Edition **No. 7 2014** | 16th June 2014

TECHNEWS

technews@aquatherm.de

aquatherm
state of the pipe

TEST REPORT (NO. 31 000 4814) OF THE MPA/NRW FOR OXYGEN PERMEABILITY OF aquatherm blue pipe MF OT

In the technews 04/2012 we informed about the modified pipe structure of the oxygen-tight pipe aquatherm blue pipe SDR 11 MF OT (then climatherm OT fiber composite pipe). Since then the EVOH-layer is on the outside and the pipe has no more grey stripes.

In our order this new pipe with external oxygen-blocking layer of EVOH and with welded-in fittings was subjected to an oxygen leak test according to DIN 4726 at the Materials Testing Office in NRW (Dortmund).

The entire tested length of the pipes aquatherm blue pipe SDR11 MF OT of the dimension 32 mm was 19.5 m. There was a total of 24 fittings, of which 22 elbows and two transition connectors for application (see figure below).

The measurement of the oxygen permeability at a temperature of 38.7 °C results in a value per unit area of 0.01 mg/(m3 x d). The permissible limit according to DIN 4726 of 0.32 mg (m3 x d) was significantly below (32-fold), despite the use of in relation to the total pipe length high number of non-oxygen-tight fittings.

In summary, this means that an installation consisting of aquatherm blue pipe SDR 11 MF OT in conjunction with aquatherm green pipe fittings is an oxygen-tight system according to DIN 4726.

During processing, the complete removal of the EVOH-layer is required. To ensure this we have presented in the technews 16/2013, the new, innovative and patented universal peeling tool.

Thereby we offer a proven oxygen-tight pipe for the heating, air conditioning and plant construction, which also can be processed quickly and easily through the universal peeling device.

The test certificate from the MPA is enclosed.

The above mentioned technews are in extracts below.

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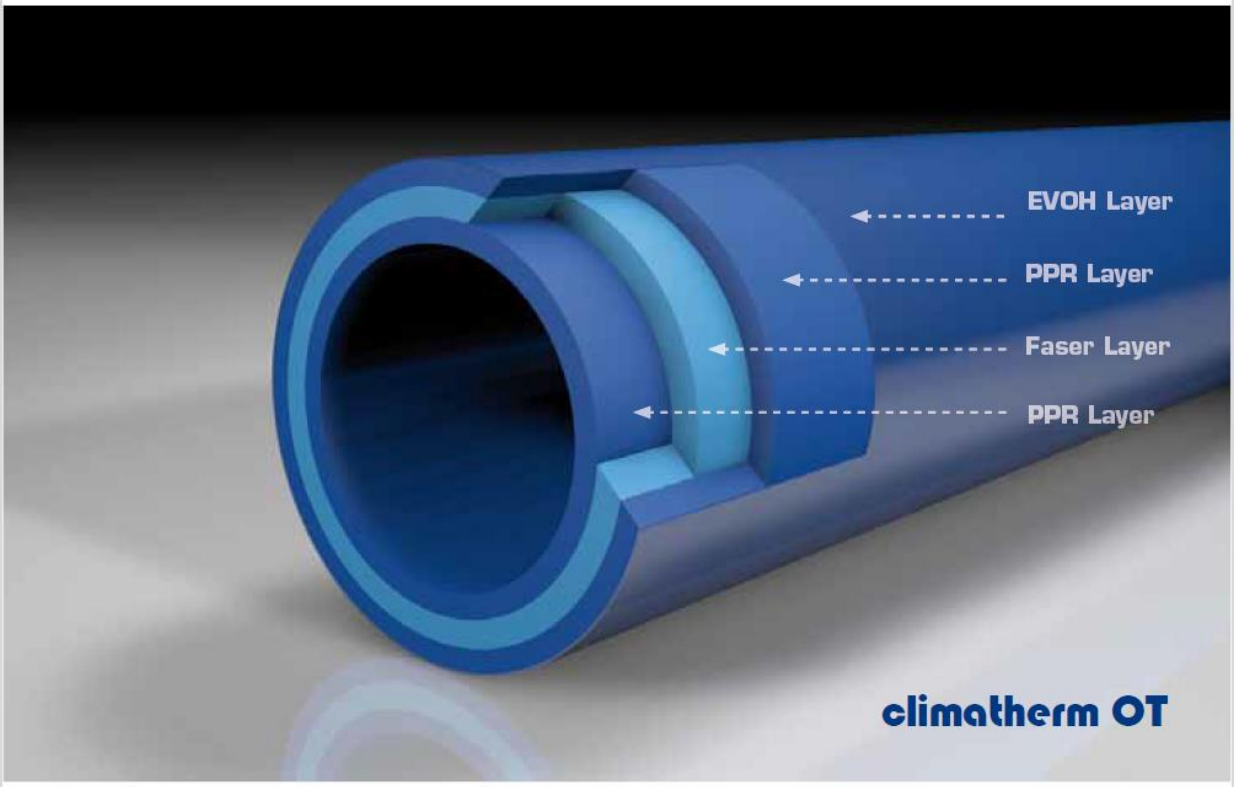
EXTRACT FROM TECHNEWS NO. 4 2012 (RELEASED 11TH JULY 2012)



