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Determination of the wind resistance of an MDFacade coating applied on omega profiles

Wind suction test

Applicant:

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TEST REPORT

(OEF012/16)

Test report corresponds to the translation of the OEF019/14 report

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Test report

Determination of the wind resistance of an MDFacade coating applied on omega profiles - Wind suction test

1 - Context and scope of this report

This report follows a request from the company Amorim Isolamentos S.A., which required the study of wind resistance of its product, MDFacade (Medium density expanded cork boards, ICB), as a coating that can be used as an alternative to ventilated facades.

In order to do this, MDFacade boards as well as the aluminium profiles with omega section were delivered on 3rd December 2013, for the construction of a ventilated facade prototype and conducting wind resistance tests. The internal reference assigned by ITeCons to the prototype was OEF021A / 13.

The objective was to find the resistance to wind of the constructive solution. It was requested to perform the wind suction test in accordance with paragraph 5.4.1.1 of ETAG034 - Guide for European technical approval of ventilated facades.

This report describes the procedures followed in the preparation, conditioning and testing of the samples. The results obtained in these tests are also presented.

2 - Description of test prototype

The prototype was built in the laboratory and consisted of a ventilated facade module, which was made out of a metallic frame which simulated the support, aluminium profiles with omega section and a coating of MDFacade boards. The total dimensions of the prototype were 2600 mm × 2050 mm.

2.1 - Support frame

The metal frame, with dimensions of 2600 mm x 2050 mm, was made out of tubular metal sections RHS 150 × 100 × 4 on the entire periphery and by horizontal tubular metal sections RHS 50 × 50 × 3, spaced 500 mm apart, which provided the support for fixing the aluminium profiles. **Figure 1** shows drawings of the frame.

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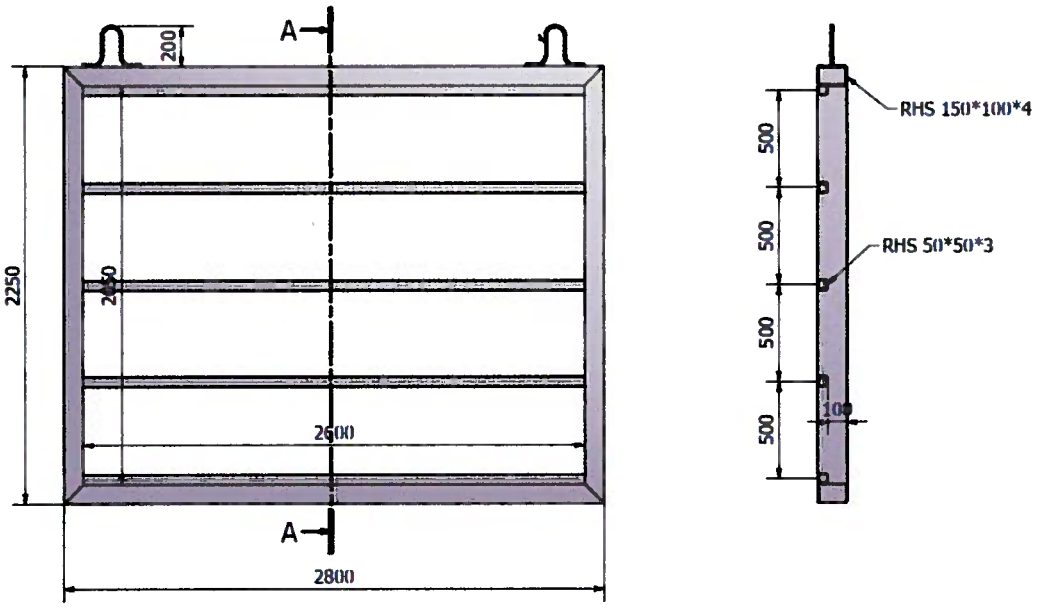

Figure 1: Frontal and lateral schematic view of the metal frame (dimensions in mm).

2.2 - Omega profiles

The profiles used in this test were anodized aluminium profiles with section in omega as shown in **Figure 2**.

