

Technical bulletin 19 contains:

1. Analysis of the different fixing brackets that could be used for fixing of ventilated façade systems, according to the following standards:

- Italian standard
UNI 11018 Cladding and anchoring systems for back ventilated external enclosures of buildings—instructions for the design, installation and maintenance—ceramic and stone cladding
- German standard
DIN 18515-1 Design and installation of tile or stone cladding
- Ukrainian standard

ДСТУ Б В.2.6-35:2008 for ventilated façade systems

2. Report from testing of cassettes, made from a whole piece of etalbond with standard size: 1250 X 3200 mm with different types of fixing

Analisis of the different fixing brackets that could be used for fixing of ventilated façade systems, according to the different standards

Standards and normative references:

- Italian standard
UNI 11018 Cladding and anchoring systems for back ventilated external enclosures of buildings—instructions for the design, installation and maintenance—ceramic and stone cladding

Summary:

4.3. Materials for anchoring system

4.3.1 Stainless steel

According to the technical references in this standard, it is recommended to use stainless steel for anchoring systems, for support and fixing purposes. The recommended types of steel and their use is as follows:

Table 1 Systems for classification of stainless steel types:

| Klassification | | |
|----------------|------------------------------|------------------|
| AISI | EN analogue - to- digital | EN digital |
| AISI 304 | X5CrNi 18-10 | 1,4301 |
| AISI 304 L | X2CrNi 19-11 X2CrNi 18-09 | 1,4306 1,4307 |
| AISI 321 | X6CrNiTi 18-10 | 1,4541 |
| AISI 316 | X5CrNiMo 17-12-2 | 1.4401 |
| AISI 316 L | X2CrNiMo 17-12-2 | 1.4404 |
| AISI 316 Ti | X6CrNiMoTi 17-12-2 | 1.4571 |

The types of steel containing Mo, is used for areas with high levels of chlorides. For instance sea areas, where it is possible to be stimulated reaction of located corrosion of the stainless steel.

In spite of this reference it is very important to take into consideration all the circumstances that are different for every project.

In table 5 there are general instructions for the compatibility options for materials.

Table 5 - General instructions

| Materials of the building base | Materials of the anchoring system | | | |
|--|-----------------------------------|------------------|-----------|--------|
| | Stainless steel | Galvanized steel | Aluminium | Bronze |
| Stainless steel | O | S | P | S |
| Galvanized steel | S | O | S | P |
| Aluminium | P | S | O | P |
| Bronze | S | P | P | O |
| Copper | S | P | P | O |
| Pliable steel | P | P | P | P |
| Cast iron | P | P | P | P |
| Compatibility: O: optimal, possible for all conditions S: possible for constant dry conditions P: possible, but with suitable safety measures | | | | |

Table 2 Characteristics for stainless steel according to the area (extract from UNI ENV 1993-1-4)

| Stainless steel | | rural | | | town | | | industrial | | | sea | | |
|---|--------|-------|---|---|------|---|-----|------------|-----|-----|-----|-----|-----|
| | | B | C | H | B | C | H | B | C | H | B | C | H |
| AISI304 | 1.4301 | O | O | O | O | O | (O) | (O) | (O) | ⌘ | O | (O) | ⌘ |
| AISI321 | 1.4541 | O | O | O | O | O | (O) | (O) | (O) | ⌘ | O | (O) | ⌘ |
| AISI316 | 1.4401 | ↑ | ↑ | ↑ | ↑ | O | O | O | O | (O) | O | O | (O) |
| AISI316L | 1.4404 | ↑ | ↑ | ↑ | ↑ | O | O | O | O | (O) | O | O | (O) |
| AISI316Ti | 1.4571 | ↑ | ↑ | ↑ | ↑ | O | O | O | O | (O) | O | O | (O) |
| Agressiveness: B = high C = medium H = low Characteristics: ↑ Potentially dimensioned O Optimally dimensioned concerning the proportion corrosion/price ⌘ Dimensioned lower (O) Useful only with additional safety measures | | | | | | | | | | | | | |

