TEST RESULTS – ATTACHMENT OF STONEL BRICK PANELS TO PAROC SANDWICH PANELS

Distribution: HkI, DK, KRa, NK, KjN, JiW, lab

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References: Ventilated build-on façades, RT product card for Stonel brick panels

1. Background

The purpose of the tests was to study the impact of the structural load of Stonel brick panels and the pressure and suction load caused by wind on the screw mounting of fixing rails.

2. Materials and testing method

Stonel brick panel cladding consists of burnt brick and galvanized sheet metal frame. The surface area, height, length and thickness of a single panel are 0.72 m², 600 mm, 1200 mm and 23 mm, respectively. The dead weight of the cladding is about 40 kg/m². The brick panels are fixed with a 600 mm vertical spacing (c/c) on a galvanized, 25 mm wide mounting rail (metal thickness t = 1.5 mm). The mounting rail is fixed directly onto the surface metal layer of the Paroc panel with self-tapping screws.

The test wall consisted of two superimposed brick plates and three mounting rails. The brick plates were fixed onto the two highest mounting rails, while the third rail at the bottom was only an installation support and did not bear any load.

In the test, the mounting strips, each 1.2 m long, were fixed with **SFS Intec's SL2-S-A14-5.5x22** and **SXL5-S16-5.5x28 screws** (two screws for each strip) on the 0.6 mm thick external metal surface of the 600 mm panel (c/c). The core of the panel was 50C wool.

The two brick panels and two mounting rails fixed to the wall panel were loaded with two different loading methods:

1) Vertical structural load of a horizontally installed wall panel: the dead weight of the panels (80 kg) plus an alternating vertical load of 120 kg applied ten times. A load of 200 kg is equal to the permissible shear force of four fixing screws ($F_{v,perm}$ = 0.5 kN/screw). The combined load is 2.5 times the dead weight of the brick plate.
2) The pressure of a wind load was simulated with the following compression load: two brick panels (40 kg + 40 kg/2 = 60 kg) plus an alternating compression load of 320 kg applied for ten times were placed on top of a wall panel installed on the floor level. Combined load: the linear load of a single rail was P = (320 kg/2 + 40 kg)/1.2 m = 167 kg/m. The linear load equals to a wind pressure of q, k = 1.5 kN/m².
3) The suction of a wind load was simulated with the following tension load: a beam of about 2 metres long and 200 mm wide was sawn off at the two highest mounting rails, then the attached mounting rail was subjected to a tension load (pulled) ten times with a force of 500 N, and finally the structure was pulled until it began to break. The force of 500 N is the permissible tension load for two fixing screws ($F_{t,perm}$ = 0.25 kN and is equal to a wind suction of about q, k = − 0.7 kN/m².

3. Test results

The failure load of the mounting rails of test walls was compared with a zero test with no load.

The failure loads of SL2 self-drilling screws were even better than the result of the corresponding zero test, and the screws had remained tightly attached to the surface metal layer during initial loading.

SXL5 is intended for metal sheets that are at least 1 mm thick. This was also apparent when the screws were tested. After initial loading, the threads of the screws were no longer tightly attached to the 0.6 mm surface metal layer of the wall panel, and the consequences were apparent in failure loads.

SL2-S-A14-5.5x22	failure load $F_{t, failure}$
Zero test	**2.31** kN
top rail	**2.87** kN
bottom rail	**2.46** kN

Characteristic value for three tests: $F_{t, char}$ = (1.63 kN/2) = 0.8 kN / screw

SXL5-S16-5.5x28	failure load $F_{t, failure}$
Zero test	**1.64** kN
top rail	**0.63** kN
bottom rail	**1.30** kN

Characteristic value for three tests: $F_{t, char}$ = (−0.43 kN/2) < 0.0 kN / screw

Some observations made during the tests:

When brick panels were installed, the position of the mounting rail and the fixing screws remained intact with both screw types and there was little deformation of the mounting rail.

With a vertical additional load, the mounting rail was bent and twisted considerably (figure 2). The SXL5 screws twisted considerably and almost came off the surface metal layer of the wall panel. The screws could be turned by hand. The SL2 screws were more tightly attached to the surface metal layer of the wall panel and did not come off.

In the compression load test, the mounting rails of the brick panel pushed the surface metal layer of the wall panel perceivably into the wool core. However, the shape of the surface metal was restored completely once the load was no longer applied.

In the tension load test, the difference between two types of screws was clear. The threads of some of the SXL5 screws had popped out of the surface metal layer before a failure load was applied.

4. Analysis of the results

The results show that it is possible to attach the mounting rails (metal thickness t = 1.5 mm) of Stonel brick panels (dead weight 40 kg/m²) directly to the surface metal layer of a Paroc wall panel with the right type of screws.

However, if the screws are not the right type, the mounting rails of the brick panel can become detached from the surface of the wall panel if the rail is twisted by hand.

The drill point of the self-drilling screw must be sufficiently narrow compared to the external diameter of the threads and the threads must be sufficiently deep. At the same time, the screw must have the correct overlap thickness.

The failure load affected an area with a diameter of 5–6 cm around the screw on the surface metal layer of the wall panel. After a tear test of the surface metal layer, a visual inspection did not reveal any adhesion damage to the surface metal layer and glue layer on the wool core (figure 9).