Product change climatherm OT

The climatherm OT faser composite pipe will have an outside EVOH layer in future. Besides, this production-related change will lead to an even easier and more improved processing. The OT pipe will no longer have grey stripes, but will generally be blue colored. The surface of the outside EVOH layer looks slightly shiny. The current peeling tools can still be used, as usual.

The article numbers remain unchanged. Still available stocks will first of all be delivered so that it will be possible to start the production of the new pipe subsequently. Due to the various stocks, the entire product group (all dimensions) cannot be changed at one point of time. Thus, pipes of the previous and new type will be delivered during the transitional phase. Both types can be processed with one another. It will be tried to avoid mixed deliveries within one dimension. As of now, the 32 mm climatherm OT pipe will be delivered in the new version only.

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EXTRACT FROM TECHNEWS NO. 16 2013 (RELEASED 9TH OCTOBER 2013)

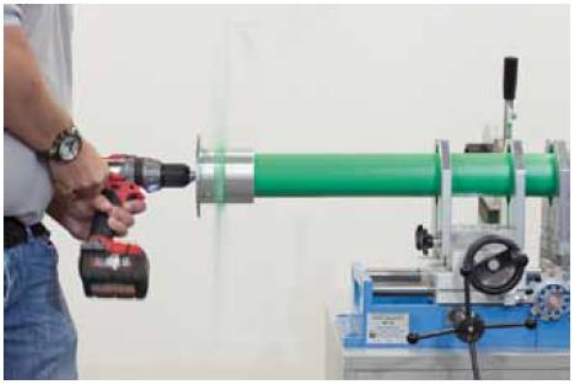
NEW AQUATHERM UNIVERSAL PEELING TOOLS

From now on aquatherm offers new universal peeling tools.

By using the aquatherm universal peeling tools the end pieces of the aquatherm OT (oxygen tight), UV (UV resistant) and MS (multilayer stabi) pipes can be peeled. By the uniform removal of the outer layer of the pipe any extension of the pipe system by electrofusion socket or fitting is possible. The universal peeling tools are available in the sizes Ø 20- Ø 125 mm (Art.-No. 50479 – 50488). The peeling process is done either mechanically or manually. For the mechanical processing two attachment plates for pipe sizes Ø20- Ø63 mm (Art.-No. 50499) and Ø75- Ø125 mm (Art.-No. 50500) are available. For the mechanically processing of the electrofusion sockets the peeler is extended by an attachment (Art.-No. 50489 – 50498). The power drill should have a high torque.

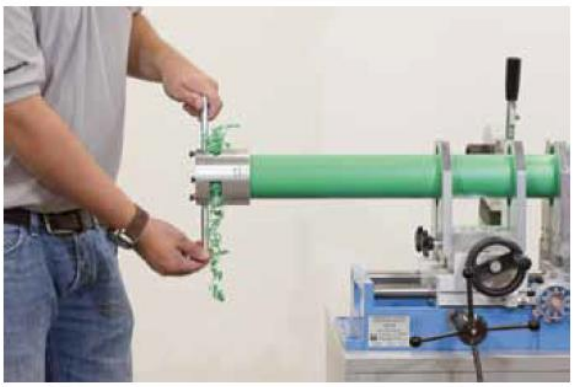
First the current stock of the old peeling tools has to be sold.

▲ Universal peeling tool (here: 75mm, Art.-No. 50485) and extension (here: 75mm, Art.-No. 50495)



▲ Mechanical peeling process: Peeling tool with attachment plate

▼ Manual peeling: Peeling tool with handles (enclosed)



MPA NRW.
Materialprüfungsamt Nordrhein-Westfalen
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Test report

No. 31 000 4814

1st Issue

Customer

Aquatherm GmbH
Biggen 5
57439 Attendorn

Date of order December 16th 2013
Receipt of sample December 16th 2013

Order

Measurement of oxygen permeability

Description of the test object

Blue fiber composite pipe with aquatherm green pipe angle connected

Number of samples 1

Marking of the sample

aquatherm blue pipe SDR7,4 MF OT (Climatherm OT Faserverbundrohr) "Abmessung 32 x 4,4mm" Art.Nr.:"2170712" PP-R/PP-R-GF/PP-R Tmax = 90°C DIN 4726 "sauerstoffdicht / oxygen tight" NSF Industrial [CSA B137.11] ASTM F2389 metric ICC ESR-1613 PMG 1014 Achtung: Rohr vor dem Verschweissen abschälen! / Attention: Peel pipe before welding! (2170712) Date Time Masch.Nr. Charge Made in Germany / For a safe connection use only original aquatherm fittings!

