

Case study: Durability of cellular glass in building applications – Testing of Foamglas® insulation

Sampling: Bavaria Brewery in Lieshout, Netherlands (flat roof installed in 1986)

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Responsibility for the content of the report lies with the authors.



FIW München

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Notified body for testing, surveillance and certification of building materials and components
Research and development in the field of heat and moisture protection

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This report includes

10 pages
4 figures
2 tables

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1 Introduction

This summary gives a short review on one of many sampling and testing operations conducted in 2016 which is part of an ongoing study on durability of cellular glass for Pittsburgh Corning Europe. General aim of the study is to increase the knowledge about the long-term behaviour of cellular glass insulation in different types of building applications and determining factors influencing the stability and expected useful life. The project focuses on specific applications for building insulation materials e.g. external wall and flat roof insulation. The full study will be concluded in 2017.

The building site of the herein described sampling operation was selected by the applicant, and the sampling procedures are supervised by a third party commissioner.



Figure 1: View of the probed building / flat roof construction

2 Sampling operation

FOAMGLAS® insulation material was sampled by a third party commissioner from SECO/BCCA (Technical Control Bureau for Construction in Belgium and Belgian Construction Certification Association) from the Brewery's flat roof in Lieshout on September 19th 2016. The applicant sent the samples to FIW München to determine thermal performance and mechanical properties.



Figure 2: During the sampling operation on site

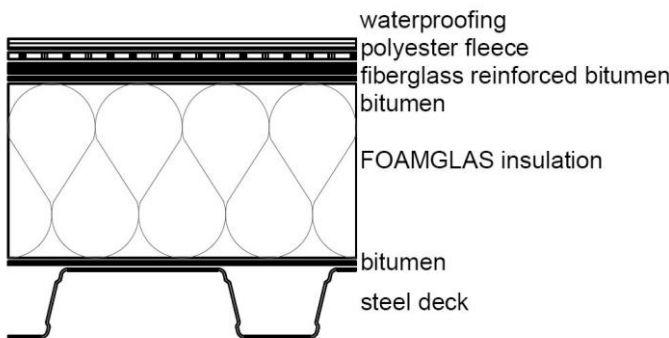
The sampling operation was conducted following a comprehensive sampling guideline issued by FIW. This guideline defines the standards of operation within the project for third parties, assigned by Pittsburgh Corning to supervise and document a sampling operation of cellular glass specimens. It includes instructions for the in-

specifications of buildings and FOAMGLAS® cellular glass products, the documentation, sampling, and shipping.

The guideline provides instructions and templates for the assigned sampling commissioners to meet the project's specifications and to harmonize the procedures for all inspections/samplings. Necessary data, which has to be gathered on site and manners of documentation for a proper evaluation within the framework of the ongoing durability study, is specified.

Important sampling documentation information on the building, the product, and construction gathered by the sampling commissioner is summarized below.

Table 1: Sampling operation in Lieshout, Netherlands (based on sampling protocol)

Building	Brewery (Brewhouse)
Location	De Stater 1 5737 Lieshout Netherlands
Year of construction	1986
Product	FOAMGLAS® T2 (50 mm) Cellular glass slabs 450 mm x 600 mm
Service Life	Since 1986 (30 years)
Sampling point	Flat roof of Brewhouse (internal heating through process heat of brewery) Criteria for selection of sampling point were exposure to sunshine, shade and possibility of puddles (slope)
Construction build-up	Compact roof build-up with bitumen cover layers and steel deck.  Slope of roof $\pm 2 \%$
Condition	The inspection showed a flat surface, waterproofing and substructure was in good condition. The surface showed traces of a puddle on part of the sampling zone.

3 Measurements

The samples were delivered in water- and vapor proof packaging to FIW München on 24th October 2016 by the applicant. The laboratories at FIW performed several measurements on the specimens.



Figure 3: Sample (1 out of 4) as arrived in the FIW laboratories (left), specimens for measurement of compressive strength (already tested) (right).

The thermal performance was determined in “as-is” condition as well as oven-dry condition in a “heat flow meter apparatus” according to ISO 8301.

The structural durability was assessed by measurement of compressive strength by means of a universal materials testing machine. The measurements were conducted according to the special requirements for cellular glass as stated in Annex A of DIN EN 826:2013.

Additionally moisture content and dry density of the samples were measured.

4 Results

The specimens from the flat roof of the Brewery in Lieshout, Netherlands show the following quality characteristics:

Table 2: Results of measurement for FOAMGLAS® insulation installed 1986 in Lieshout

Thermal conductivity (DIN EN 12667:2001-05)	0.043 W/(m·K) (condition as sampled) 0.043 W/(m·K) (dry condition)
Compressive strength (DIN EN 826:2013-05)	1102 kPa (dry condition)
Moisture content (DIN EN ISO 12570:2013-09)	0.1 % by mass / 0.01 % by volume
Density (oven-dry) (EN 1602:2013-05)	126 kg/m³

5 Conclusion

For the time of the product installation in 1986, there is no technical approval or similar document for the insulation material available in the Netherlands. Therefore the sampled product was assessed according to the approval in the country of manufacture (Belgium). The approval was issued by the Belgian Union for technical approval in construction (BUtgb), see technical approval ATG/H 539 of November 1983.

It states a thermal conductivity for FOAMGLAS® T 2 for new FOAMGLAS® insulation material of 0.045 W/(m·K) and a compressive strength of 500 kPa (according to the then valid standard ASTM C 240-72).



Figure 4: Header of Belgian technical approval for FOAMGLAS T2 valid 1986

Considering the stated period of use (30 years) the tested samples showed good mechanical properties and thermal performance, still meeting the requirements for new manufactured products of 1986 with over 1000 kPa compressive strength and a thermal conductivity in sampled condition of 0.043 W/(m·K).

6 Liability

Measurements results are valid only for the described materials, properties and dimensions. The report is based on the current knowledge from research in thermal transport. Liability can only be accepted within the scope of this knowledge.

Warranty for analysis results and expert opinions of FIW München e.V. is limited to the limitations of claim in § 634a BGB for buildings.



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