



CZECH TECHNICAL UNIVERSITY IN PRAGUE
FACULTY OF CIVIL ENGINEERING – TEST LABORATORY
Test laboratory No. 1048 accredited by ČIA according to
ČSN EN ISO/IEC 17025:2018
Thákurova 7, 166 29 Praha 6



L 1048

EXPERT LABORATORY OL 124
Phone: +420224354806
E-mail: jiranek@fsv.cvut.cz

No. of copies: 2
Copy No: 1
No. of pages: 3
Page No.: 1
No. of annexes: 0
No. of annexes pages: 0

Order No: 8602249A000

TEST REPORT No: 124028/2022

upon the test : **Determination of the radon diffusion coefficient
of POLYFLEECE SX1000 membrane carried out in
accordance with the ISO/TS 11665-13**

Client's name and address:

an.kox GmbH
Junghansring 52
72108 Rottenburg a.N.
Germany



Date of issue: 11.7.2022

Approved by:


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

This report can only be reproduced in its entirety; in part only with a written consent of the testing laboratory. The test results refer exclusively to the subject of the test (test sample).

Subject of the test: Polyfleece SX1000 – a composite membrane comprised of an LDPE film, reactive coating made of modified polymers and a fleece

Testing procedure: Determination of the radon diffusion coefficient

Test regulation: ISO/TS 11665-13

Test execution date: 28.6.2022 – 30.6.2022

Test execution place: laboratory OL124 – D2044d

Test samples

Test samples were cut from the material handed by the client representative Mark Weichert on 27.6.2022. The samples were registered with marks 24/22/J (1 to 5) by M. Jiránek. The dimensions of the samples were 135 x 325 mm (effective area $293 \cdot 10^{-4} \text{ m}^2$) and their thickness was 0,49 mm (only the thickness of the LDPE film with the reactive coating was considered). The permeable fleece was removed from the samples before testing. The tested joint was sealed with 75 mm wide adhesive tapes applied from both sides of the membrane.

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

Polyfleece SX1000 – material

Steady state radon concentration in the source container: $1,6 \pm 0,1 \text{ MBq/m}^3$

Maximum radon concentration in the receiver containers: $79,5 \pm 3,7 \text{ kBq/m}^3$

Polyfleece SX1000 – joint

Steady state radon concentration in the source container: $1,6 \pm 0,1 \text{ MBq/m}^3$

Maximum radon concentration in the receiver containers: $26,2 \pm 0,4 \text{ kBq/m}^3$

Laboratory temperature: $24^\circ\text{C} \pm 1^\circ\text{C}$

Relative humidity of air in the laboratory: $41\% \pm 3\%$

Pressure difference between the lower and the upper containers: $1 \text{ Pa} \pm 1 \text{ Pa}$

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		Polyfleece SX1000	Joint
Rn diffusion coefficient D (m ² /s)	mean value	$2,8 \cdot 10^{-11}$	$9,2 \cdot 10^{-12}$
	±U	$\pm 0,3 \cdot 10^{-11}$	$\pm 1,1 \cdot 10^{-12}$
Rn diffusion length l (m)	mean value	$3,7 \cdot 10^{-3}$	$2,1 \cdot 10^{-3}$
	±U	$\pm 0,4 \cdot 10^{-3}$	$\pm 0,2 \cdot 10^{-3}$
Rn resistance R_{Rn} (Ms/m)	mean value	17,6	53,7
	±U	$\pm 2,1$	$\pm 6,4$

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 $\lambda = 2,1 \cdot 10^{-6} \text{ s}^{-1}$ and $d = 0,49 \text{ mm} = 0,49 \cdot 10^{-3} \text{ m}$.

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.