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Subject: Technical application test of the watertightness of the MetaSole photovoltaic mounting system on two substructures with different fixings

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1 Scope of tasks

The mounting system from Renusol Europe GmbH under the name MetaSole is used for mounting framed photovoltaic modules on pitched roofs with roofing made of trapezoidal steel sheets as well as corrugated profiles and tiled sheets.

According to the specific instructions provided by the client, the various clamping profiles/fasteners fastened to the crests of the trapezoidal and tile sheets should be subjected to water exposure within the framework of a test oriented towards application.

2 Object of the examination

The MetaSole mounting system can be attached to the sheet metal profiles using the clamping profiles/fasteners described in the system below. The end and middle clamps for anchoring the PV modules with the clamping feet are not relevant to this test and are therefore not described.

- System 1: Fastener MS+P on tiled sheet
  - Clamping profile: rectangular, tubular aluminium profile, 400 mm long and approx. 40 mm high, aligned at right angles to the crests, with rails/claws formed on the upper end along the longitudinal edges to hold the clamps, as well as flat profiles formed on the two lower edges and two EPDM sealing strips affixed onto the underside (standard), Annex 1, Figure 1
  - 4 x drilling screw SW 8 6.0x25 E16 for fixing the clamping profile onto steel or aluminium sheets with a thickness of 0.75 - 1.5 mm or 0.5 - 2.0 mm without pre-drilling (specific instruction from client)

- System 3: Fastener MS+ on trapezoidal sheet
  - Clamping profile: tubular, 125 mm long and approx. 18 mm high, U-shaped aluminium profile with rails/claws formed along the upper longitudinal edges to hold the clamps as well as 2 holes for the screws and an EPDM sealing strip (standard) affixed onto the underside over the entire surface, Annex 1, Figure 2
  - 2 x drilling screw SW 8 6.0x25 E16 for fixing the clamping profile onto steel or aluminium sheets with a thickness of 0.75 - 1.5 mm or 0.5 - 2.0 mm (specific instruction from client)

- System 4: Fastener MS+ on trapezoidal sheet
  - Similar to system 3, but including the EPDM sealing strip (alternative)

- System 5: Fastener MS+H on trapezoidal sheet
  - Clamping profile: tubular, 125 mm long and approx. 70 mm high, U-shaped aluminium profile with rails/claws formed along the upper longitudinal edges to hold the clamps as well as an EPDM sealing strip affixed onto the underside (standard) and 4 holes for the screws, Annex 1, Figure 3
  - 4 x drilling screw SW 8 6.0x25 E16 for fixing the clamping profile onto steel or aluminium sheets with a thickness of 0.75 - 1.5 mm or 0.5 - 2.0 mm (specific instruction from client)
According to statements from the client, the 2 mm thick and 20 mm wide sealing strips are foamed EPDM with a shore hardness of 32 - 48. The standard variant was used for all fasteners. Additionally, an alternative variant was investigated using System 4. The length of the sealing strips depends on the length of the respective fastener, i.e. it is 125 mm for MS+ and MS+H and 400 mm for MS+P.

According to the specific instructions from the client, the mounting systems are fastened with a cordless screwdriver with socket key SW 8 mm by screwing in the drilling screws until the sealing washer fits into the respective sheet metal. The tightening torque should be selected so that the sealing washer is in full contact with the sheet metal but is not pressed out from under the washer of the screw head.

3 Tightness test

3.1 Test specimens

For all systems, the clamping rail and clamping feet were fixed to the sheet metal profiles with the drilling screws by the client in their test laboratory.

The following test setups were handed over:

- Tiled sheet with fastener MS+P (System 1), Annex 1, Figures 4 and 5
  - Surface-coated sheet metal cut-out made from steel (dimensions: 0.64 m x 0.44 m, d = 0.5 mm) with 3 crests, crest spacing: approx. 22 cm
  - Arrangement of the fastener at right angles to the crest alignment with 2 x 2 drilling screws on 2 crests

- Trapezoidal sheet with fasteners for the MS+ with EPDM sealing strips (system 3), MS+ (system 4) and MS+H (system 5), Annex 1, Figure 6
  - Surface-coated sheet metal cut-out made from steel (dimensions: 0.49 m x 0.38 m, d = 0.7 mm) with 6 crests, crest spacing: approx. 75 mm
  - Arrangement of the fasteners parallel to the crest alignment with
    - 2 drilling screws each on the crests (systems 3 and 4) and
    - 4 drilling screws on a crest (system 5)

3.2 Test setup and execution

The purpose of the tests to be performed is to check the tightness of the fixing points of the four MetaSole mounting systems through which the drill screws pass. The water exposure occurs with a water column of 0.2 m above the crest of the sheet metal profiles.

For this purpose, two containers made of transparent acrylic glass (PMMA) adapted to the geometry of the sheets were manufactured and affixed onto the sheets in such a way that a minimum distance of 25 mm between the screws and the container wall was maintained, Annex 1, Figures 7 to 9.
After the adhesive and sealant had hardened, the containers were filled. The water was dyed in order to illustrate a possible water passage at the screw connection points, Annex 1, Figures 10 and 11. The sheets affixed to the containers were placed onto an acrylic glass plate covered with absorbent paper. In this way, the tightness of the screw connection points on the underside of the sheets could be visually checked during the test.

The period of use was 14 days, as agreed. During this time, visual checks were carried out at regular intervals to ensure that the undersides of the sheets were free of moisture and the absorbent paper was discoloured. At the end of the test period, the water was removed from the containers.

3.3 Test results

Both during the 14-day exposure to water and after dismantling the test set-ups, no water passage could be detected on the fasteners mounted with the drilling screws SW 8 6.0x25 E16, Annex 1, Figures 12 and 13.

As a result of the tests carried out, it can be stated that the MetaSole mounting system from Renusol for fixing mounting framed PV modules with the fasteners

- MS+ (with EPDM sealing strips, standard and alternative) on a trapezoidal sheet
- MS+H (with EPDM sealing strips, standard) on a trapezoidal sheet and
- MS+P (with EPDM sealing strip, standard) on a tiled sheet

in conjunction with the SW 8 6.0x25 E16 drilling screws did not reveal any leaks under the tested boundary conditions within a test period of 14 days.

Leipzig, 02 December 2019

Dr.-Ing. Ute Hornig
Division Manager
Figure 1: Fastener MS+, shown here with drilling screws RP-T 6.0 x 25 E16
(Source: client)

Figure 2: Fastener MS+, shown here with drilling screws RP-T 6.0 x 25 E16
(Source: client)
Figure 3: Fastener MS+H with 2 of 4 drilling screws SW 8 6.0x25 E16
(Source: client)

Figure 4: Tiled sheet with fastener MS+P (system 1) supplied by the client
Image 5: Same View from underside

Figure 6: Trapezoidal sheet with fastener MS+ and MS+H (system 3, 4 and 5) supplied by the client
Figure 7: Bonding of two acrylic glass (PMMA) containers adapted to the geometry of the sheets.

Figure 8: Ibidem – containers with system 1.
Figure 9: Ibidem – containers with system 3, 4 and 5 (above)

Figure 10: Container filled with dyed water for testing systems 3, 4 and 5
Figure 11: Container filled with dyed water for testing system 1

Figure 12: Underside of system 1 (MS+P on tiled sheet) without traces of water passage at drilling screws SW 8 6.0x25 E16
Figure 13: Underside of systems 3 - 5 (MS+ as well as MS+H on trapezoidal sheet) without traces of water passage at drilling screws SW 8 6.0x25 E16