Description of the test/regulations according to

Measurement of oxygen permeability at 40 ° C.

This test report includes 5 pages

Specification of the test object

For measuring the oxygen permeability, the client provided the MPA NRW with a heating panel of approx 1,500 mm x 1,000 mm x 120 mm (LxWxH). The heating panel consisted of rigid pipes and connectors with an ½ inch threat inside. The pipes were connected in serpentines by butt welding. Picture 1 shows the heating panel provided. When producing the panel, the following number of pipe sections were installed with the lengths mentioned:

Description	Number	Length[1)]
Pipe	12	1460 mm
Pipe	11	175 mm
Elbow 90°	22	
Connector ½"	2	

1) Length without push-in depth from elbow to elbow

For the determining the total length, the distance of the centre line between two parallel pipe sections was measured. The addition of the lengths of all pipe sections amounted to a length of 19.5 m for the heating panel.

Picture 1 Heating panel

The blue pipe consisting of PP-R/PP-R-GF/PP-R, according to the information of the client, The pipe was marked at its outside in black letters as follows:

aquatherm blue pipe SDR7,4 MF OT (Climatherm OT Faserverbundrohr) "Abmessung 32 x 4,4mm" Art.Nr.:"2170712" PP-R/PP-R-GF/PP-R Tmax = 90°C DIN 4726 "sauerstoffdicht / oxygen tight" NSF Industrial [CSA B137.11] ASTM F2389 metric ICC ESR-1613 PMG 1014 Achtung: Rohr vor dem Verschweissen abschälen! / Attention: Peel pipe before welding! (2170712) Date Time Masch.Nr. Charge Made in Germany / For a safe connection use only original aquatherm fittings!

Test procedures

For determining the oxygen permeability of the pipe, the contents of oxygen of a low-oxygen water was measured before and after the flow through the pipe. For detection the oxygen content an Orbisphere 2713 oxygen analyser made by Hach Lange GmbH, Düsseldorf., Lich was used.

With using

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

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

$$I(O_2) = \Delta c(O_2) \cdot \dot{V} \cdot 24 \cdot 10^{-3} \cdot \frac{p_0}{p} \quad \text{in} \quad \text{mg/d} \qquad (1)$$

If

– d =	32	mm	for outer diameter
– s =	4.4	mm	for wall thickness
– l =	19.5	m	for length of

is used

the length related oxygen diffusion is given by

$$I(O_2)_{\text{based on length}} = \frac{I(O_2)}{l} \qquad \text{mg/(m • d)} \qquad (2)$$

the area related oxygen diffusion is given by

$$I(O_2)_{\text{based on area}} = \frac{I(O_2)}{d \cdot \pi \cdot l \cdot 10^{-3}} \qquad \text{mg/(m}^2 \text{ • d)} \qquad (3)$$

the volume related oxygen diffusion is given by

$$I(O_2)_{\text{based on volume}} = \frac{I(O_2)}{(d-2s)^2 \cdot \pi/4 \cdot l \cdot 10^{-3}} \qquad \text{g/(m}^3 \text{ • d)} \qquad (4)$$

Result

The measurement of the oxygen permeability was effected between March, 31th and April, 11th 2014.

Table 1: Measurement results

Measurement No.	Air pressure bar	$t^{1)}$ °C	$t^{2)}$ °C	$\Delta c(O_2)$ µg/l	$\dot{V}$ l/h	$I(O_2)$ mg/d
19	1.003	42.0	35.5	0.09	8.77	0.019
20	1.002	42.0	35.5	0.09	8.77	0.019
21	1.001	42.0	35.4	0.10	8.77	0.021
Mean value		38.7				0.020

1) Water temperature before entering the pipe
2) Water temperature after leaving the pipe

Table 2: Calculated oxygen permeability

Measurement No.	$I(O_2)_{based\ on\ length}$ mg/(m • d)	$I(O_2)_{based\ on\ area}$ mg/(m² • d)	$I(O_2)_{based\ on\ volume}$ g/(m³ • d)
19	0.00097	0.0097	0.0023
20	0.00097	0.0097	0.0023
21	0.00108	0.0107	0.0025
Mean value	0.00101	0.0100	0.0024

The measurement of the oxygen permeability revealed for the pipe assembly to be tested, at a temperature of 40.6 °C, an oxygen permeability related to volume of

$$I(O_2)_{based\ on\ volume} = 0.0024\ g/(m^3\ d)$$

Dortmund, April, 15th 2014

By order

i.V.

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Vice Head of the Testing Laboratory