4.3.2 Galvanized steel and similar steel

The anchoring parts could be made from galvanized steel, but only when that concerns steels for structural purposes, as it is pointed in table 3:

Table 3 System for classification of galvanized steels for structural purposes

| Classification | | |
|----------------|------------------------------------|------------------|
| Historical | EN analogue- to- digital | EN digital |
| Fe360 D (+Z) | S 235 J2G3 (+Z) S 235 J2G4 (+Z) | 1.0116 1.0117 |
| Fe430 D (+Z) | S 275 J2G3 (+Z) S 275 J2G4 (+Z) | 1.0144 1.0145 |
| Fe510 D (+Z) | S 355 J2G3 (+Z) S 355 J2G4 (+Z) | 1.0570 1.0577 |

- German standard
DIN 18515-1 Design and installation of tile or stone cladding

Extract:

7.2.3 Anchor supporting, joining and fixing elements

7.2.3.1 As anchor supporting, joining and fixing elements could be used the following materials without special certification of the corrosion resistance characteristics:

a) stainless steels according to DIN EN10088-1, DIN EN 10088-2, DIN EN 10088-3, DIN 17455 or DIN 17456, mechanical joining elements according to DIN EN ISO 3506-1, DIN EN ISO 3506-2, DIN EN ISO 3506-3., steels group A4.

b) aluminium according to DIN 4113-1, DIN EN 573-3 and DIN EN 573-4,

The aluminium building elements have to be put directly on the concrete building elements, if only it is guaranteed that there won't be humidity between the building elements

7.2.3.2 For other anchoring parts there should be special certificate for suitability.

- Ukrainian standard ДСТУ Б В.2.6-35:2008 for ventilated façade systems

Extract:

5.2.2.1 The fixing parts of the thermo-insulating system have to be made from stainless steel type 25X13H2 according to ГОСТ 5632 or from steel type 20 according to ГОСТ 1050 with hot galvanized coating with minimum thickness 45µm.

Conclusion:

According to the above mentioned standards, the fixing parts used in ventilated façade systems have to be made from :

- **Stainless steel**
- **Galvanized steel**

It is advisable to use fixing elements from stainless steel. The normative references don't forbid or oblige to use these materials (with the exception of the Ukrainian standard).

It is possible to use fixing elements from galvanized steel but it is necessary to assure protection against atmosphere influences in order to prevent the corrosion process.

The producers of fixing elements have to give guarantee and certificates for the anchoring parts. If it is necessary, a test on the construction site should be made.

The designers from EBS recommend fixing elements produced from proved manufacturers: Fisher, Wassi and Sormat.

REPORT N 2

**Testing of cassettes, made from a whole piece of etalbond with standard size: 1250 X 3200 mm
with two different types of fixing**

1. Objective

The purpose of the test is to follow the reaction of cassettes etalbond, placed in real atmosphere conditions. The cassettes have standard size 1250x3200, with the following types of fixing:

- Cassette 1 is fixed with 2 vertical punched L profiles, that are stuck on the cassette and are hanged to the main load bearing profiles, i.e. the cassette is hanged to 4 load bearing profiles.
- Cassette 2 is fixed with 2 vertical fixing rims, stucked on the cassette. The cassette is hanged to 2 load bearing profiles from its two ends.

2. Description

The deformations of the cassettes is measured 9 days—from 15.10.2009 to 23.10.2009. In this period four measurements are made. Additional measurement is made on 6.11.2009.

3. Formulation

- Place of the test:
Sample wall in Steelmet, Sofia, Bulgaria. The main construction of the wall is steel welded construction from rectangular standard tubes, mounted in area with elevation +0.00.
- The normative value of wind load in Sofia is $W_n=0.43 \text{ kN/m}^2$.
- The cassettes' end size is 1140/3130 mm.