5. Instructions for choosing the right fixture sizes for Stonel brick panels

The recommended fixtures for attaching the mounting rail are **Bulb-Tite** rivets or **Peel Rivets** by SFS Intec.

A possibly suitable self-drilling screw type for fixing the mounting rail is **SFS Intec's SL2-S-A14-5.5x22** or a corresponding screw type recommended by SFS Intec.

For these screws, the following tension and shear forces are permissible (according to Technical Guide 3.20 for Paroc panels, January 2009):

- permissible shear force $F_{v,perm}$ = 0.5 kN/fixture

- permissible tension force $F_{t,perm}$ = 0.25 kN/fixture

The maximum permissible spacing between fixing screws of the mounting rail is 600 mm (c/c), in which case the critical load is not the dead weight of the brick panel (40 kg/m²) but the wind load.

The impact of the wind load on the number of fixtures of the mounting rail if the vertical spacing of the mounting rail is 600 mm (c/c):

- wind pressure may be q, k = 1.5 kN/m² (the wind design of the wall panel will be separately reviewed)
- if the spacing between fixtures is 600 mm (c/c), the wind suction may be q, k= −0.7 kN/m² (terrain class II)
- if the spacing between fixtures is 400 mm (c/c), the wind suction may be q, k= −1.05 kN/m² and
- if the spacing between fixtures is 300 mm (c/c), the wind suction may be q, k= −1.4 kN/m² (corner zones).

Annexes

A. Pictures of the test arrangements

Figure 1. Vertical load arrangement. Figure 2. Loaded with dead weight + 120 kg.

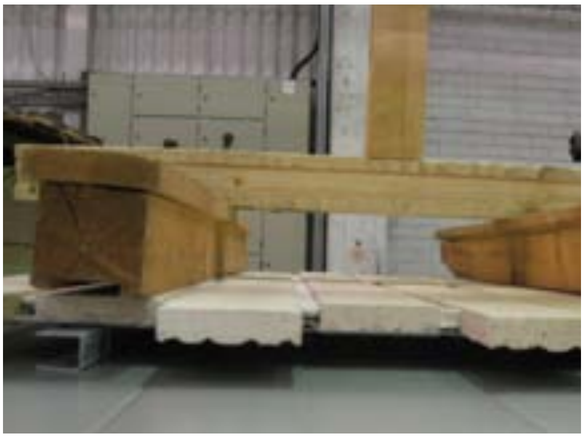

Figure 3. Compression load arrangement. **Figure 4. Linear load of the mounting rails.**

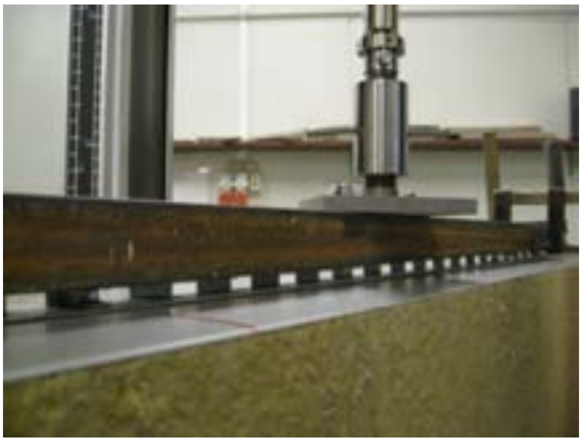

Figure 5. Tension load arrangement.

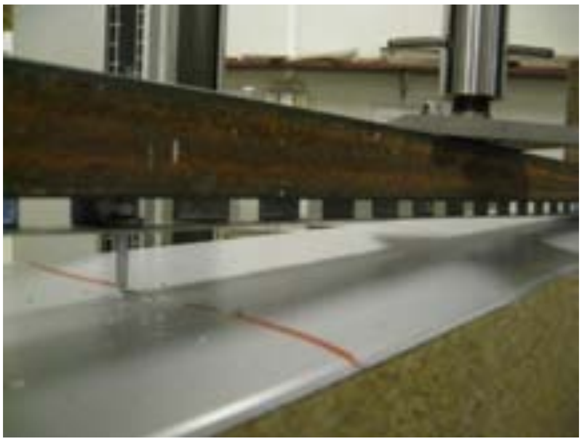

Figure 6. Failure load of the screw reached.

Figure 7. 10 × tension load, SXL5 screw

Figure 8. 10 × tension load, SL2 screw

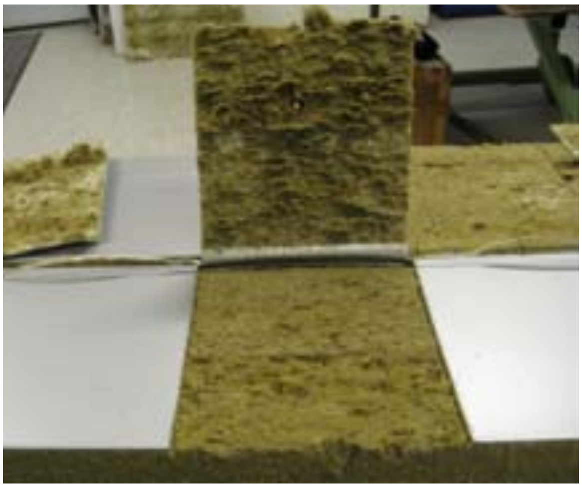

Figure 9. The background of the surface metal layer after failure load.