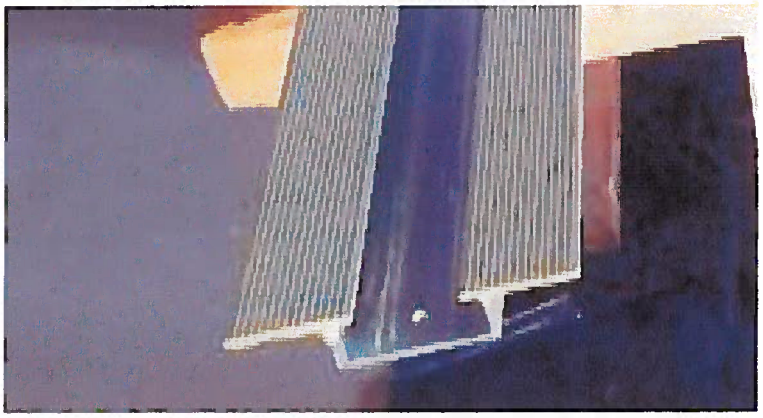

Figure 2: Omega profiles.

Two different distances between omega profiles were considered:

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- Zone A: Spacing of 485 mm so that each ICB board is fixed at both ends and on its centre point, i.e. 3 profiles to support each board;
- Zone B: spacing of 242.5 mm, so that there are 5 profiles to support each ICB board

Figure 3 shows the application of the omega profiles in the frame.

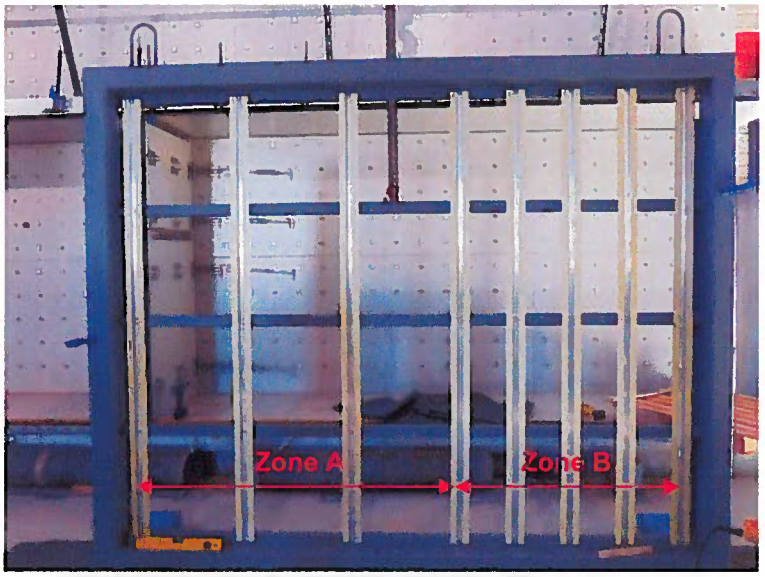

Figure 3: Omega profiles applied to the frame.

Notice that, in this case, the omega profiles were fixed to the support on a contrary way to what is traditionally considered, i.e., instead of setting the flaps to the support, it was fixed to the web, leaving the flaps free for fixing the cork boards, as shown in Figure 4.

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Figure 4: Detail of the fixation of the profiles to the frame.

2.3 - Coating

The prototype coating was made using medium density expanded agglomerated cork boards (ICB), with client reference *MDFacade*. These boards had a thickness of 60 mm, overall dimensions of 1000 mm × 500 mm and a density of 140-160 kg / m^3. Additionally, the boards had a 30 mm × 30 mm milling on all sides to hold a half lap splice in height and width.

With this milling, the boards had useful dimensions of 970 mm × 470 mm. This justifies the spacing between the metal profiles of the zone A of 485 mm (970 mm / 2= 485 mm → 3 profiles per ICB board) and of Zone B, 242.5 mm (970 mm / 4 → 5 = 242.5 mm profiles per ICB board).

Figure 5 shows the detail of the milling of the cork boards used in the coating to provide the half lap splice.

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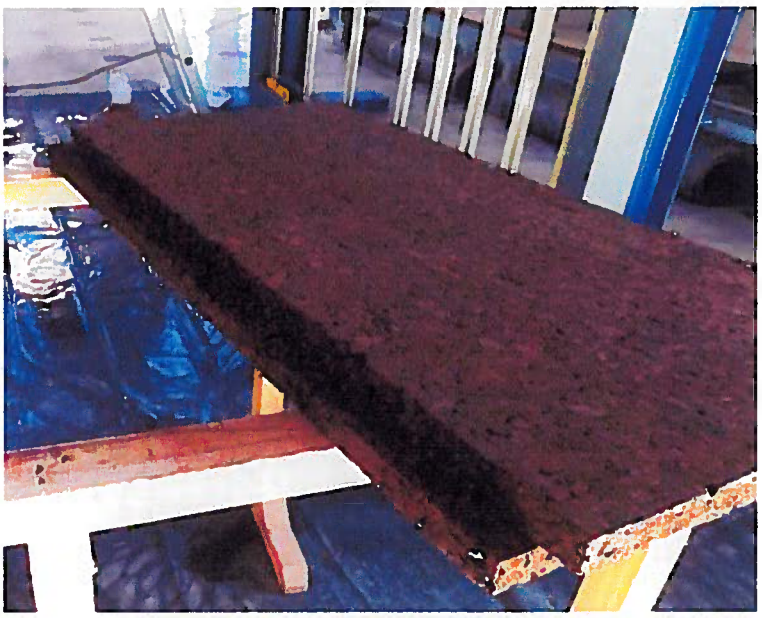

