CZECH TECHNICAL UNIVERSITY IN PRAGUE
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TEST REPORT No: 124043/2022

upon the test : **Determination of the radon diffusion coefficient of BTF ALU STRONG membrane carried out in accordance with the ISO/TS 11665-13**

Client`s name and address:

btf Innovationen für den Bau GmbH
Fahrenheitsstraße 3
86899 Landsberg am Lech
Germany

ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE FSv č. 1048 Akreditovaná zkušební laboratoř OL 124

Date of issue: 29.9.2022

Approved by:

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prof. Ing. Martin Jiránek, CSc.
head of OL 124 laboratory

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Subject of the test: BTF ALU STRONG – a multilayer membrane comprising AL foil and a geotextile sheet on the bottom surface

Testing procedure: Determination of the radon diffusion coefficient

Test regulation: ISO/TS 11665-13

Test execution date: 21.9.2022 – 29.9.2022

Test execution place: laboratory OL124 – D2044d

Test samples

Test samples were cut from the material handed by the client representative on 8.9.2022. The samples were registered with marks 36/22/J (1 to 3) by M. Jiránek. The dimensions of the samples were 135 x 325 mm (effective area 293.10^{-4} m^2) and their thickness was 0,20 mm (the test was performed on samples with the geotextile removed from the bottom side).

Test method

Radon diffusion coefficient was determined according to the method A of ISO/TS 11665-13. The tested samples were placed between the source and the receiver containers. Radon diffuses through the samples from the source container, which is connected to the radon source RF 100, to the receiver containers. Concentrations on both sides of the tested samples are measured continuously by radon detectors TSR-4 of the TERA system (receiver containers) and current mode ionization chambers (source container). Radon diffusion coefficient was derived from the process of fitting the numerical solution to the curves of radon concentration measured in the receiver containers. Numerical solution is based on the one-dimensional time-dependent diffusion equation describing radon transport through the tested material.

Laboratory conditions

BTF ALU STRONG – material
Steady state radon concentration in the source container: 9,6 ± 0,1 MBq/m^3
Maximum radon concentration in the receiver containers: below the detection limit

Laboratory temperature: 21°C ± 1°C
Relative humidity of air in the laboratory: 36% ± 3%
Pressure difference between the lower and the upper containers: 1 Pa ± 1 Pa

Test device

Radon detectors TSR-4 of the TERA system (N17)
Measuring system with ionization chambers operating in current mode (N14)
Radon concentration measuring system RM-2 (N15)
Micrometer (N11)

Test results

The resulting values of the radon diffusion coefficient, the radon diffusion length and the radon resistance including expanded measurement uncertainty, are listed in the following table. The results refer to the samples as they were taken over.

TESTED MATERIAL		**BTF ALU STRONG**
Rn diffusion coefficient ***D*** **(m^2/s)**	mean value	$< 6{,}0.10^{-15}$
	±U	$\pm 0{,}7.10^{-15}$
Rn diffusion length ***l*** **(m)**	mean value	$< 5{,}3.10^{-5}$
	±U	$\pm 0{,}6.10^{-5}$
Rn resistance **R_{Rn} (Ms/m)**	mean value	> 187 725
	±U	± 22 339

The expanded uncertainties of measurement $\pm U$ mentioned are the product of standard measurement uncertainties and the expansion coefficient k = 2, which provides a confidence interval of approx. 95 %. The radon diffusion length was calculated according to the equation $l = \sqrt{D/\lambda}$ and the radon resistance as follows: $R_{Rn} = \frac{\sinh(d/l)}{\lambda \cdot l}$, where $\lambda = 2{,}1.10^{-6}\ s^{-1}$ and $d = 0{,}20$ mm = $0{,}20.10^{-3}$ m.

The test was performed by: prof. Ing. Martin Jiránek, CSc., Ing. Veronika Kačmaříková, Ph.D.

The report was prepared by: prof. Ing. Martin Jiránek, CSc.

end of the report