

Suitability of light external renders and coatings on AAC

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1. INTRODUCTION

The development of improving the thermal insulation of masonry and as a reaction on this the reduction of thermal conductivity of building materials lead to high heat-insulating masonry with low density. For these new wall systems all the appropriate components have to be adapted. An important step in this process was the development of a new generation of light external renderings with similar properties and behaviour than the new wall materials.

In the last years a big number of suitability tests for new light external renderings and coatings on AAC have been done at Xella Technologie- und Forschungsgesellschaft together with manufacturers of such systems. Both to be able to give recommendations for renders on AAC with low density and also to get more information about the conditions at which such renders work well on light AAC material. On base of long experiences in the field of application of renderings on AAC and suitability tests for renderings Xella developed a special guideline to have a good fundament for the recommendation of tested renders by Xella.

2. DETAILS

2.1. Description of the method to test renders

General

On base of the standard EN 998-1 and on a wide experience of executed suitability tests with renders and coatings on AAC a guideline for doing such tests was created. The guideline describes all details concerning the tests like e. g. dimension and materials of the test walls, cycles of the climate simulation or which accompanying material tests should be done. It also contents all criteria to evaluate the results of the tests. Both, the performance of the renders at the test wall and the results of the material tests must fulfill the requirements of the guideline to get a recommendation from Xella for the render or coating.

Description of suitability tests

The suitability tests consist of a full-scale test with a test wall (description in Fig. 1), accompanying tests and measurements while and after the test and material tests with all renders and additional components which are part of the system which shall be tested.

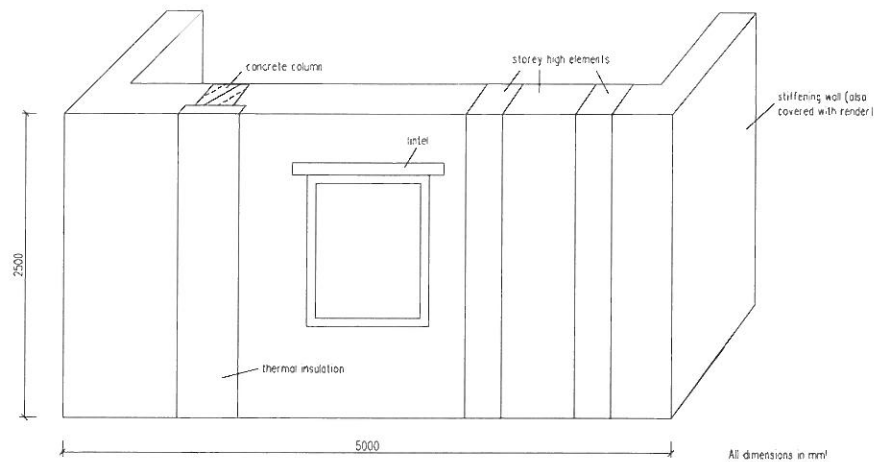


Fig. 1. Full scale test wall

This refers on the AAC material for which the renders shall be tested (blocks, storey high elements) and on additional components (like thermal insulation in front of a column). To take into account the special situation for constructions around openings a window is also part of the test wall. How the test wall exactly looks like depends on the definition of the conditions for which the render or coating shall be used.

The rendering is done by an expert of the manufacturer which produces the material. Important details like pretreatment of the different surfaces or dry-out periods for the different layers shall be kept and are documented in the test report.

After a short dry-out period the test starts by doing a climate simulation. This is done with the help of a special device with high-power lamps and for moistening the wall (see figures 2 and 3). The climate simulation consists of changes between periods with high temperatures (up to 70°C), moistening and phases of conditioning. The reason for moistening the walls is not only to test the reaction of the render on rain but also to cool down the surface temperature of the wall very fast to see if this can lead to negative influences on the bond of the different layers and on the bond between render and AAC. This refers on the situation on a hot summer day when the facade is heated by the sun and then cooled down by a shower. The cycles of the climate simulation are shown in figure 4.

To get information about the moisture and temperature conditions inside the wall (between the layers, on the surface of the AAC and in the AAC) and on its surface measuring devices are placed for online measurements (example: see figure 5). While the simulation the wall is inspected continuously for cracks, local separations or other failures. The same happens after the climate simulation is finished. In addition to that the quality of the test wall is checked by drilling out several samples to get an information about the moisture distribution in the wall and the bond strength between render and AAC is tested like shown in figure 6.

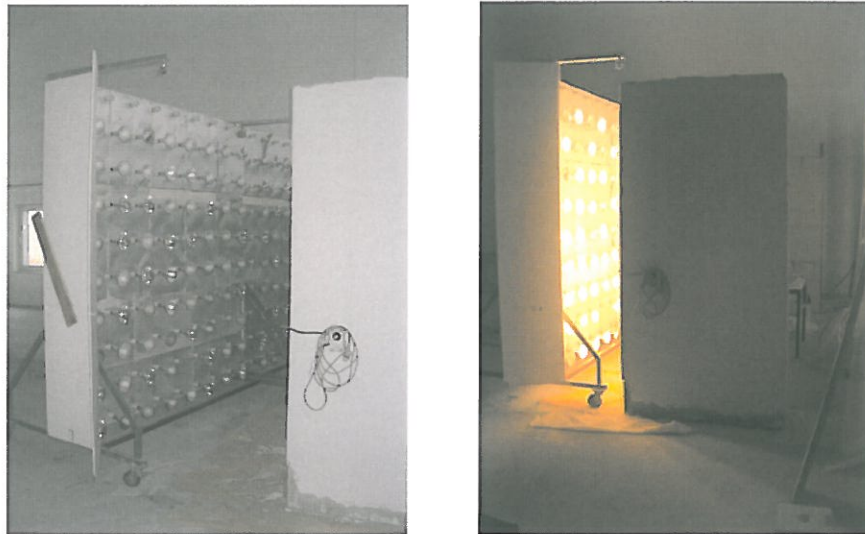


Fig. 2 and 3. Test device for executing the climate simulation.

