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BRE Test Report

Weathertightness Testing of Renusol PV Systems to MCS012

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1 Introduction

At the request of Nico Schwarze, TUV Rheinland Solar GmBH, BRE issued Proposal P123168 issue 4 on 29th June 2022. This was accepted on 10th August 2022. The tests on the specimens were carried out under the BRE Standard Terms and Conditions of Business under BRE project P123168-1000.

The MCS 012 standard specifies the test procedures which shall be used to demonstrate the performance of PV modules and solar thermal collectors and/or their installation kits under the action of wind loads. These test methods apply to 'in roof' and 'above roof' systems fixed to pitched roofs. They do not apply to systems mounted inclined above flat roofs or mounted on vertical walls.

This report describes the test methods and results for weathertightness testing carried out on three Renusol PV mounting brackets to the MCS 012 test method [1]. Testing was completed during week beginning 24th October 2022.

2 Details of the Test Specimen and Installation

Four Renusol PV mounting systems were tested for weathertightness. Renusol representatives installed the specimens for the weathertightness testing.

2.1 RH1 Roof Hook

Table 1 outlines the components tested and the configuration parameters. The RH1 roof hook was installed as per the Renusol installation manual. Figure 1 shows the specimen installed on the BRE test rig prior to test.

Parameter	Product Number	Product Number
Roof Hook	RH1 Roof Hook	R420171
Fixings	3 x Sparibo 6.0mm x 80mm Sit 30 Pan Head Wood Construction Screw	R900318
Tile Type	Double Roman	
Batten Gauge, mm	345mm	
Headlap, mm	75mm, single lap	
Sidelap, mm	35mm side interlock	
Roof Pitch, °	22.5°	
Roofing Fixing Strategy	2.65mm nails	

Table 1. Configuration parameters for RH1 roof hook weathertightness test.

Note. The installation of the RH1 roof hook meant a notch had to be cut out of the tile, Figure 2. This did not create a larger unprotected gap relative to the surrounding reference tiles.

Figure 1.RH1 roof hook installed on the BRE test rig prior to test.

Figure 2. Close up of installation of RH1 roof hook with notch cut out of tile.

2.2 RH Flat Roof Hook

Table 2 outlines the components tested and the configuration parameters. The RH flat roof hook was installed as per the Renusol installation manual.

Parameter	Product Number	Product Number
Roof Hook	RH Flat Roof Hook	R420172
Fixings	2 x Sparibo 6.0mm x 80mm Sit 30 Pan Head Wood Construction Screw	R900318
Tile Type	Plain tiles	
Batten Gauge, mm	100mm	
Headlap, mm	65mm, double lap	
Sidelap, mm	N/A	
Roof Pitch, °	35°	
Roofing Fixing Strategy	2.65mm nails	

Table 2. Configuration parameters for RH flat roof hook weathertightness test.

Please note. The installation of the RH flat roof hook meant that a slot must be cut into the tile, Figure 3, with a flexible flashing added to provide a weathertight seal, Figure 4. Figure 5 shows the specimen installed on the BRE test rig prior to test. Note, two RH flat roof brackets were installed. One without the flexible flashing, left hook, and one with the flexible flashing, right hook.

Figure 3.Slot cut out of tiles to accommodate the RH flat roof hook.

