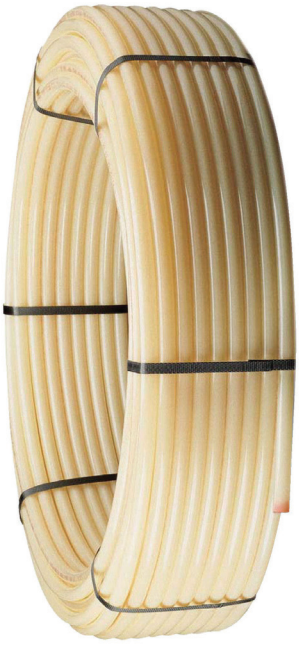

Rev. 01/2023

RBM KILMA-FLEX PE-Xc PIPE

Floor heating / sanitary.

Rev. 01/2023

RBM KILMA-FLEX PE-Xc PIPE

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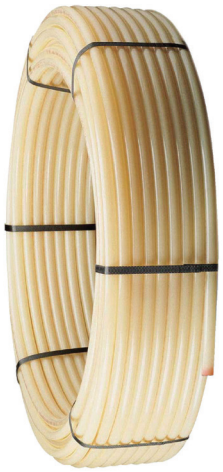


PRODUCTION RANGE

Code	External diameter [mm]	Thickness [mm]	V water [m/s]	Water volume per metre of pipe [litres/metre]	Maximum operating pressure* [bar]	Roll length [m]
464.08.02	8	1	Refer to the pressure drops diagram on the last page.	0,028	8 (class 1, 2 and 5) 10 (class 4)	1000
464.10.12	10	1,2		0,045	8 (class 2 and 5) 10 (class 1 and 4)	120
464.10.02	10	1,2		0,045	8 (class 2 and 5) 10 (class 1 and 4)	1000
464.12.02	12	2		0,050	10 (class 1, 2, 4 and 5)	240
464.16.02	16	2		0,113	8 (class 5) 10 (class 1, 2 and 4)	120
464.16.12	16	2		0,113	8 (class 5) 10 (class 1, 2 and 4)	240
464.16.22	16	2		0,113	8 (class 5) 10 (class 1, 2 and 4)	600
464.17.12	17	2		0,133	8 (class 2 and 5) 10 (class 1 and 4)	120
464.17.02	17	2		0,133	8 (class 2 and 5) 10 (class 1 and 4)	240
464.17.22	17	2		0,133	8 (class 2 and 5) 10 (class 1 and 4)	600
464.18.02	18	2		0,154	8 (class 1, 2 and 5) 10 (class 4)	240
464.20.02	20	2		0,201	6 (classi 2 and 5) 8 (classi 1 and 4)	240
464.20.32	20	2		0,201	6 (class 2 and 5) 8 (class 1 and 4)	500
464.25.02	25	2,3		0,327	6 (class 1, 2 and 5) 8 (class 4)	240
464.25.22	25	2,3		0,327	6 (class 1, 2 and 5) 8 (class 4)	310

* Working pressure may vary according to the class of product use: for further details, consult the relative section of this sheet.

Field of application	Thermal conductivity	Modulus of elasticity	Pipe roughness (Ra)
+5 ÷ +100 °C	0,41 W/mK	> 600 MPa	1,0 µm

DESCRIPTION

The **RBM KILMA-FLEX PE-Xc** pipe is made a product made up of three layers:

- The **innermost layer**, made of **PE-Xc** (high density polyethylene crosslinked according to the "C" method with β type rays) has an extremely smooth surface and allows to drastically reduce pressure drops compared to the traditional metal pipe used in the plumbing industry.
- The **outer layer**, made of **EVOH** (ethylene-vinyl-alcohol), is a barrier of some tens of μm which makes the pipe practically impermeable to oxygen**, allowing a drastic reduction of corrosive problems in heating systems where the plastic pipes are combined with materials sensitive to such phenomena.
- The **intermediate layer** is instead a very thin layer of polymeric material (highly adhesive) that keeps together the two layers described above.

The product complies with standard **EN ISO 15875-2***** "Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X)" and with standard **DIN 4726** relating to the requirements on oxygen impermeability of the EVOH barrier and minimum radii of curvature of the pipes.