4. Materials used

- The cassettes are made from composite material etalbond with 4 mm thickness. Two cassettes with sizes—width 1140 and length 3130 mm, are made from the standard etalbond sheet 1250x3200 after sagging .
- Aluminium anchoring system BRAVO
 - fixing brackets 100 mm, code 07varioQ10
 - main load bearing profiles code 21895
 - fixing bracket code 07bravo00
 - rivet Ø4.8 x 12 for fixing the load bearing profile to the brackets
 - rivets Ø4.8 x 32 for fixing the brackets to the metal construction
- Sticking system Sika[®] Tack-Panel with the following elements:
 - Sika Cleaner-205
 - primer Sika Tack-Panel Primer
 - mounting tape
 - Sika Tack-Panel glue

Cassette 1



Cassette 2



Photo 1

Photo 2

5. Cassettes description

Cassette 1

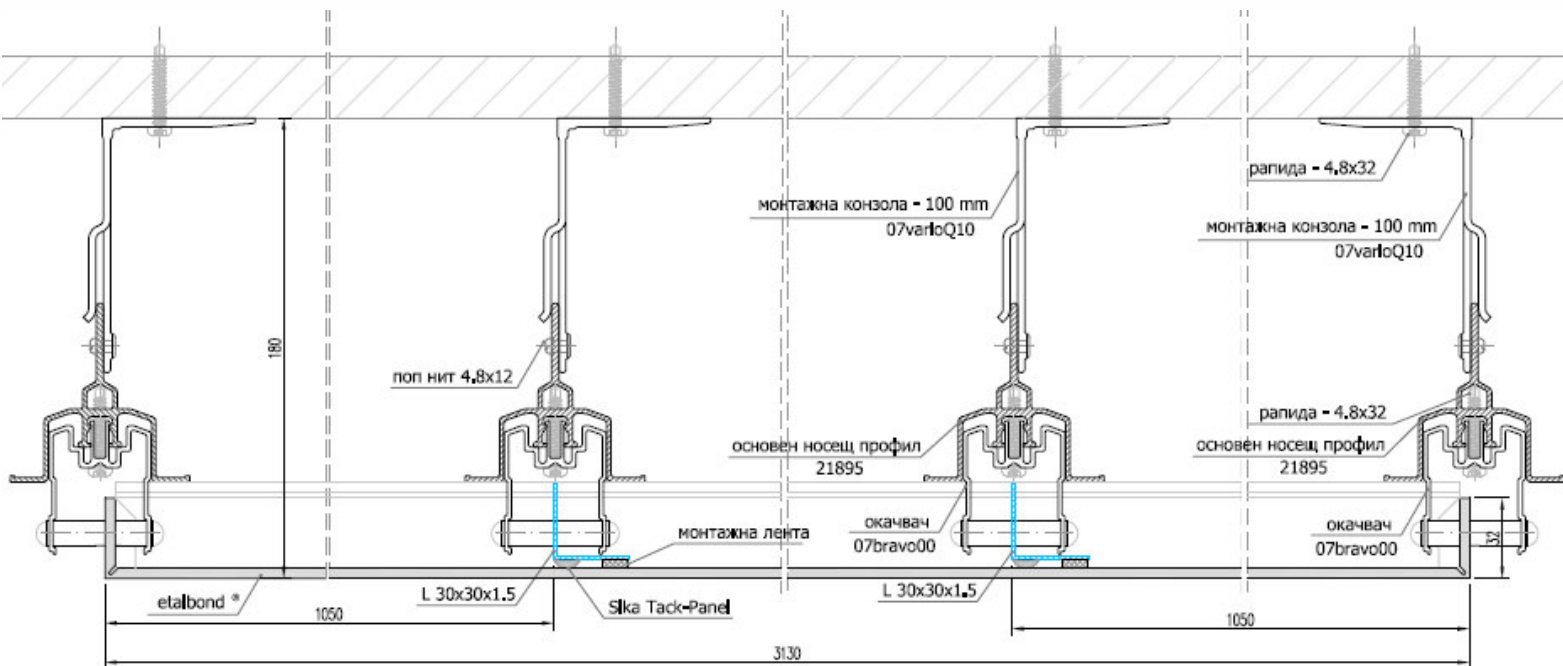
System BRAVO is used. The number of fixing brackets is calculated by the R&D department in ETEM Building Systems.

