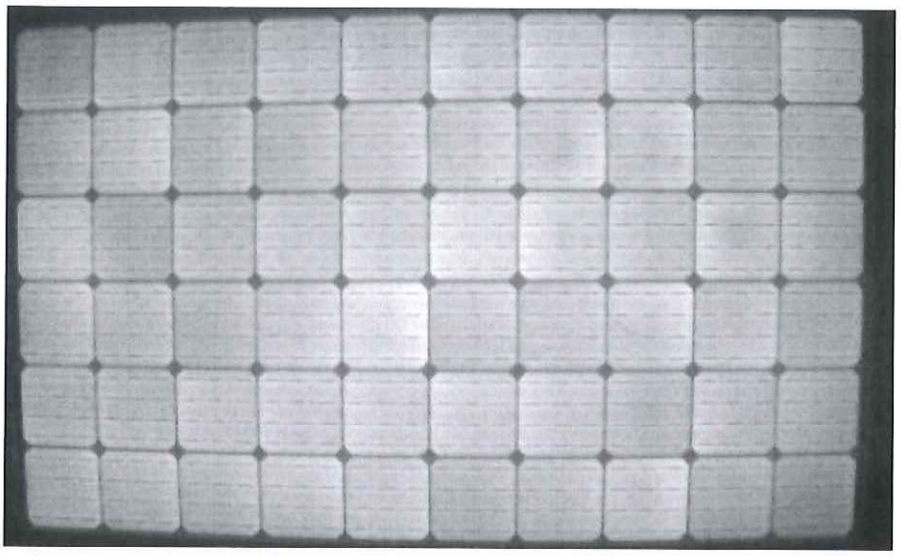
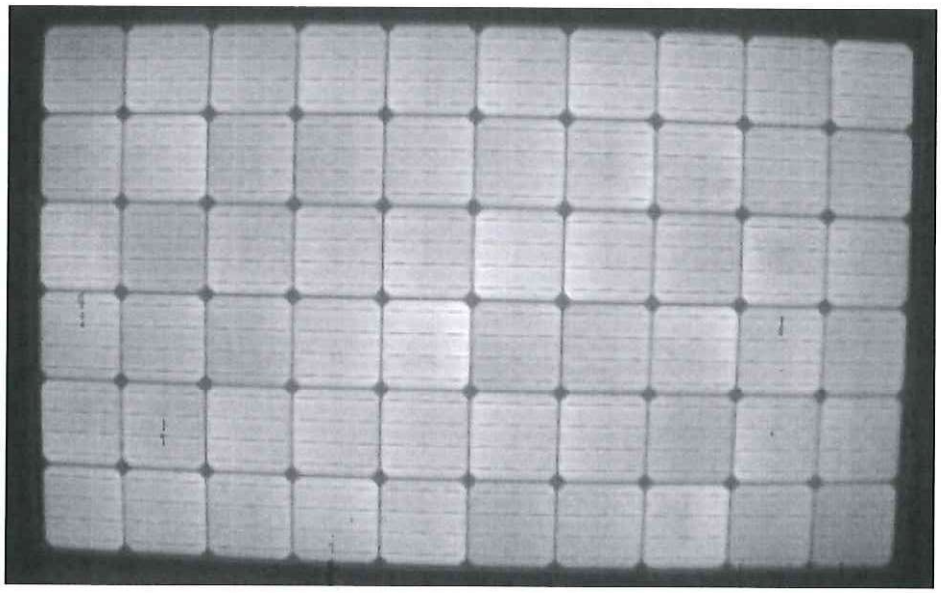


