

Determination of the Radon Diffusion Coefficient and Radon Diffusion Length of a single building entry system

Client: Hauff-Technik GmbH & Co. KG
Robert-Bosch-Straße 9
89568 Hermaringen

Project: Determination of the Radon Diffusion Coefficient and
Radon Diffusion Length of a single building entry system
"ESH PolySafe"

Project number: 190319-07

Contractor: IAF-Radioökologie GmbH

Prepared by: Dipl.-Ing. (BA) R. Baumert

Radeberg, 06. August 2019



Dr. rer. nat. habil. Hartmut Schulz
Managing Director



The accreditation is valid for the measurement results of the radon concentration indoors (SOP 4-02, 2018-11). The assessments made are based on this measurements results.

Wilhelm-Rönsch-Str. 9
01454 Radeberg
Fon +49 (0) 3528 48730-0
Fax +49 (0) 3528 48730-22
E-Mail info@iaf-dresden.de

Managing Directors:
Dr. rer. nat. habil. Hartmut Schulz
Dr. rer. nat. Christian Kunze
Dipl.-Ing. (BA) René Baumert
Trade register: HRB 9185
Register court: Dresden

Bank account:
HypoVereinsbank Dresden
IBAN: DE92 8502 0086 5360 1794 29
SWIFT (BIC): HYVEDEMM496

1 Task

According to the order issued by Hauff-Technik GmbH & Co. KG, the Radon Diffusion Coefficient of the single building entry system "ESH PolySafe" has to be determined by the IAF-Radioökologie GmbH (IAF) and an assessment has to be made regarding the "radon tightness" of the material.

2 Methodological framework

In order to determine the radon diffusion values, the specimen was installed in a two chamber measuring system in such a way that radon can migrate from chamber 1 into chamber 2 only if it traverses the sealing system as a result of a diffusion process. The radon concentration developing in chamber 2 is recorded at one-hour intervals. Depending on the radon tightness of the sealing system, the increase in radon concentration in chamber 2 varies, resulting in a plateau value, which forms a steady state between radon migration from the radon reservoir (chamber 1) through the sealing system and radon decay in the measuring chamber (chamber 2) and thus determines the radon diffusion coefficient D , measured in $[m^2/s]$. The diffusion length L_D of the specimen is given by

$$L_D = \sqrt{\frac{D}{\lambda_{Rn}}},$$

with $\lambda_{Rn} = 2,1 \cdot 10^{-6} / s$ being the radon decay coefficient. The radon diffusion length L_D is the average length a radon atom passes through the test specimen during its half-life. A sealing system is to be rated as "radon-tight" if the material thickness (d) is at least three times its radon diffusion length L_D .

$$R = \frac{d}{L_D} \geq 3,$$

Otherwise the material is rated as "not radon tight".

3 Results and assessment

The radon diffusion length calculated from the measurement results and the results of the "radon tightness" are summarized in Table 1.

Table 1: Results of the test for radon tightness

Sealing material	Material thickness of the specimen [d]	Diffusion coefficient [D]	Diffusion length [L_D]	Test parameter $R = d/L_D$	Result
ESH PolySafe	40 mm	$2.4 \cdot 10^{-10} m^2/s$	10.3 mm	3.9	R > 3, radon-tight