The back part of the cassette is fixed with punched profiles L 30x30x1.5 at intervals of 1050 mm.

The profiles are fixed with system Sika® Tack-Panel.

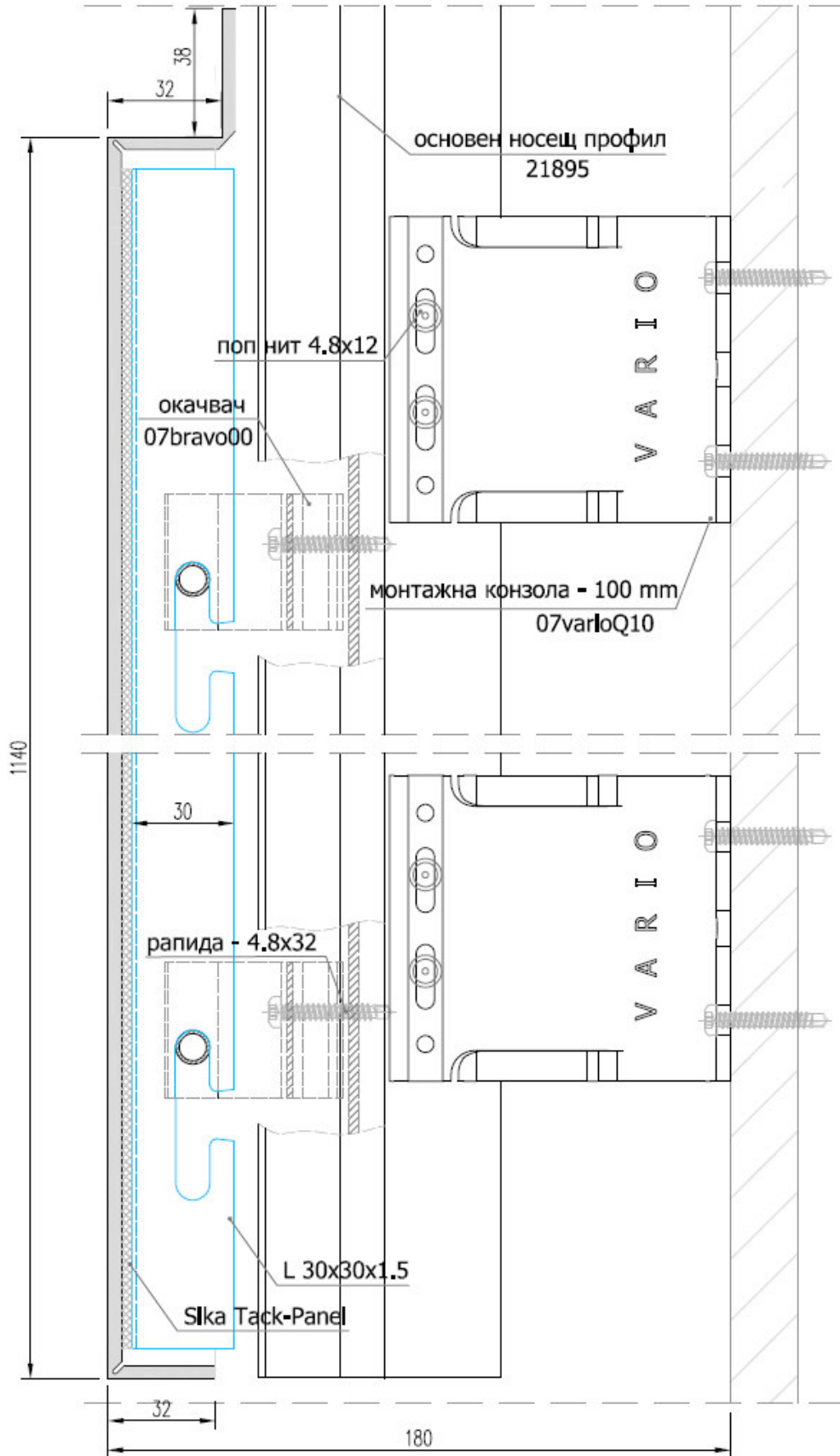
The length of the L profiles is equal to the height of the cassette.