Moreover the **RBM KILMA-FLEX PE-Xc** pipe complies with the **Ministry of Health Decree no. 174 of 6 April 2004** ("Regulation of materials and objects that can be used in stationary water collection, treatment, supply and distribution systems intended for human consumption "- published on 17 July 2004 in the Official Gazette General Series No. 166).

The tests that ensure compliance with the above, are regularly conducted at the **SKZ laboratories** (German Certification Institute) and Plastics Testing Laboratory Foundation of the **Politecnico di Milano**.

THE PURPOSE

The **RBM KILMA-FLEX PE-Xc** pipe is designed to convey water and other hot fluids under pressure.In particular, the product has been designed to allow an ideal application when it is laid entirely underground, for example, within concrete screeds.

THE USE

The **RBM KILMA-FLEX PE-Xc** pipe is perfect for use in radiant floor and wall heating systems.

In fact in these systems the pipe must be completely "drowned" in the concrete screed and, thanks to the high modulus of elasticity that distinguishes it, the (new) product enables perfect containment of any stresses generated in the wall due to the impediment (caused by laying the pipe underground) of the length variations that would occur within the temperature gradients applied.

However the special features of the product:

- the anti-oxygen barrier;
- high durability;
- high resistance to temperatures close to 100 °C (in case of malfunction);
- extremely low roughness (that involves often negligible pressure drops);
- non-toxicity (which enables to use it with alimentary fluids and drinking water);
- lightness, flexibility and its resistance to scratches.

make the product competitive compared to the traditional metal pipe; in fact, ever more frequently, the **RBM KILMA-FLEX PE-Xc** pipe is preferred in the construction of plumbing distribution systems and heating systems with radiators or fan convectors.

** The amount of oxygen that, at a temperature of 40 °C, goes through the pipe in one day, does not exceed 0.1 grams per cubic metre.

*** Except for 8x1 mm (code 464.08.02) and 10x1.2 mm diameters (code 464.10.X2), which are certified by SKZ in compliance with specification HR 3.2

EXAMPLE OF MARKING

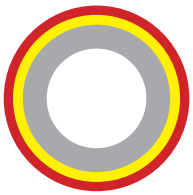
The directions are provided only to allow a quick read of the product features: marking may be different from that indicated as an example

RBM KILMA-FLEX PE-Xc EVOH Ø17X2.0 C –SKZ X 000 EN ISO 15875-2 – Application class 1/10 bar, 2/8, bar, 4/10 bar, 5/8 bar – oxygen barrier complying with DIN 4726 – Lämmitysputki – XX00X – Made in Swiss – (- -)/(- -)/(- -) – (- -):(- -) – X.00.0000.00 – 000m – >I<

RBM KILMA-FLEX	Manufacturer name and commercial brand
PE-Xc EVOH	Type "C" crosslinked polyethylene with oxygen barrier
Ø17X2.0 C	External diameter and wall thickness; size class: C
SKZ X 000	Indicates that compliance with the Standard is guaranteed by the "SKZ" Institute and identification no. released by SKZ
EN ISO 15875-2	Reference Standard
Application class	Application class (consult the relative section of this sheet)
Oxygen barrier complying with DIN 4726	Impermeability to oxygen has been tested in compliance with DIN 4726
XX00X	Alphanumeric anti-fraud code
Made in Swiss	Identifies the country of production
(- -)/(- -)/(- -) – (- -):(- -)	Date of production and time of production
X.00.0000.00	Batch No.
000m – >I<	No. of metres

CONSTRUCTION FEATURES

Type of pipe



Innermost layer:	PE-Xc pipe
Intermediate layer:	adhesive surface made of polymeric material
Outer layer:	EVOH anti-oxygen barrier

TECHNICAL FEATURES (FIRST PART)

Dimensions [mm]	8x1	10 x 1,2	12 x 2	16 x 2	17 x 2	18 x 2	20 x 2	25 x 2,3
Weight per metre of pipe [Kg/m]	0,023	0,034	0,064	0,089	0,096	0,100	0,115	0,170

