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MPA NRW

Materialprüfungsamt Nordrhein-Westfalen

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Test Report

Nr. 31 000 1788
1st Execution

Customer

Georg Fischer Piping Systems AG

Amsler-Laffon-Str.9

CH- 8200 Schaffhausen

date of purchase 20.10.2003

incoming of samples 02.09.2003

free translation from +GF+ Schaffhausen (M.Bulmer)

Order Description

Measurement of oxygen diffusion

Description of Test Object

Grey plastic pipe consisting of Acryl-Butadien-Styrol (ABS)

Number of Samples 1

Sample Identification

+GF+ (Special characters) DEKA ABS 169.017.085 50X3.0 PN10 04/09/02 22

(Dashed line before and after identification)

Description of the Test Fundamentals / Procedure

Measurement of oxygen diffusion without alternating thermal stress load

Dieser Prüfbericht umfasst 4 Seiten
Die Gültigkeit des Prüfberichtes endet am 16.12.2005

Type and Description of Testing Material

The customer supplied a piece of pipe with a length of 5m and plastic brackets to MPA NRW for the testing of oxygen diffusion. From the pipe and the plastic brackets a test sample for installation with measuring fixture was assembled. The plastic pipe, consisting of ABS had no oxygen barrier layer and was marked on the outside as follows:

+GF+ (Special characters) DEKA ABS 169.017.085 50X3.0 PN10 04/09/02 22
(Dashed line before and after identification)

Testing Method

To establish the oxygen diffusion of the pipe, the oxygen content of the water flowing through the pipe was measured before and after the test sample. Measurement was done using the system 2713 from the company Orbisphere Laboratories, Genf.

With

- an increase of oxygen concentration	$\Delta c(O_2)$	in		$\mu g / l$
- a flow velocity	$\dot{V}$	in		l / h
- a measured air pressure	p	in		bar
- the regular air pressure	p_0	=	1,013	bar

The oxygen diffusion flow I(O_2) is calculated according to the formula

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

With a sample pipe as follows:

- an external diameter of	d	=	50,0	mm
- a wall thikness of	s	=	3,0	mm
- a pipe length of	l	=	5,0	m

To the length-related oxygen diffusion flow is calculated according to the following formula

$$I(O_2)_{length-related} = \frac{I(O_2)}{I} \quad \text{in} \quad \text{mg/(m d)}$$

the area-related oxygen diffusion flow according to the following formula

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

the volume-related oxygen diffusion flow according to the following formula

$$I(O_2)_{volume-related} = \frac{I(O_2)}{(d-2s)^2 * \frac{\pi}{4} * l * 10^{-3}} \quad \text{in} \quad \text{g/(m}^3\text{d)}$$

Results

Table 1: Measurement results

Measurement	Air pressure bar	$t^{1)}$ °C	$t^{2)}$ °C	$\Delta c(O_2)$ µg/l	$\dot{V}$ l/h	$I(O_2)$ mg/d
1	0,990	14,4	17,5	13,46	8,36	2,701
2	0,990	14,4	17,6	13,57	8,33	2,713
3	0,991	14,5	17,6	13,62	8,35	2,729
Median		16,0				2,714

1) temperature before the test pipe
2) temperature after the test pipe

Table 2: Calculated oxygen diffusion flows

Measurement	$I(O_2)_{length-related}$ mg/(m d)	$I(O_2)_{area-related}$ mg/(m²d)	$I(O_2)_{volume-related}$ g/(m³d)
1	0,5402	3,439	0,3553
2	0,5426	3,454	0,3568
3	0,5458	3,475	0,3590
Median	0,54	3,5	0,36

The results from the measurement of the oxygen diffusion through +GF+ ABS pipe at a temperature of +16°C, give a volume related value of:

$$I(O_2)_{volume-related} = 0{,}36 g/(m^3 d)$$

Dortmund, 16. Dezember 2003
Im Auftrag

Stettnisch
Sachbearbeiter

Materialprüfungsamt MPA NRW 11 Nordrhein-Westfalen