Every load bearing profile is fixed to the construction basis with 3 brackets.



drawing1

Horizontal section Cassette 1



Drawing 2

Vertical section Cassette 1

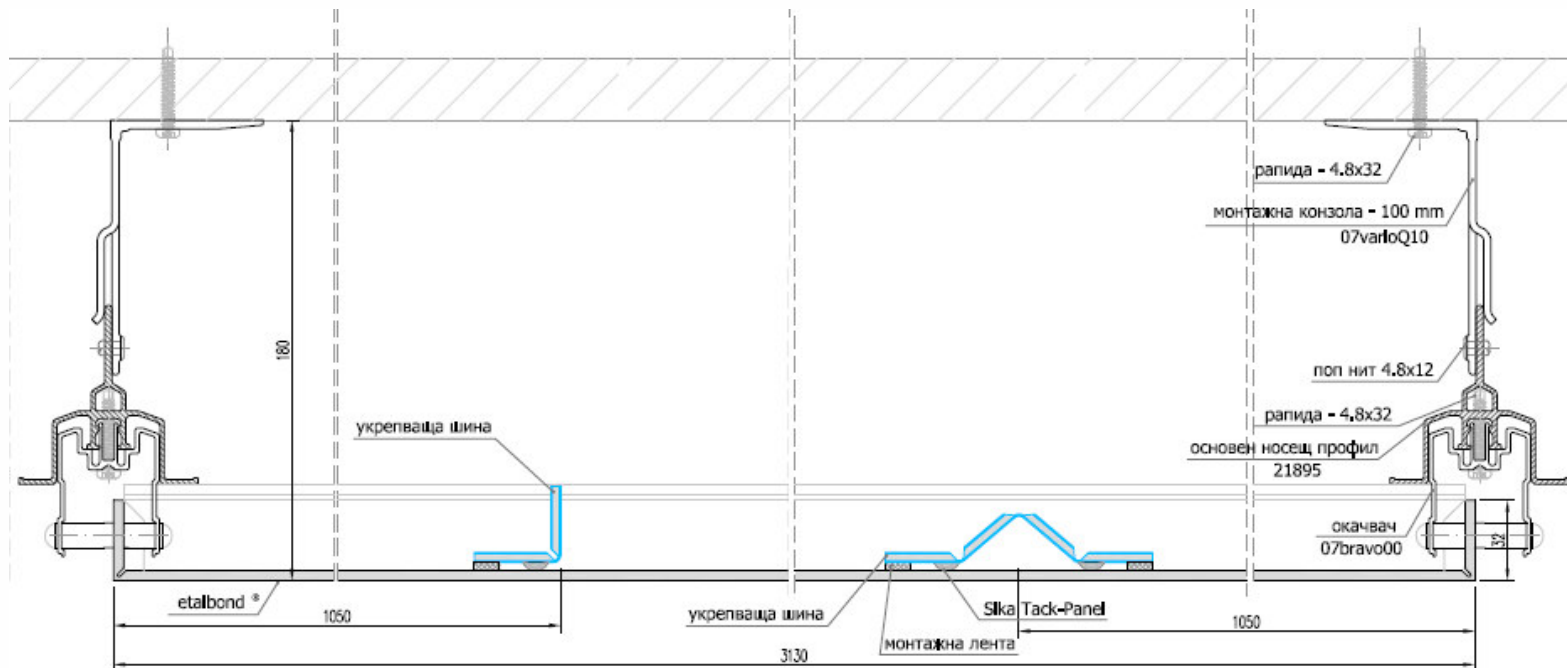
Cassette 2

System Bravo is used.