Before cleaning of CAAL216011616



After cleaning of CAAL216011616





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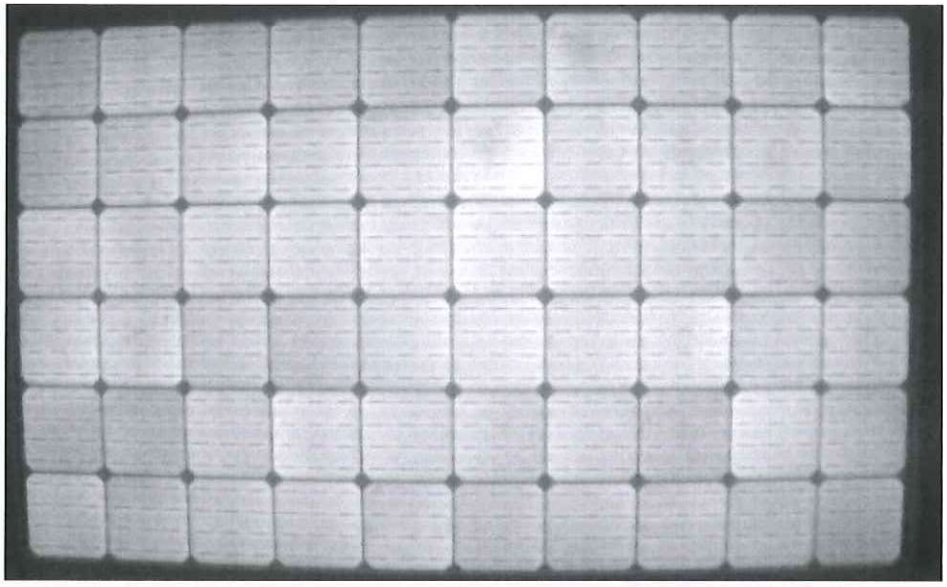
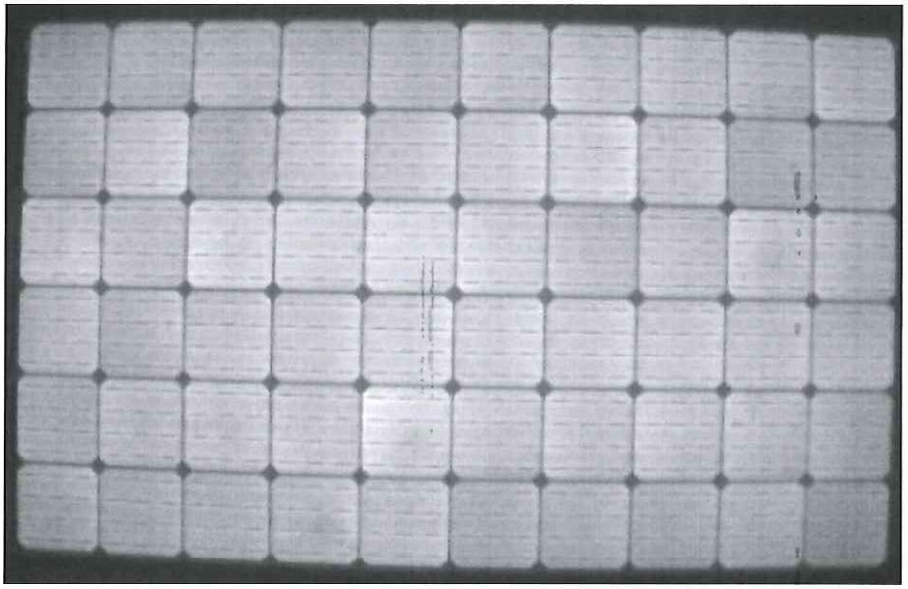