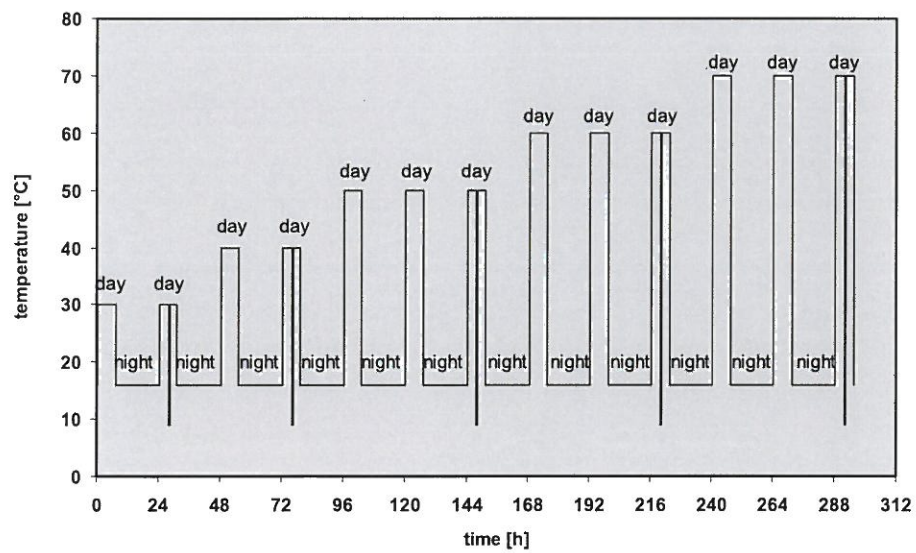


Fig. 4. Test cycle of the climate simulation.

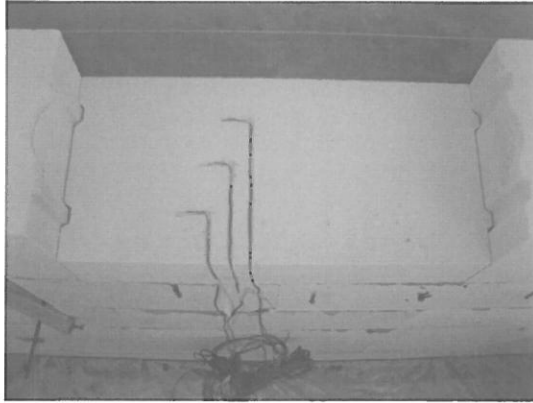


Fig. 5. Online measuring of the temperature inside the test wall



Fig. 6. Determination of the bond strength

Description of the material tests

Accompanying to the suitability test with the full scale wall quality control of the properties of the involved renders is done. Therefore samples are made directly from the materials which are applied to test wall. The test methods refer on what is described in different parts of EN 1015. The results have to fulfill the requirements of EN 998-1 and internal demands defined on the experience of Xella for assuring the quality of the combination of AAC and renders or coatings for high insulating masonry.

2.2. Rating of the test results

The suitability test with the full scale wall has a positive result when no damages at the test wall can be detected, when there are no abnormalities in the moisture distribution of the wall (like high moisture in the renders or at the surface of AAC) and when the bond strength corresponds with the tensile strength of AAC. So the results will be okay if it fails in the AAC or if the failure is in the render and the values are higher than 0.2 MPa.

The properties of the tested renders have to keep the values which are put together in the following table.

Table 1. Target values for the material properties of the tested renders

No.	Property	Requirement	Technical regulation
L0	mortar group	LW CS II	DIN EN 998-1
L1	dry density	600 – 1300 kg/m ³	DIN EN 998-1
L2	compressive strength	1,5 – 5,0 N/mm ² (Kategorie CS II)	DIN EN 998-1
L2.1	flexural tensile strength	≥ 0,5 N/mm ²	internal regulation on basis of experience
L2.2	modulus of elasticity	1500 – 2500 N/mm ²	internal regulation on basis of experience
L2.3	coefficient of thermal expansion	$\alpha_T \approx 1,0 \times 10^{-6} /K$	internal regulation on basis of experience
L3	bond strength before climate test	≥ 0,2 N/mm ²	declared value
L4	bond strength after climate test	≥ 0,2 N/mm ²	declared value
L5	water absorption and s _d -Value	$w \leq 0,5 \text{ kg}/(\text{m}^2 \times \text{h}^{0,5})$ $w \times s_d \leq 1,0 \text{ m}$ $s_d \leq 2,0 \text{ m}$	DIN 18550 (water repellent plaster)
L8	vapour permeability	$\mu \leq 25$	declared value
L9/L10	thermal conductivity	$\lambda_R \leq 0,40 \text{ W}/(\text{m} \times \text{K})$	declared value
L11	behaviour under fire	Euroclass A1	DIN 4102-1 (declaration of manufacturer)
L13	operational safety	poor of chromate	TRGS 613 (declaration of manufacturer)

3. CONCLUSIONS

All test results like the effects of the climate simulation on the test wall, all results of the diverse measurements, the results of the material tests are documented and rated in a report. If the results of all single tests are positive the render system is recommended by Xella for the use on AAC. If not hints are given how the properties and the behaviour of the system on AAC can be improved.

BIBLIOGRAPHY

- [1] Schoch T., Loderer F., 2004. Eignungsprüfungen für Außenputze auf Porenbeton.