The back part of the cassette is fixed at intervals of 1050 mm on two places with fixing elements from etalbond as it is shown on drawing 3 and 4. They are fixed with system Sika® Tack-Panel.

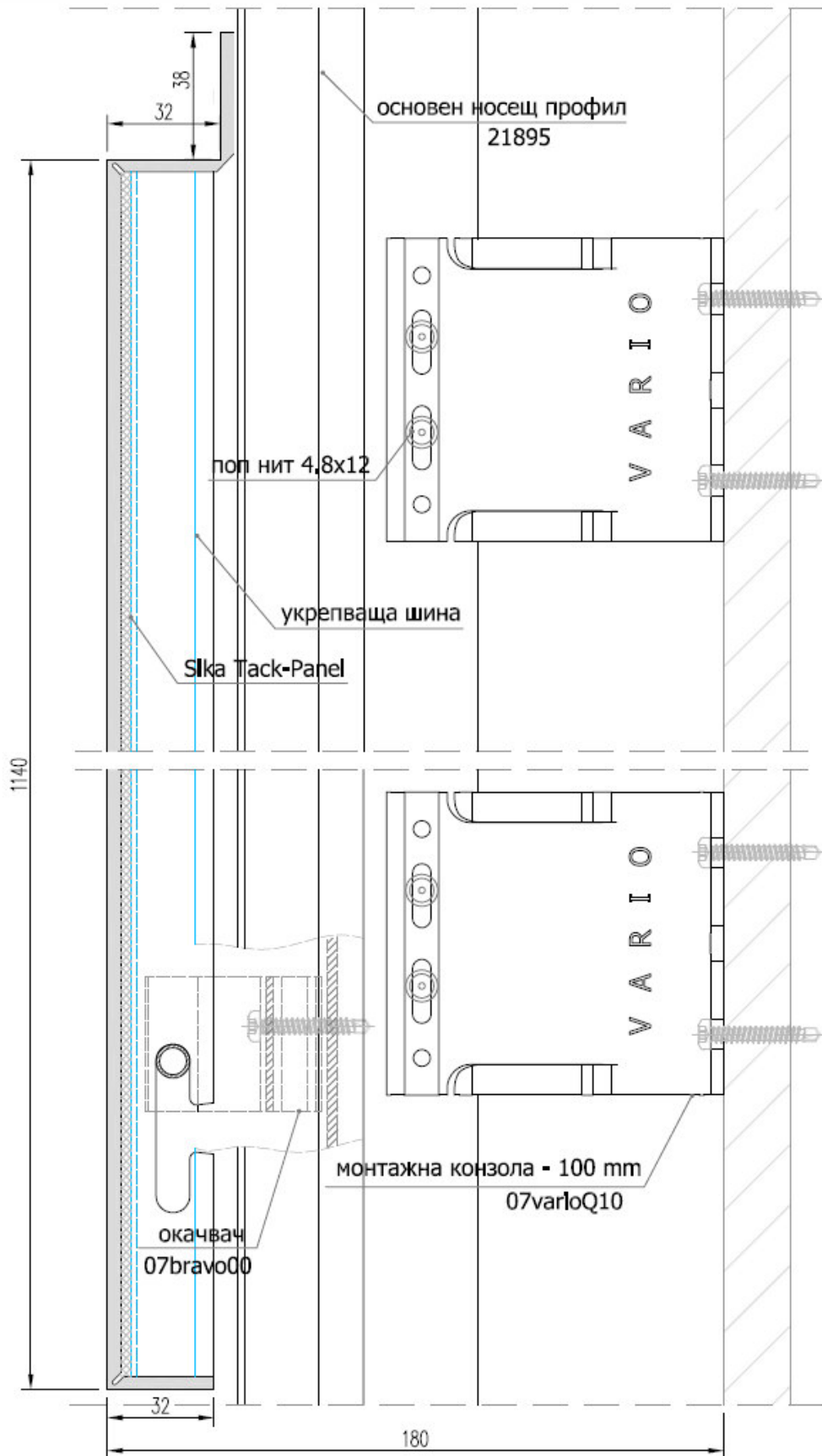
The length of the L profiles is equal to the height of the cassette.