Before cleaning of CAAC217007891



After cleaning of CAAC217007891





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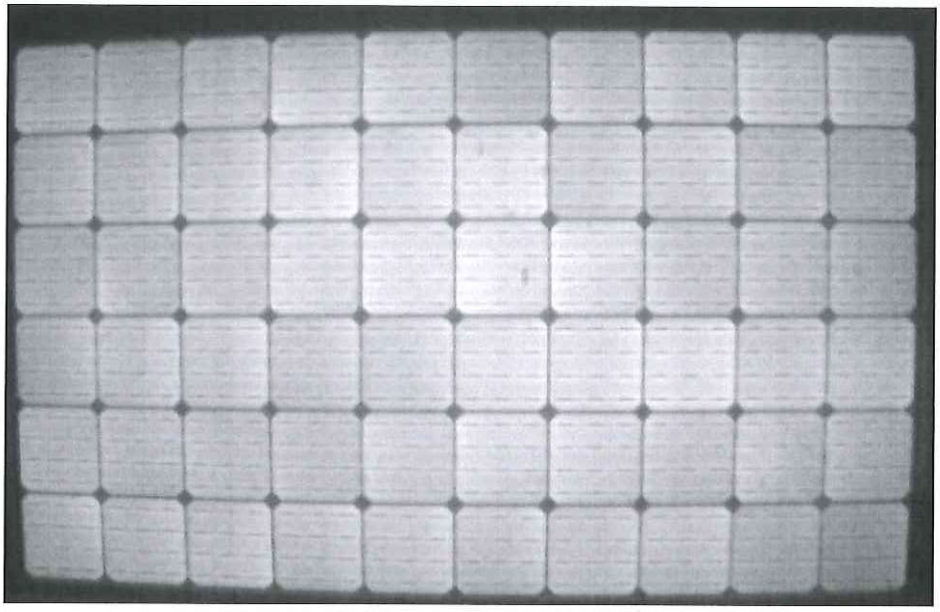
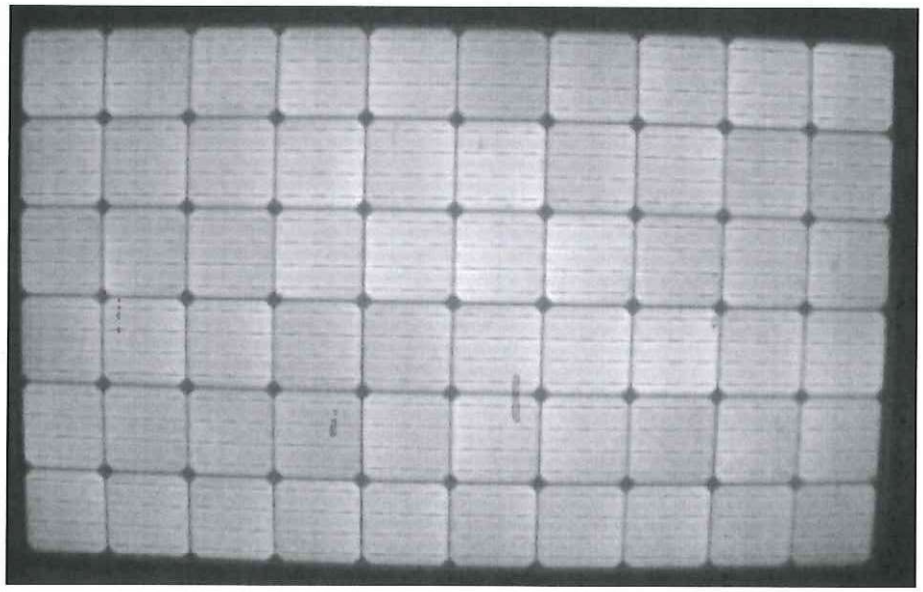


Before cleaning of CAAC217007948



After cleaning of CAAC217007948





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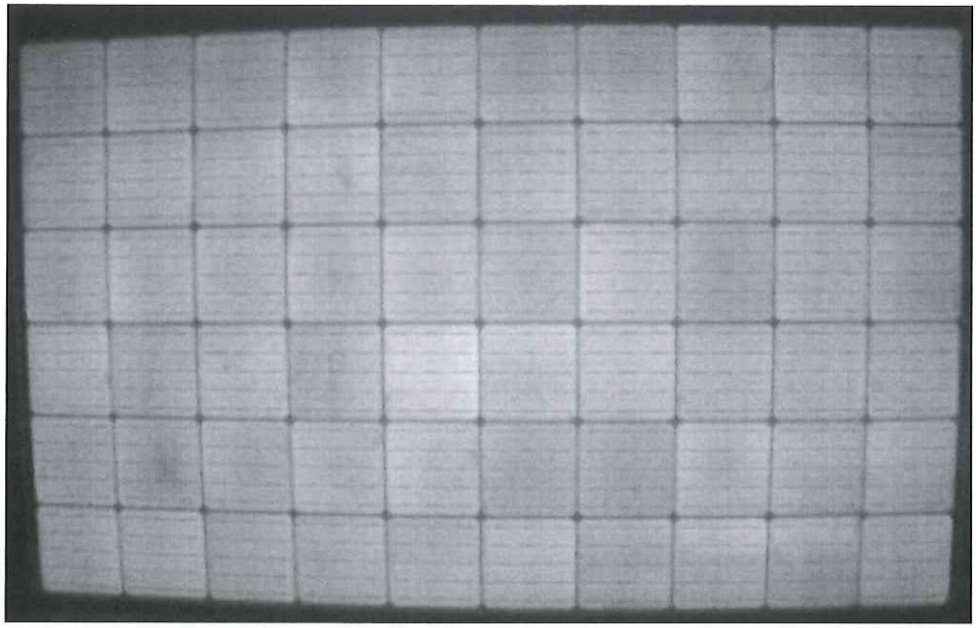
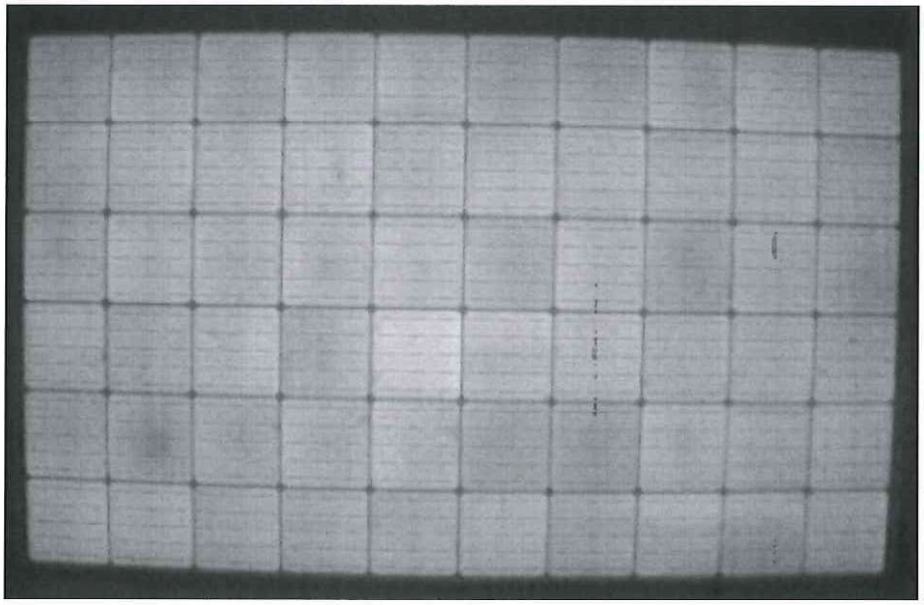