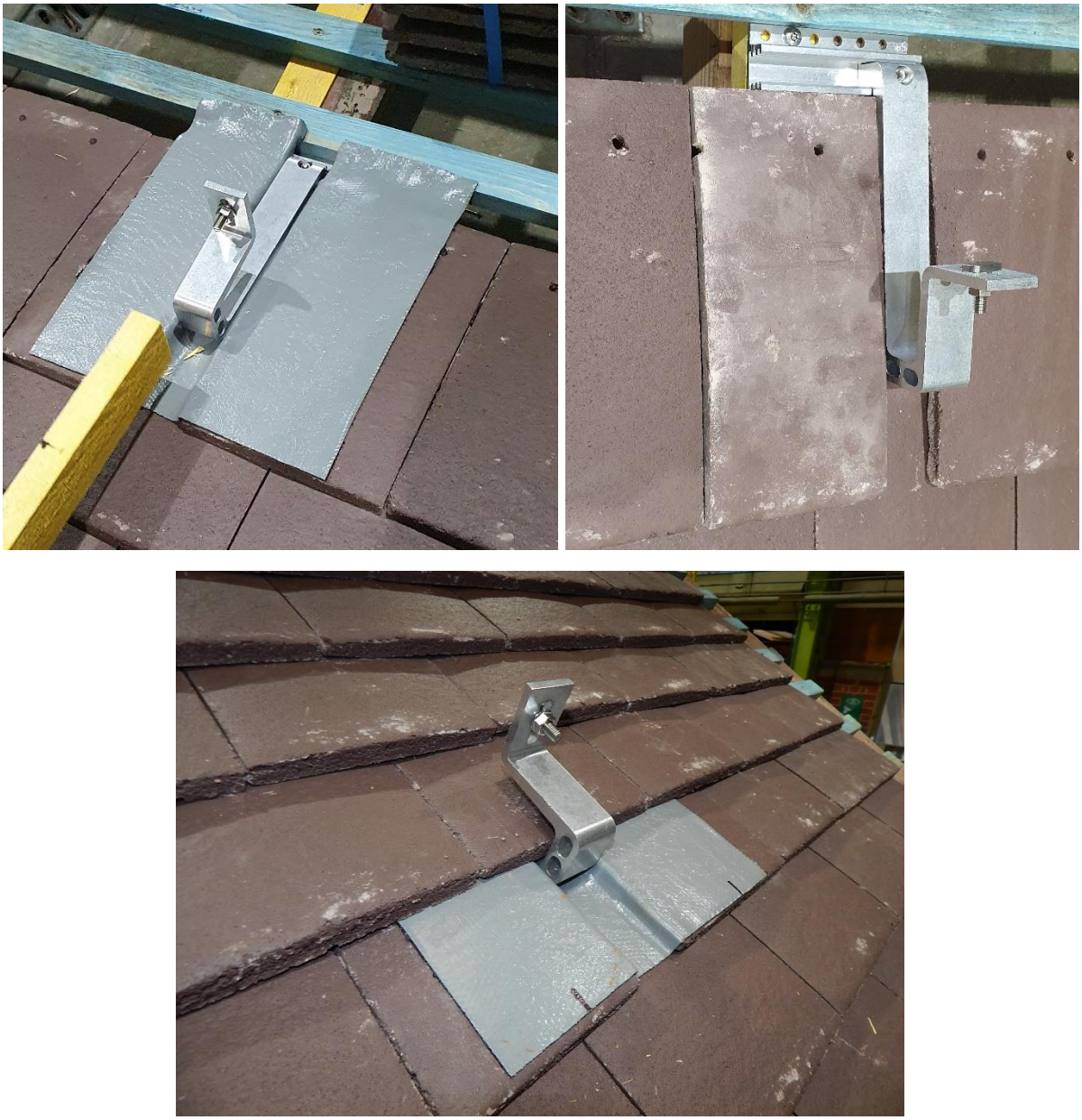

Figure 4.Inclusion of a flexible flashing around the RH flat roof hook.

Figure 5. RH flat roof hook installed on the BRE test rig prior to test.

The installation of the RH flat roof hook created a gap between the underside of the roof hook and the upper surface of the tile below, Figure 6. However, the size of the gap was comparable to the gaps observed with the reference tiles however the length of it was larger. Nevertheless, this gap is unprotected.

