

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

Sampling: Hospital in Kristianstad, Sweden (flat roof built in 1973)

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



FIW München

Report: E3.3-2017/05



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

Gräfelfing, 9 January 2017

Director

Head of Department

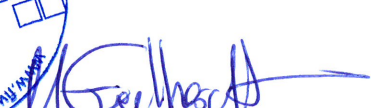
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1 Introduction

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. The sampling procedure was conducted by personnel of Pittsburgh Corning Europe.



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

2 Sampling operation

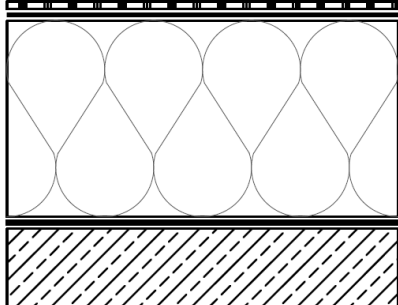
FOAMGLAS® insulation material was sampled by the applicant from the flat roof of the hospital “CSK – Centralsjukhuset Kristianstad” in Kristianstad, Sweden on 27th January 2016.



Figure 2:During the sampling operation on site

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

Table 1: Sampling operation in Kristianstad, Sweden (based on sampling protocol)

Building	CSK – Centralsjukhuset Kristianstad (hospital)
Location	J A Hedlunds väg 5 29185 Kristianstad Sweden
Year of construction	1973
Product	FOAMGLAS® S3 (50 mm) Cellular glass slabs 450 mm x 600 mm
Service Life	Since 1973 (43 years)
Sampling point	Terrace roof, surrounded by higher building parts over cleaning spaces (sterilization of surgical tools) Normal heating assumed.
Construction build-up	<p>Compact roof build-up with 2 bitumen cover layers, underlayer and concrete substructure.</p> <p>Layers are fully adhered to cellular glass. Cellular glass slabs are joined with bitumen.</p>  <p>2 layers bitumen roofing</p> <p>FOAMGLAS insulation</p> <p>bitumen roofing underlayer</p> <p>concrete substructure</p> <p>No slope.</p>
Condition	<p>The inspection showed an even surface, no water accumulation (waterproofing in good condition).</p> <p>The concrete substructure was in good condition.</p>

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.

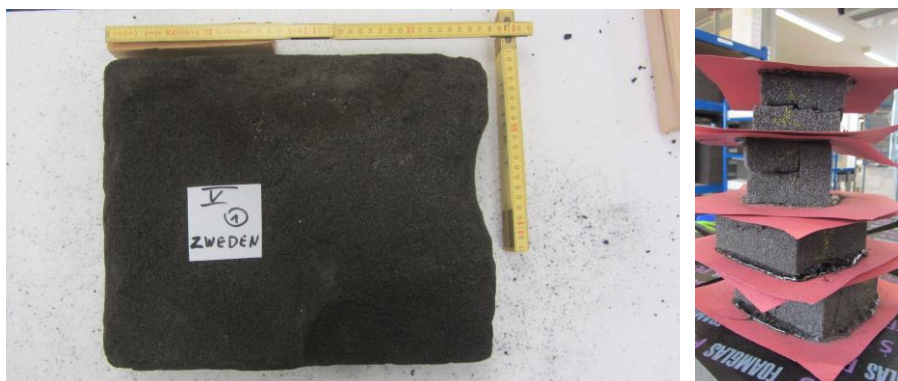


Figure 3: Sample as arrived in the FIW laboratories (left); specimens for measurement of compressive strength, already tested (right).

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 hospital in Kristianstad, Sweden show the following quality characteristics:

Table 2: Results of measurement for FOAMGLAS® insulation installed 1973 in Kristianstad

Thermal conductivity (DIN EN 12667:2001-05)	0.047 W/(m·K) (condition as sampled) 0.047 W/(m·K) (dry condition)
Compressive strength (DIN EN 826:2013-05)	1480 kPa (dry condition)
Moisture content (DIN EN ISO 12570:2013-09)	1.7 % by mass / 0.2 % by volume
Density (oven-dry) (EN 1602:2013-05)	128 kg/m³

5 Conclusion

According to our best knowledge from the time and location of the product installation (1973 in Sweden), for the sampled product no technical approval was valid or existent. In the country of manufacture (Belgium), the sampled product was approved by the Belgian “Institute National Du Logement”, see technical approval N° 1074 of February 1971. It states a thermal conductivity for FOAMGLAS® S 3 of 0.042 kcal/m/K which equates to 0.049 W/(m·K) and a compressive strength of 500 kPa (according to the then valid standard ASTM C 240-61).


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<p>MEMBRE DE L'UNION EUROPÉENNE POUR L'AGRÈMENT TECHNIQUE DANS LA CONSTRUCTION (UEAtc)</p>	<p>S.A. PITTSBURGH CORNING EUROPE avenue de Tervuren 32-38 1040 BRUXELLES (Tél. : 02/35.90.36, telex : 22277)</p>	<p>DÉCISION N° 1074</p>

Figure 4: Header of Belgian technical approval for FOAMGLAS S3 valid 1973

Considering the stated period of use (43 years) the tested samples of cellular glass showed good thermal performance with a thermal conductivity in sampled condition of 0.047 W/(m·K), still meeting the requirements for the new material in 1978. Also the compressive strength of the samples was very high with over 1400 kPa.

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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