Properties		Value	Unit of measure
Volumic mass (Density) at 23 °C		946	Kg/m^3
Field of application		+5 ÷ +100	°C
Transportable fluids		As the pipe is non-toxic and thus compliant with Ministerial Decree no. 174/2004, it enables the conveyance of water intended for human consumption*. Moreover, in general, the pipe can convey all fluids that meet the requirements imposed by standard ISO 15875 and that are also compatible with the pipe composition material (in this regard refer to technical report ISO/TR10358: "Plastics pipes and fittings – Combined chemical – resistance classification table).	
Roughness of the pipe (Ra according to DIN EN ISO 4287, ASME B46.1)		1,0	µm
Thermal conductivity		0,41	$\frac{W}{m \times K}$
Thermal expansion coefficient		0,15	$\frac{mm}{m \times °C}$
Oxygen permeability at 40 °C (Barrier testing is carried out by a verification system within the company)	(reference: DIN 4726)	≤ 0,1	$\frac{g}{m^3 \times d}$
	(reference: ISO 17455)	≤ 0,32	$mg/m^2 \times d$
Crosslinking degree (verification as described in EN ISO 15875-2)		≥ 60	%
Elasticity modulus		> 600	MPa
Internal tensions over the length (verification as described in EN ISO 15875-2)		≤ 3	%
Yield stress		≈ 24	MPa
Minimum allowable bending radius** (reference: DIN 4726)		5d	mm
Elongation at break		≥ 500	%
Internal pressure resistance (verification as described in EN ISO 15875-2)			
At 20 °C with σ=12.0 MPa stress		≥ 1	hour
At 95 °C with σ=4.7 MPa stress		≥ 22	hours
At 95 °C with σ=4.6 MPa stress		≥ 165	hours
At 95 °C with σ=4.4 MPa stress		≥ 1000	hours
Inspection of the appearance and size of the tube		The verification is carried out in compliance with EN ISO 15875-2, via an ultrasound system, with lasers and manually.	
Inspection of defects in the pipe wall		Carried out during the crosslinking process.	
Recommendations for product storage		The pipe is supplied in packages that protect it during the storage period: the product has been stabilised against ultraviolet rays but its exposure over extended periods of time would damage it irreparably, **therefore it should not be exposed to direct sunlight.**	

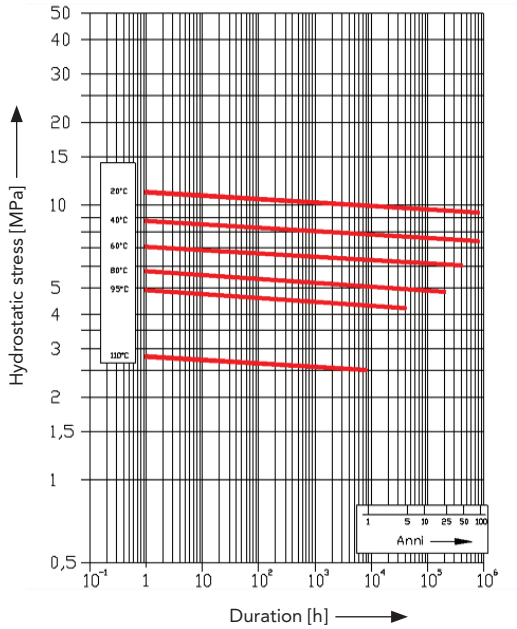
* By water intended for human consumption one means treated or untreated water, for drinking, preparing food and drinks, or other domestic purposes, regardless of their origin, whether supplied via a distribution system, using tanks, bottles or containers; including water used in a food business for manufacturing, processing, storage or marketing of products or substances intended for human consumption*. For further details please refer to the relative legislation in force and particularly to the rules and decrees mentioned.

** One refers to the minimum radius measured on the axis plane of the pipe in the curvature point; also by d one refers to the average outer diameter of the pipe.

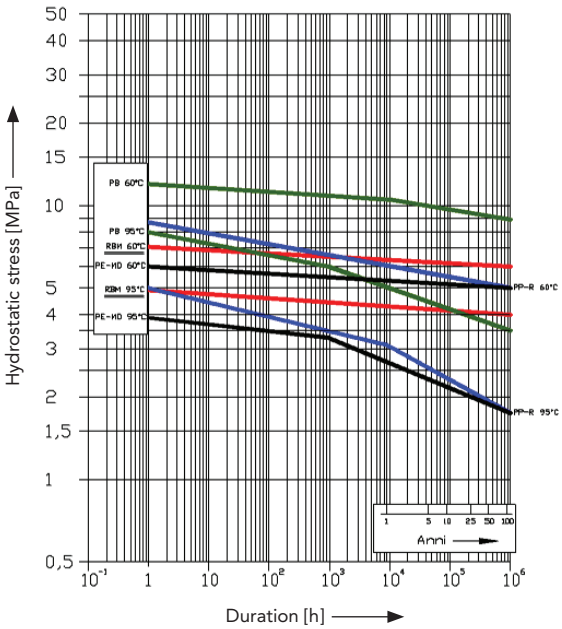
TECHNICAL FEATURES (SECOND PART)