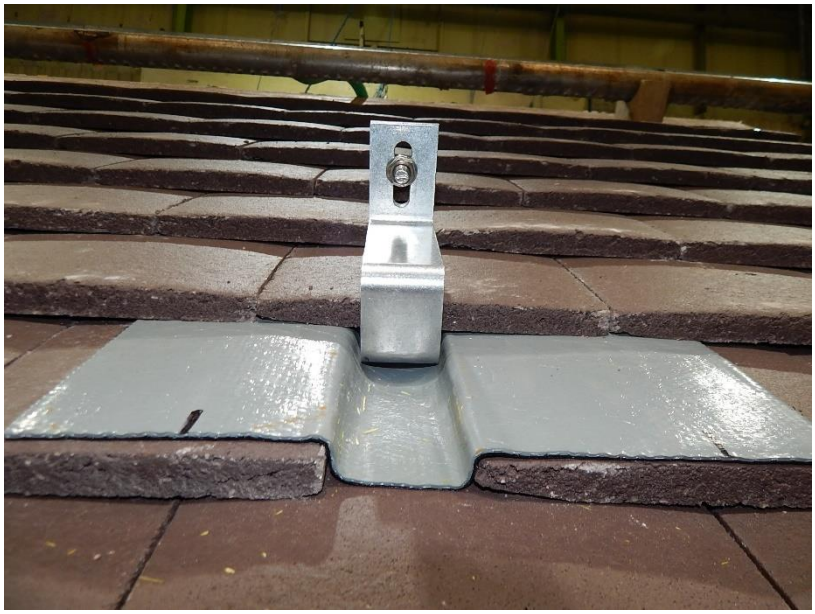

Figure 6. Gap created by installation of the RH flat roof bracket.

2.3 Hanger Bolt

Table 3 outlines the Renusol components tested and the configuration parameters. The Hanger Bolts were installed as per the Renusol installation manual. Figure 7 shows the hanger bolt installed with the corrugated metal sheet. Figure 8 shows the specimen installed on the BRE test rig prior to test. Note, two Hanger bolts were installed. One was installed on the side overlap of the two sheets and one was installed on a single sheet.

Parameter	Product Number	Product Number
Roof Hook	Hanger Bolt M10 x 250mm	R860021 & R860022
Fixings	N/A	
Tile Type	Two off 2510mm x 1100mm x 0.7mm corrugated metal sheet	
Batten Gauge, mm	N/A	
Headlap, mm	N/A	
Sidelap, mm	100mm	
Roof Pitch, °	5°	
Roofing Fixing Strategy	N/A	

Table 3. Configuration parameters for hanger bolt weathertightness test.

Figure 7. Hanger bolt installed prior to test.

Figure 8.Hanger bolt and Metasole bracket installed on the BRE test rig prior to test.

2.4 Metasole Bracket

Table 4 outlines the Renusol components tested and the configuration parameters. The Metasole brackets were installed as per the Renusol installation manual. Figure 9 shows the hanger bolt installed with the corrugated metal sheet. Figure 8 shows the specimen installed on the BRE test rig prior to test. Note, two Hanger bolts were installed. One was installed on the side overlap of the two sheets and one was installed on a single sheet.

Parameter	Product Number	Product Number
Roof Hook	MS+ Corrugated rail	R420171
Fixings	2 x Ejofast Stainless Steel Self Drilling Screws, 5mm x 25mm SW8 E16	R400301
Tile Type	Two off 2510mm x 1100mm x 0.7mm corrugated metal sheet	
Batten Gauge, mm	N/A	
Headlap, mm	N/A	
Sidelap, mm	100mm	
Roof Pitch, °	5°	
Roofing Fixing Strategy	N/A	

Table 4. Configuration parameters for Metasole weathertightness test.

Figure 9. Metasole bracket installed prior to test.

3 Details of the Tests Carried Out

The specimens were installed on the BRE test rig positioned at the exit of the BRE's No. 3 Boundary Layer Wind Tunnel. Due to the need for only deluge testing to be completed, a simplified test was used. The pressure chamber, suction device, or fan system as required in PD CEN/TR 15601:2012 was not required.

