

**TEST REPORT
S 196/13.5
of 10 December 2013**

**External Wall Cladding – STOA metal clips
for fixing of natural stone, preliminary
research**

Subject Matter

Natural stone cladding with rear ventilation
Use of aluminium grid structure with STOA metal clips
for fixing slabs of natural stone

Commissioned by:

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The present report consists of 5 text pages and 6 appendices.

The publication of the present test report, or parts of it, as well as its use for the purposes of advertising will require our consent.

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1 Aims and objectives of the testing

STOA OOD of Sofia, Bulgaria produces and trades in façade systems with rear ventilation external wall cladding. The grid structure comprises aluminium strut profiles and aluminium fixing clips.

An overall construction/technical approval/permit for the façade is finally needed. Thus, as the first step in obtaining it, the different types of fixing clips, as well as the pins with a diameter of 6 and 8 mm, are subjected to comparative tests conducted to determine the resistance of the fasteners to tensile load in the centre, vertically to the plane of the slabs.

On the basis of the test findings, further procedure has to be chosen to work out a testing programme for obtaining an overall construction-technical approval.

2 Reference documentation

[1] European Organisation for Technical Approvals: ETAG 034, publication April 2012. Guideline for European Technical Approval of Kits for External Wall Claddings

[2] DIN EN 18516: Cladding for external walls, with ventilation at the rear, Part 1: Requirements, principles of testing, Publication June 2010.

[3] DIN EN 13364: Natural stone test methods - Determination of the breaking load at dowel hole, Publication March 2002.

3 Production of specimens

The natural stone specimens needed for the testing have been produced according to the requirements of the Testing Institute of the Commissioner and have been put at the disposal of this Testing Institute. The imbedding of the pins was done at this Testing Institute.

The clips are prototypes produced for the tests.

4. Testing programme

During the preliminary tests with these natural stone specimens there were comparative tests of pins with a diameter of 6 and 8 mm and two fixing clips. These clips include a fixing clip for bottom support of the slab (clip A) and a middle fixing clip for fixing between two slabs (clip B).

The specimens were kept on the premises of the Testing Institute in normal climatic conditions.

4.1 Determining the breaking load on pins

The results from the tests for determining the breaking load on pins are summarised in Table 1:

Diameter of pin [mm]	Number	Mean value [N/mm ²]	Standard difference [N/mm ²]	Coefficient of variation [%]	Minimal value [N/mm ²]
6	3	1668,3	336,5	20,2	1456,6
8	5	2099,3	388,1	18,5	1681,6

Table 1: Results for determining the breaking load on pins

Five tests were conducted on a set of pins with a diameter of 6mm. Due to the big difference in the results from the statistical assessment, the ultimate maximum and minimum values were not taken into consideration.

Both with 6mm pins and the 8mm pins there is breaking of the natural stone (examples in photo 1 and photo 2).

4.2 Determining the breaking load on the fixing clips

The results from the tests for determining the breaking load on the fixing clips are summarised in Table 2:

Type of clip	Number	Mean value [N/mm ²]	Standard difference [N/mm ²]	Coefficient of variation [%]	Minimal value [N/mm ²]
A	4	1752,3	60,3	3,4	1684,9
B	4	1589,1	262,7	16,5	1275,3

Tables 2: Results for determining the breaking load on metal clips

During the preliminary tests fixing clip B, to be used between two panels, was fixed to one of the panels.

With the two clips subjected to the tests there was breaking of the natural stone (examples photo 3 and photo 4).

The results can be seen in tables 3 and 4 in Appendix B.

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Apendix A

Photo documentation



Photo 1 Pin of 6 mm, manner of breaking during testing



Photo 2 Pin of 8 mm, manner of breaking during testing



Photo 3 Clip A, manner of breaking during testing



Photo 4 Clip B, manner of breaking during testing

Appendix B

Detailed results from the tests at CRP

Specimen	Storage	Type of Specimen	Breaking load [N]	Manner of breaking
1	Reference series	Pin 6 mm	2056,4	Truncated cone
2	Reference series	Pin 6 mm	1456,6	Truncated cone
3	Reference series	Pin 6 mm	1492,0	Truncated cone
4	Reference series	Pin 6 mm	1210,3	Truncated cone*)
5	Reference series	Pin 6 mm	3007,6	Truncated cone*)
Minimum			1456,6	*) because of the great deviation these values have not been taken into consideration
Mean value			1668,3	
Maximum			2056,4	
Standard difference			336,5	
Coefficient of variation			20,2	
5% fractal value			607,6	

Table 1: Pin 6 mm

Specimen	Storage	Type of Specimen	Breaking load [N]	Manner of breaking
1	Reference series	Pin 8 mm	2149,7	Truncated cone
2	Reference series	Pin 8 mm	2266,1	Truncated cone
3	Reference series	Pin 8 mm	1765,2	Truncated cone
4	Reference series	Pin 8 mm	1681,6	Truncated cone
5	Reference series	Pin 8 mm	2634,1	Truncated cone
Minimum			1681,6	
Mean value			2099,3	
Maximum			2634,1	
Standard difference			388,1	
Coefficient of variation			18,5	
5% fractal value			1143,5	

Table 2: Pin 8 mm

Specimen	Storage	Type of Specimen	Breaking load [N]	Manner of breaking
1	Reference series	Bottom Clip	1752,2	Truncated cone
2	Reference series	Bottom Clip	1823,7	Truncated cone
3	Reference series	Bottom Clip	1684,9	Truncated cone
4	Reference series	Bottom Clip	1775,4	Truncated cone
Minimum			1684,9	
Mean value			1752,3	
Maximum			1823,7	
Standard difference			60,3	
Coefficient of variation			3,4	
5% fractal value			1590,6	

Table 3: Bottom Clip

Specimen	Storage	Type of Specimen	Breaking load [N]	Manner of breaking
1	Reference series	Middle Clip	1275,3	Truncated cone
2	Reference series	Middle Clip	1890,9	Truncated cone
3	Reference series	Middle Clip	1688,4	Truncated cone
4	Reference series	Middle Clip	1501,6	Truncated cone
Minimum			1275,3	
Mean value			1589,1	
Maximum			1890,9	
Standard difference			262,7	
Coefficient of variation			16,5	
5% fractal value			884,7	

Table 4: Clip in the Middle