

Test report No. 22 100 1129 - 2

14/11/2022

Customer: ABN Pipe Systems
Parque Empresarial Medina
ON. Autovía A-6, KM 152
47400, Medina del Campo
Spanien

Date of order: 04/07/2022

Receipt of sample: 17/06/2022

Testing until: 17/10/2022

Order

Measuring oxygen permeability at 40°C and 80°C according to DIN 4726

Description of the test object

For measuring oxygen permeability the customer made available 20 m of a floor heating pipe.

Designation:	Heating pipe (PP) DIN CERTCO Coil No2
Colour:	grey
Colour of the marking:	black
Length:	20,0 m
Diameter:	20,0 mm
Wall thickness:	2,8 mm
Marking:	ABN//INSTAL CTFASERRD PP-RCT RP7PP-RCT RP+FV/PP-RCT RP Ø20x2,8 s-3,2 AENOR CC B- s1,d0 001/00646 R.P. Certificado Afiti-Licof (Clase 1/10bar Clase 2/10bar)(20°C/31,7bar/50a) (60°C/17,7bar/50a) DIN 8078:2008-09 11/05/22 HH:MM SF=1,25 NTC 4897 Antimicrobiano

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Deutsche
Akkreditierungsstelle
D-PL-11142-01-01

Test procedure

Measurement of oxygen permeability according to DIN 4726:2008-10 "Hot water surface heaters and radiator connections - plastic pipe and composite pipe systems" Section 5.4 "Oxygen tightness" and BS ISO 17455:2007-06 "Plastic pipe systems - multi-layer composite pipes - Determination of oxygen permeability of the barrier layer" Section 10.2 "Dynamic test method (Method I)".

The measurement is carried out at 40 °C and 80 °C after 24 hours of storage in water at a temperature of 20 °C and subsequent 28 days of storage in a standard climate for plastics at 23 °C and 50 % humidity. The tube to be tested has a length of at least 20 meters, whereby about 10 percent of the total length is wound and fixed according to a specified minimum bending radius.

The following is a list and calculation of the parameters relevant for the test.

with:

- for increase of the oxygen concentration $\Delta c(O_2)$ in $\mu\text{g/l}$
- for volume flow rate \dot{V} in l/h
- for measured atmospheric pressure p in bar
- for standard atmospheric pressure p_0 = 1.013 bar

the oxygen diffusion $I(O_2)$ is calculated by the formula

$$I(O_2) = \Delta c(O_2) \cdot \dot{V} \cdot 24 \cdot 10^{-3} \cdot \frac{p_0}{p} \quad \text{in} \quad \text{mg/d}$$

For an underfloor heating pipe with:

- for outer diameter d = 20 mm
- for wall thickness s = 2.8 mm
- for length of l = 20 m

the area related oxygen diffusion is given by

$$I(O_2)_{\text{flachenbezogen}} = \frac{I(O_2)}{d \cdot \pi \cdot l \cdot 10^{-3}} \quad \text{in} \quad \text{mg}/(\text{m}^2 \cdot \text{d}) \quad (3)$$

Progress of the test

Climate storage at	23 °C	from	08/08/2022	to	05/09/2022
Measurement of oxygen permeability at	40 °C	from	22/09/2022	to	05/10/2022
Measurement of oxygen permeability at	80 °C	from	05/10/2022	to	17/10/2022

Results of the test at 40 °C

Measurement	Air pressure bar	t ¹⁾ °C	t ²⁾ °C	Δc(O ₂) μg/l	\dot{V} l/h	I(O ₂) mg/d	I(O ₂) _{area-based} mg/(m ² · d)
1	0,998	42,2	38,6	< 0,03	6,2	< 0,005	< 0,004
2	1,010	42,1	38,5	< 0,03	6,4	< 0,005	< 0,004
3	1,005	42,2	38,8	< 0,03	6,3	< 0,005	< 0,004
Mean value	1,004	40,4				< 0,005	< 0,004

Results of the test at 80 °C

Measurement	Air pressure bar	t ¹⁾ °C	t ²⁾ °C	Δc(O ₂) μg/l	\dot{V} l/h	I(O ₂) mg/d	I(O ₂) _{area-based} mg/(m ² · d)
1	0,997	84,2	76,0	7,80	12,6	2,400	1,909
2	0,992	84,3	76,1	7,64	12,5	2,342	1,864
3	0,992	84,2	75,7	8,50	12,6	2,628	2,091
Mean value	0,994	80,1				2,457	1,955

Dortmund, 14/11/22

By order

Naczynski
 Official in charge