A spray nozzle was mounted above the roof, so that water could be sprayed down onto the roof to provide deluge rain at a rate equivalent to a rainfall of 225mm/hour over the whole roof. The wind tunnel was not running during deluge rain testing. Simulated rainfall of 225mm/hour over the rest of a typical 7m roof was produced via a splarge bar mounted across the top edge of the roof. The test conditions represent the worst-case wind and rain combination likely to occur in Northern Europe during any 50-year period.

The sample was mounted on a transparent box which allowed for the collection and measurement of water from leakage and also the ability to view the location of any leaks.

A schematic diagram of the test arrangement is shown in Figure 10.

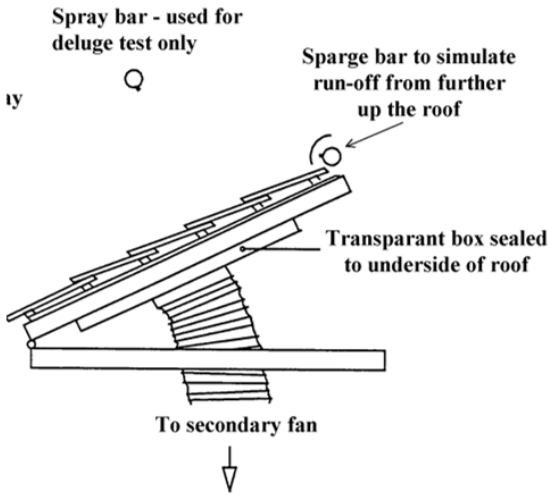

Figure 10. Diagram to show the simplified set up for deluge testing.

4 Test Results

4.1 Principle

The test is used to assess the water entry via the penetrations through the outer roof covering and to address the leakage mechanisms.

Essentially, the presence of the solar panel mounting system must not decrease the weather performance of the roof covering or the roof structure. The performance of the surrounding roof covering elements which are unaffected by the presence of the solar panels mounting brackets were taken as a benchmark against which to judge the performance of the brackets. The comparison was made on the basis of any water entry during the test period. To be acceptable the solar panel mounting brackets system should have a level of performance at least equal to that of the unaffected roofing elements.

4.2 Weathertightness Results

Figure 11 shows the three specimens under deluge test.

Any observed leaks during the deluge testing of each product was noted and is described in Table 5.

Product	Notes
RH1 Roof Hook	No observed leakages
RH Flat Roof Hook with flexible flashing	No observed leakages
RH Flat Roof Hook without flexible flashing	No observed leakages
Hanger Bolt	No observed leakages
Metasole Bracket	No observed leakages

Table 5. Weathertightness test results for the RH1 roof hook, RH flat troof hjook, Hanger bolt and Metasole Bracket under deluge testing.

Please note. The client was advised that the RH Flat Roof Hook required a full wind driven rain test as a result of the unprotected gap. However, the client insisted that only a deluge test was completed. The roof hook may be unsuitable under wind driven rain conditions.

Figure 11. The test specimens under deluge test (RH1 roof hook top left image, RH Flat roof hook top right image, Metasole Bracket and Hanger Bolt bottom centre image).

5 Conclusions

This report describes tests carried out on four Renusol PV mounting systems to determine the weathertightness performance in accordance with MCS 012.

The following conclusions can be drawn from these tests:

Weathertightness

- For the RH1 roof hook with double roman tiles, no leaks were evident through any fixing holes and the weathertightness performance was acceptable at 22.5° roof pitch angle.
- For the RH flat roof hook with plain tiles, no leaks were evident through any fixing holes and the weathertightness performance was acceptable at 35° roof pitch angle. However, the roof hook may be unsuitable under wind driven rain conditions (not tested)
- For the hanger bolt with corrugated metal sheeting, no leaks were evident through any fixing holes and the weathertightness performance was acceptable at 5° roof pitch angle.
- For the Metasole bracket with corrugated metal sheeting, no leaks were evident through any fixing holes and the weathertightness performance was acceptable at 5° roof pitch angle.

6 References

1) MCS012; Microgeneration Certification Scheme, Roof performance tests for solar thermal collectors and PV modules.