Figure 5: Detail of the milling of the cork boards used to coat the prototype.

The cork boards were fixed to the omega profiles by means of bonding and auxiliary mechanical fixing by means of self-tapping screws.

The fixation of the cork boards to the omega profiles was made following these steps:

- Application of the primer, *Weber.prim AD*, on the profiles' flaps using a brush (**Figure 6**), leaving it to cure for 3 days;
- Cutting the cork boards to size and testing its position on the prototype (**Figure 7**);
- Preparation of the bonding mortar, *weber.therm flex P*, according to the manufacturer's instructions;
- Application of the bonding mortar on the omega profiles flaps and on the cork boards, by using a 6 mm square notch trowel (**Figure 8**);
- Sequential placement of cork boards in the profiles by manually pressing the board against the profile to ensure proper adhesion;
- Auxiliary mechanical fixing of each cork board applying self-tapping screws in middle of the half lap splice in all joints located on the top of each board with the omega profiles and on the lower right corner (Figure 9).

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Figure 6: Omega profiles flaps with primer.

Figure 7: Cutting of the boards and testing its position.

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Figure 8: Bonding mortar application in the flaps of omega profiles and in the cork boards.

Figure 9: Fixing of the lower right corner of a board (half lap zone).

2.4 - Air permeability of the support

To ensure an adequate air permeability of the support, acrylic plates were applied to the inside face of the prototype, which were carefully sealed with silicone. Holes with a diameter of 15 mm were drilled approximately every square meter of the prototype, as required in ETAG034. **Figure 10** shows the acrylic plates after applied and drilled.

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Figure 10: Acrylic plates after their application on the inside face of the prototype and a detail of one of the holes drilled in accordance to ETAG034.

Additionally, 3 holes with 8 mm diameter were drilled in one of the profiles and in the centre of two cork boards, for placing the displacement transducers.

Figure 11 shows the front and the rear of the prototype after its construction was completed.

Figure 11: Prototype after assembling (the grey strips were result of a mishap that occurred during the assembly of the prototype).

2.5 - Assembly and cure aspects

The application of the primer was performed on 30th November 2013, having been left to cure under ambient laboratory conditions until 3rd December 2013, when all the remaining assembling of the prototype was resumed. After which, the bonding mortars cured for three days under normal laboratory conditions. The test was held on 6th December 2013.

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3 - Test procedures

The wind suction test was carried out according to paragraph 5.4.1.1 of ETAG034 – *Guideline for European technical approval of kits for external wall claddings.* The test consists on the application of a uniformly distributed load of suction to the outer face of the ventilated facades elements, whilst recording the deformation of these elements and the integrity of the prototype under test.

The test performs the following consecutive suction levels: 2 levels of 300 Pa, 1 level of 500 Pa, 1 level of 1000 Pa and thereafter the levels increase in increments of 200 Pa, with a return to approximately 0 Pa, after the solicitation of each suction level. The test continues until there is failure or excessive permanent deformation.

Each suction level is applied during at least 10 seconds after the stabilisation of the deformations. The suction load is then withdrawn and the residual strain, after 1 minute, is recorded.

The suction loads were reached by making use of the chamber where the sample was placed, which is equipped with a fan and a differential pressure transducer. The fan drew air out from the chamber until the specified value of differential pressure was reached, which was measured by the differential pressure transducer.

Figure 12 shows an example of the application mode of the suction levels.