Every load bearing profile is fixed to the construction basis with 3 brackets.



Drawing 3

Horizontal section Cassette 2



drawing4

Vertical section Cassette 2

6. Results

The cassettes are mounted on 13.10.2009.

In the mounted period, the surface of the cassettes is evened without any visible deformations.

The measured deformations from wind load are shown in table 1.

| Date | Conditions | Deformations Cassette 1 | | | Deformations Cassette 2 | | |
|------------|-----------------|-------------------------|------|-------|-------------------------|-------|-------|
| | | up | down | photo | up | down | photo |
| 15.10.2009 | Sunny and quiet | no | no | 3 | no | no | 4 |
| 21.10.2009 | Windy | 3 mm | 3 mm | 5 | 21 mm | 24 mm | 6 |
| 22.10.2009 | Strong wind | 3 mm | 3 mm | 7 | 25 mm | 25 mm | 8 |
| 23.10.2009 | Strong wind | 4 mm | 3 mm | 9 | 23 mm | 24 mm | 10 |
| 06.11.2009 | Quiet | no | no | | 22 mm | 24 mm | |

Table 1

Date 15.10.2009

Cassette 1



photo3

Cassette 2

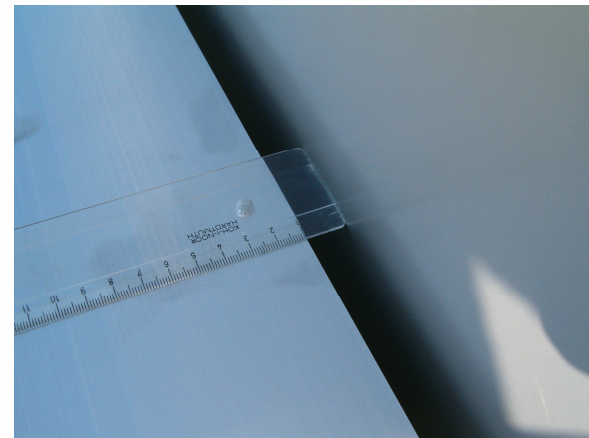


Photo 4

Date 21.10.2009

Cassette 1



photo 5

Cassette 2



photo6

Date 22.10.2009

Cassette 1

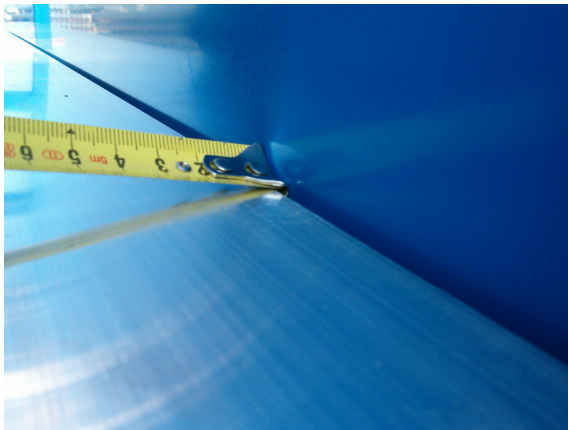


photo7

Cassette 2



photo8

Date 23.10.2009

Cassette 1



photo9

Cassette 2



photo10

7. Analysis

- **Cassette 1**, fixed with profiles and brackets in the middle part, has minimum deformations from wind load. The maximum alteration of the cassette is 4 mm and it is temporary. These deformations don't influence the etalbond characteristics as a facade material.
- Cassette 2, fixed with additional tapes of etalbond , the deformations are essential. 22-24 mm deformation is a plastic deformation which leads to visual changes of the façade. When the load is repeated, it is possible to harm the cassette seriously.

In this case the fixing of the cassette with additional bands of etalbond is not appropriate.

The two types of fixing is suitable and possible for different conditions and architectural requirements.

For maximum area of the cassette without need of fixing against wind load is accepted 1,5 m².

Date : 30.10.2009