Diagrams of regression: of the sole RBM KILMA-FLEX PE-Xc pipe and RBM pipe compared to PP-R, PB or PE-MD pipes

Graph 1
Diagram made according to EN ISO 15875-2



Graph 2
Regression curves compared: PE-Xc, PP-R, PB, PE-MD



The graphs above show the regression curves relating to circumferential stresses σ in the **RBM KILMA-FLEX PE-Xc** pipes.

Graph 2 compares the curves relative to RBM (shown in red) pipes made of PP-R (in blue), PB (in green) and PE-MD (in black).

As one can notice, the regression curves of RBM pipes do not have the typical "knee" of regression curves of pipes made of PP-R, PB or PE-MD thus allowing linear extrapolation. Until not long ago, moreover, these diagrams were essential for calculating (by means of simple mathematical formulas) the maximum working pressure in the face of certain conditions of use.

With the new legislation, however, regression graphs are used only to provide qualitative indications, while for quantitative information, one can use the following tables:

Code	Dimension	Operating pressure [bar] For application class*			
		Class 1	Class 2	Class 4	Class 5
464.08.02	8 x 1	8	8	10	8
464.10.X2	10 x 1,2	10	8	10	8
464.12.02	12 x 2	10	10	10	10
464.16.X2	16 x 2	10	10	10	8
464.17.X2	17 x 2	10	8	10	8
464.18.02	18 x 2	8	8	10	8
464.20.X2	20 x 2	8	6	8	6
464.25.X2	25 x 2,3	6	6	8	6

Application Class**	Operating conditions for a duration of 50 years and 100 hours of which	Application Class
1 ***	49 years at the operating temperature (T_D) of 60 °C, 1 year at the maximum temperature (T_{max}) of 80 °C and 100 hours at the malfunction temperature (T_{mal}) of 95 °C	Hot water supply (60 °C)
2 ***	49 years at the operating temperature (T_D) of 70 °C, 1 year at the maximum temperature (T_{max}) of 80 °C and 100 hours at the malfunction temperature (T_{mal}) of 95 °C	Hot water supply (70 °C)
4	2.5 years at the operating temperature (T_D) of 20 °C, 20 years at the working temperature (T_D) of 40 °C, 25 years at the working temperature (T_D) of 60 °C, 2.5 years at the maximum temperature (T_{max}) of 70 °C and 100 hours at the malfunction temperature (T_{mal}) of 100 °C	Floor heating and radiators at low temperature
5	14 years at the operating temperature (T_D) of 20 °C, 25 years at the working temperature (T_D) of 60 °C, 10 years at the working temperature (T_D) of 80 °C, 1 years at the maximum temperature (T_{max}) of 90 °C and 100 hours at the malfunction temperature (T_{mal}) of 100 °C	Floor heating and radiators at low temperature

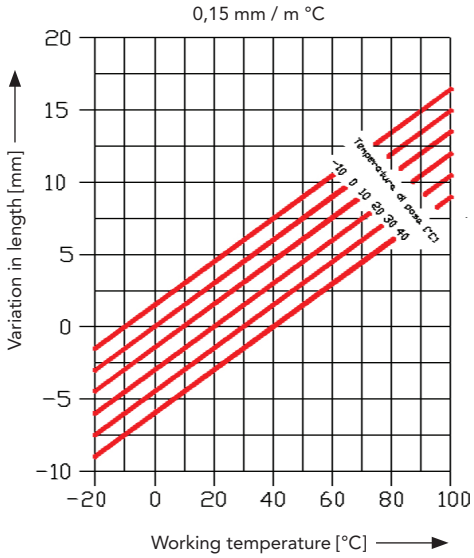
* The classification by application classes is obtained from standard ISO 15875 which we invite to refer to for further details.