Before cleaning of CAAL216000465D



After cleaning of CAAL216000465D



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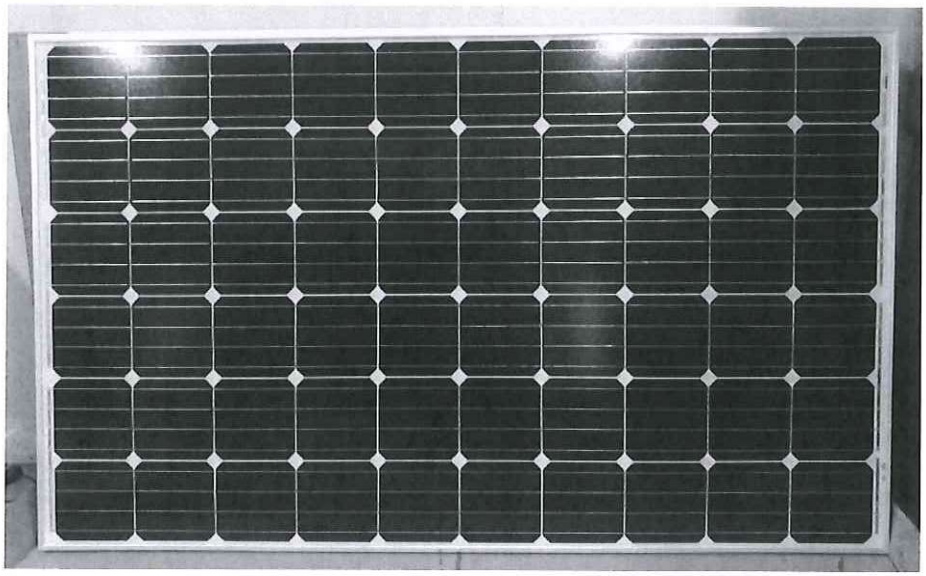
### 3.4 Picture of test site and test sample





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## 4 Remark

Test Equipment information

| No. | equimpent | type | Serial No. | Effective date |
|---|---|---|---|---|
| 1 | IV tester | GMC SOZ-03 | BJPV011729 | 2019-05-05 |
| 2 | EL tester | WIFI EL | BJPV001622 | N/A |

## 4.1 Remarks to Factory

N/A

## 5 Documentation

N/A

## 6 Summary

Using the cleaning equipment to clean 5 pcs modules, do the test before and after 5000 times cleaning (Visual, IV, EL), comparing the test data before and after cleaning, there is no visual defects, no adding new cracks, IV parameter is also OK.

**TÜV SÜD Certification and Testing (China) Co., Ltd.**
**TÜV SÜD Group**

**Engineer:** fangzhaogang
**Fang Zhaogang**
**Project Handler**

**Technical Report checked:** liyuqing
**Li Yuqing**
**Designated Reviewer**



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