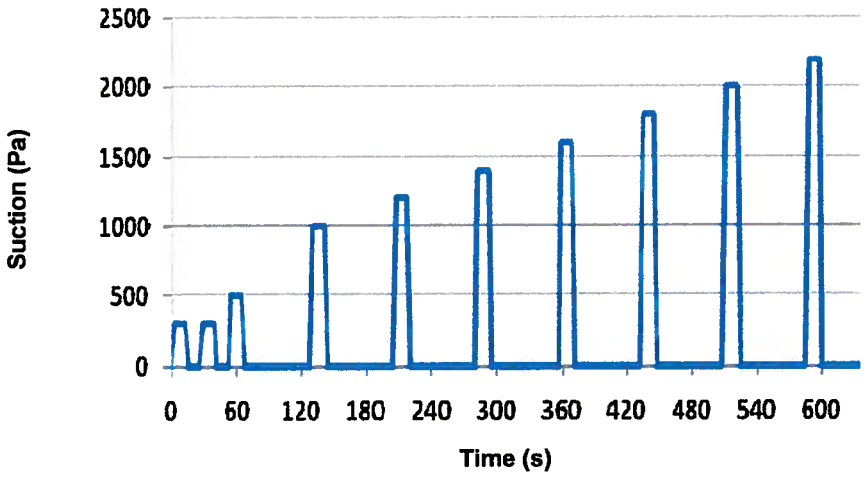

Figure 12: Example of the application mode of the suction loads, from 0 Pa to 2200 Pa.

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4 - Results

The wind suction test, to which the prototype with OEF021A / 13 reference was submitted, was performed on 6th December 2013

Table 1 shows the results obtained from the test, namely the maximum and residual deformations obtained for each pressure applied to the tested prototype, for zones A and B, corresponding to the areas with spacing's between profiles of 485 mm and 242.5 mm, respectively.

Zone A is the zone in which each cork board was supported on 3 profiles and zone B is the zone in which each cork board was supported on 5 profiles.

Table 1: Test results.

Pressure (Pa)	Zone A		Zone B	
	Maximum deformation (mm)	Residual deformation (mm)	Maximum deformation (mm)	Residual deformation (mm)
300	1,01	0,21	1,01	0,13
300	1,05	0,17	1,03	0,12
500	1,89	0,20	1,87	0,14
1000	4,14	0,23	4,06	0,16
1200	4,85	0,26	4,81	0,17
1400	5,84	0,28	5,76	0,20
1600	6,65	0,30	6,59	0,22
1800	7,60	0,27	7,53	0,20
2000	8,41	0,33	8,31	0,29
2200	9,22	0,38	9,15	0,33
2400	10,13	0,40	10,03	0,36
2600	10,93	0,45	10,82	0,41
2800	11,80	0,50	11,68	0,46
3000	12,64	0,57	12,50	0,53

It was verified that, up to a maximum applied pressure of 3000 Pa, the prototype withstood the pressure without suffering any kind of failure or exhibiting excessive residual deformations.

Figure 13 shows the prototype after the test had been performed.

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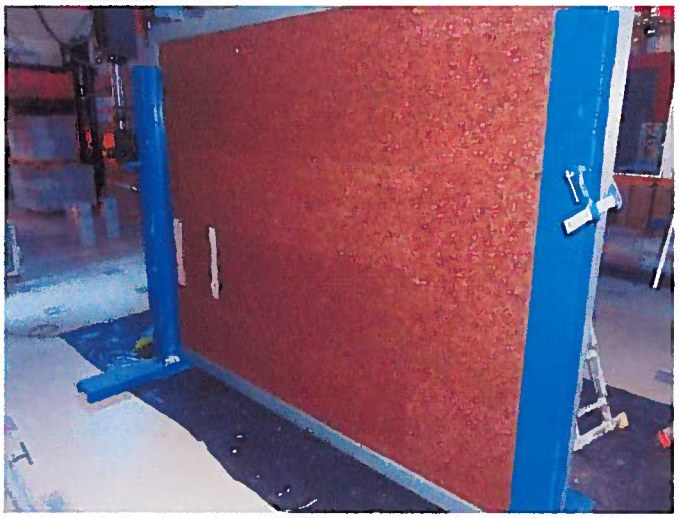

Figure 13: Prototype condition after the test.

5 - Final remarks

This work carried out a wind suction test on a facade prototype coated with expanded cork agglomerate (ICB) called MDFacade. Section 4 presents the results of maximum pressure and its correspondent maximum and residual deformations suffered by the specimen.

By carrying out these tests, up to a maximum applied pressure of 3000 Pa, it was verified that the prototype withstood this pressure without suffering any kind of failure or exhibit excessive residual deformations.

Thus, it is considered that up to a maximum pressure of 3000 Pa the prototype presented a satisfactory performance in terms of wind resistance

Coimbra, September 05, 2016

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