** All systems which satisfy the conditions of any of the application classes listed above, are also used for conveying cold water at 20°C for a period of 50 years and at a working pressure of 10 bar.

*** The operating temperature is in compliance with national laws.

Linear thermal expansion diagram

Graph 3
Expansion of 1 m of RBM KILMA-FLEX PE-Xc pipe



This diagram takes into account the linear dilation of 1 m of pipe (measured at laying temperature T_{posa}), as soon as it is put into operation.

Variations in length were calculated using the renowned formula:

$$\Delta L = \alpha \times L_{posa} \times (T_{esercizio} - T_{posa})$$

Where

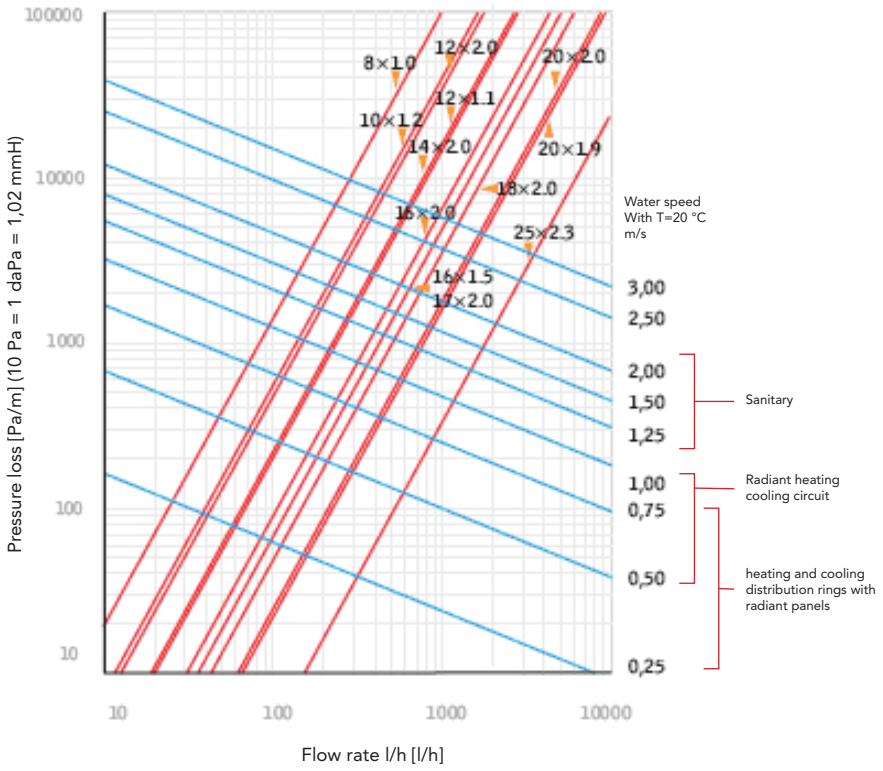
ΔL is the variation in length of the pipe in mm;
α is the linear dilation coefficient (0,15 $\frac{mm}{m\ °C}$)
L_{posa} is the length of the pipe at laying temperature (1 m);
T_{posa} is the temperature at which the pipe is installed;
$T_{esercizio}$ is the temperature at which the pipe is used.

Please note that, for chased parts of the system, the effect of expansion is negligible since, as the pipe is unable to dilate, it absorbs this effect autonomously.

Furthermore, as already said in the description of the product, thanks to the high modulus of elasticity, the new pipe enables perfect containment of the stresses generated in the wall.

Perdite di carico nei tubi RBM KILMA-FLEX PE-Xc percorsi da acqua in condizioni ambiente (T=293,16 K; P=1 atm)

Graph 4
Pressure drops in the RBM KILMA-FLEX PE-Xc pipe



D [mm]	Di [mm]	Kv [m³/h]
8x1	6,0	1,00
10x1,2	7,6	1,67
12x2	8,0	1,75
16x2	12,0	4,40
17x2	13,0	5,10
18x2	14,0	6,16
20x2	16,0	8,90
25x2,3	20,4	22,00

* pressure loss expressed in "Pa per linear meter of pipe"

RBM spa reserves the right to improve and change the described products and related technical data at any moment and without prior notice: always refer to the instructions attached with the supplied components; this sheet is an aid, should the instructions be extremely schematic. Our technical office is always at your disposal for any doubt, problem or explanation.

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