



**Stadt
Wien**

Prüf-, Inspektions- und
Zertifizierungsstelle

Study on the topic
„Fire behavior of façade greening
in large scale tests“
(Abstract)

carried out by
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Vienna, 22 December 2021

Abstract

1.1 Initial situation

In recent years, a lot has happened in the promotion of façade greening in Vienna - not least due to the development of fire protection requirements, which on the one hand had the fire protection level of façades in mind, and on the other hand, at least in the same interest, the enabling of maximum greening areas within this scope. Thus, what seemed far away a few years ago is possible today: based on a guideline of the Municipal Department 37 (Building Inspection), available for download under <https://www.wien.gv.at/wohnen/baupolizei/pdf/fassadenbegruenung-2021.pdf>, it is possible to install a variety of greening constructions on the façade without significantly decreasing the fire protection standards. These constructions include both ground-mounted systems and façade-mounted systems; trough constructions are treated in the same way as, for example, trellis constructions placed in front of the façade.

Since façade greening continues to represent a mosaic stone in the fight against urban heat islands and there is potential beyond the previously greened areas on façades, the Vienna City Administration is of course not satisfied with the solutions developed so far. That is why, under the leadership of the Testing Centre, Inspection and Certification Body (Municipal Department 39), funded by Housing Promotion and Arbitration Board for Legal Housing Matters (Municipal Department 50), and in ongoing technical exchange with Municipal Department 37 the Fire Services and Disaster Relief (Municipal Department 68), the research package on the fire behaviour of façade greening described in this report was launched in 2021.

After extensive introspection within the technical departments of the city, but also based on the feedback received from façade greening constructors, planners, architects or fire protection experts after the publication of the above-mentioned guideline, it was agreed that the research project under consideration should mainly deal with fire tests in the

interaction of external wall thermal insulation composite systems (ETICS) with combustible insulation materials and greenery mounted on them.

1.2 Objective

The aim of this study is therefore to determine to what extent the greening affects the fire behaviour of an ETICS applied for the thermal insulation of a building with the combustible insulation material EPS (expanded polystyrene). It seems possible, for example, that heat is conducted through the ETICS into the combustible insulation material due to the installation of the greening construction on the solid exterior wall, resulting in increased thermal damage to the ETICS.

In addition, in order to further validate the previous requirements, a façade greening should be purposely made to burn and it should be investigated whether the fire protection means defined in the guideline effectively limits the fire propagation.

1.3 Methodology

For the large-scale fire tests, the fire scenario was chosen based on ÖNORM B 3800-5 (Fire Behaviour of Building Materials and Components, Part 5: Fire Behaviour of Facades - Requirements, Tests and Evaluations). The assumed scenario is a complete fire in a room that breaks out of a window and attacks the adjoining façade.

For the assessment, the contribution to the spread of flame, which is offered by the present façade design (form, building materials, mounting systems, etc.) in addition to the ever-present spread, is used. The fire load used is a 25 kg spruce wood crib.

Assessment criteria are including

- the fire propagation along the façade greening and
- the falling of large and / or burning parts of the façade construction.

A total of five large-scale fire tests were carried out, whereby the fire load was purposely doubled in two tests (two cribs of 25 kg spruce wood each), on the one hand to purposely stimulate the greenery to spread the fire and, on the other hand, to be able to represent an increased fire load on balconies, loggias, etc.

1.4 Results

In none of the tests could it be determined that the installation of various greening constructions using metal threaded rods caused such a temperature entry into the attached EPS-ETICS that it led to a fire protection failure of the composite thermal insulation system. Even in the case of purposely defective substructures (e.g. open gap in the case of threaded rods passing through the ETICS), this could be seen. All this applies under the condition that both the greening and the ETICS have the required fire protection measures (fire penetration seals or fire protection bars). In all cases, the standardised mineral wool fire protection bars installed in the ETICS fulfilled their function.

The maximum temperatures measured on the metal substructures of the greening troughs were approx. 180°C, and approx. 450°C at the threaded rods of the front trellis aids, which were directly exposed to the fire.

Furthermore, it was clearly evident that the design of the fire barriers defined in the guideline of Municipal Department 37 with at least 10 cm projection over the outer edge of the greening fulfils its function.

Additionally, it was found that if the distances or growth depths defined in the guideline are not adhered to, fire propagation upwards via the greenery is basically possible, which is not permissible according to ÖNORM B 3800-5.

Moreover, as in all previous fire tests, no falling of large or burning parts was observed in any of the tests, neither did lateral fire spread play a significant role.

1.5 Further steps

As conclusion from the results of the tests, Municipal Department 39 may state the following points:

- The application of façade greening to ETICS with combustible insulation material does not have a negative impact on the fire performance of the ETICS - if both systems are designed in accordance with the current fire protection requirements (e.g. fire penetration seals or mineral wool fire bars). The (punctual) temperature entry via the metallic substructure into the ETICS is not sufficient to cause a significantly different burning behaviour of the combustible insulation material. Regardless of this, it is of course important to ensure proper installation of both systems, especially in the area where the surface of the ETICS is penetrated by the metal substructure.
- The fire barriers defined in the guideline of Municipal Department 37 withstand a (in this project purposely induced) fire propagation of the façade greening. In the case of the fire scenario defined in ÖNORM B 3800-5 (protection goal is the second storey above the primary fire source) on the façade, it can be assumed that an effective limitation of fire propagation via the façade greening takes place when fire barriers are installed.

- Furthermore, façade greenings have to be professionally maintained and kept in a vital, functional condition (building logbook, clear regulation of the responsibility for maintenance and preservation of the greening). Necessary maintenance measures are to be taken into account during the planning phase and, if necessary, recorded in the building logbook. As a guide for the professional implementation of maintenance measures, ÖNORM L 1136, may be used. In addition to the measures defined there, special attention must be paid to the growth depth of the plants or to the boundary conditions for the spread of the greenery specified in the fire protection guidelines. If the greenery grows into the defined "fire protection corridor" of 10 cm or even over a fire penetration seal, the protection goal of effectively limiting fire propagation can no longer be assumed to be fulfilled and fire propagation over several floors must be expected in the event of a fire.

These conclusions from the tests were discussed with experts on the subject at the end of the project, so that a revised guideline of the Municipal Department 37 - CCFP is expected to be published in 2022, which will include the results of this study. Further greening measures will then be possible, especially in connection with composite thermal insulation systems.