| | | REC P | Peak Energy 72 Series | | REC Solar Pte. Ltd. |
|----------------------|--|---|--|--|---|
| 🔍 REC | | Panel Appearance Specification - Q2 | | | Document No.: SGM-QD-MQS-Q2-002-01 |
| Orig Jane 11.0 | inator / Date: e Smile Rosales)3.15 | Prepared by / Date: Jane Smile Rosales 18.12.15 | Reviewed by / Date: Neil Edwards 18.12.15 | | Approved By / Date: Teck Cheng Tan 18.12.15 |
| S/N | Product Area | Product Characteristics / Tolerance | Quality Demand / Tolerance Parameter | Illustration | Additional Information |
| 1 | Glass | Contamination (non-removable), scratches or unevenness on glass which can not be removed by advised cleaning method. | Visible at a distance equal to B4 is permitted | Not applicable | See Appendix 1 |
| 2 | Glass | Frame tape on glass | Permitted | The second secon | |
| 3 | Glass | Residual sealant on front which cannot be removed by advised cleaning method | Permitted | 1 | |
| 4 | Ribbon | Misaligned ribbon | Permitted | | |
| 5 | Ribbon | Placement of ribbon on cell | Ribbon shall be soldered on each cell, independent of position. | | |
| 6 | Ribbon / Cross-connector | Interconnection of ribbon and cross connector | Ribbon shall have min. 1 mm distance to another conducting surface and shall be placed at least 1 mm from frame. | | |
| 7 | Ribbon / Cross-connector | Placement of ribbon at the end of cross-connector | No demand | Not applicable | |
| 8 | Cross connector | Cross-connector alignment | The cross-connector may be bent away from a straight line without any maximum limit but a minimum distance of 1 mm is required between the cross connector and another conducting surface. | ≥1 mm | |
| 9 | Cross-connector / Cell | Distance between cross- connectors | Min. 1 mm | | |
| 10 | Cross-connector / Cell | Distance between cross-connector and cell | No demand | | |
| 11 | Cell / String | String alignment | No demand | | |
| 12 | Cell / String | Distance between cells in one string | No demand | * | |

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| 13 | Cell / String | Distance between cells in two different strings | Min. 1 mm | | |
| 14 | Cell / Lamination | Distance between cell and frame or between cross connector and frame | Min. 8.4 mm security distance between cell or cross connector and edge of glass | + | |
| 15 | Cell | Cell finger width | No demand, however min. Wp per module shall be 300 W | • | |
| 16 | Cell | Cell paste spot | No demand, however min. Wp per module shall be 300 W | • | |
| 17 | Cell | Broken cell finger | No demand, however min. Wp per module shall be 300 W | | |
| 18 | Cell | Cracked / broken cells | Visible crack is not allowed. | | |
| 19 | Cell | Corner chip | Damaged corners of max. 5 mm x 5 mm are permitted on an unlimited number of cells. | | |
| 20 | Cell | Edge chip | Damage to cell edges is permitted on an unlimited number of cells. Damage may not exceed a max. length of 20 mm and depth of 4 mm. | | |
| 21 | Contamination Conductive | Conductive parts in laminate (e.g. cell pieces, ribbon parts): Distance for isolation | A visible gap between conductive part and rest of panel/between the two parts. | | |
| 22 | Contamination | Non-conductive particles in the laminate, maximum size and count | See attached table | | See Appendix 2 |
| 23 | Conductive Contamination | Non conductive foreign objects (e.g. hair) | Permitted | | |

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| S/N | Product Area | Product Characteristics / Tolerance | Quality Demand / Tolerance Parameter | Illustration | Additional Information |
| 24 | Bubbles | Bubbles on front side or rear of panel | Bubbles allowed on front and rear. Total area must not exceed 4 cm ² . | | |
| 25 | Frame | A gap at the frame joints. | Permitted | | |
| 26 | Frame | Sharpness of frame corners | The corners shall be have frame corners filed smooth. | Not applicable | |
| 27 | Frame | Alignment of frame corners | No demand | | |
| 28 | Frame | Defects on the front and side of the frame, i.e. visible surfaces for a mounted module | Visible at a distance equal to B4 is permitted | Not applicable | See Appendix 1 |
| 29 | Frame | Defects on rear and the inner sides of the frame, i.e. non-visible surfaces for a mounted module | Visible at a distance equal to B6 is permitted | Not applicable | See Appendix 1 |
| 30 | Frame (sealant) | Discontinuous overflow on backsheet | Discontinous length max. 10 cm from each frame corner | | |
| 31 | Frame (sealant) | Residual sealant on backsheet which cannot be removed by advised cleaning method | Permitted | 7 | |
| 32 | Power | Power output | According to watt class tolerance as set out in product specifications. | Not applicable | |
| 33 | Assembly | Module dimensions | Length = 1968 ± 2.5 mm, Width = 991 mm ± 2.5 mm. | Not applicable | |



Quality Specification

Appendix 1 - Visual Judgement

Place the test scheme at the maximum distance where both lines in the relevant section (e.g., B4) can be read. Place the panel at the same distance: If the defect can be seen, the module shall not be classified as Q2

| B1 | qeryuiopadaxcvnmjunhybgtvfrcdexswzaqlpaghioseyhkaeqpaoacvbnygrgokreediöwsxvuiopadaxcvnmjunhybgtvfrcdexswzaql qazwsxedcrfvtgbyhnujmikdolzpllkjhgfdsapoiuytrewmnbvcxzplknjiuhhbvgytfvcxdresawqxdfrtjihunh | |
|------------|--|--|
| B2 | aplokimjunhybgtvfrcdexswaqzqwertyuiopaasdfghjklozxcvbnmokmuhbtfce aqzswxdecfrvgtbhynjumkilopljgdawryiambczxvnhnujmrfvgwerapom | |
| B 3 | oplmkoijnbhuygvcftrdxzsewsaqqetuoaaljgdazxbnkjhygf plokijuhygtfrdeswaqzxczvbnmljygfdertiuytaaplk | |
| B4 | iuytrehgfsamnbvcokmtcyhdijokwsxda azsxdcfvgbhnjmkolpoaijuhy | |
| | xrfvgyhnjiklordesa | |
| | | |
| B5 | wsrdeugtfyijuhn | |
| B5 | wsrdeugtfyijuhn vyjmplaastgij | |

By using a contemplating distance for visual judgements the result will not be depending on the variation of visual acuity between different people or the variation in lightning.

To find your contemplating distance you should be able to read the lower line of letters but not the upper line. The levels for the contemplating distances are shown in the left column.

Contemplating distance = B





Appendix 2 - Contamination

Size and count of foreign object in the laminate

| | Module Quality |
|---------------------|----------------|
| Maximum Area | Q2 |
| >50 mm ² | |
| 50 mm ² | ≤ 3 |
| 30 mm ² | ≤ 5 |
| 20 mm ² | ≤ 7 |
| 10 mm ² | ≤ 9 |
| 5 mm ² | ≤ 10 |
| 1 mm ² | > 10 |

Measurement Method:

1. Measure the biggest particle and find the corresponding row in the table

2. Count the number of particles and find module quality Q2 in the column