UNDERFLOOR HEATING

KILMA-FLEX PIPE PE-Xa

CT2009.0_03
EN
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PRODUCTION RANGE

Code	External diameter [mm]	Thickness [mm]	Water.V [m/s]	Volume of water per metre of pipe [litres/metre]	Maximum operating pressure* [bar]	Roll length [m]
2009.17.02	17	2	See the head loss diagram on the last page.	0.133	6 (classes 4 and 5)	600
2009.20.02	20	2		0.201	6 (classes 4 and 5)	500

Field of application	Thermal conductivity	Modulus of elasticity	Pipe roughness (Ra)
+5 to +90°C	0.41 W/mK	> 600 MPa	1.0 µm

DESCRIPTION

The *RBM Kilma-Flex* pipe is a product consisting of three layers:

- The *inner layer*, made of *PE-Xa* (high-density polyethylene cross-linked according to the "A" method with peroxides), has an extremely smooth surface that allows a drastic reduction in head loss compared to the traditional metal pipe used in the heating and plumbing sector.
- The *outer layer*, in *EVOH* (ethylene-vinyl-alcohol), is a barrier of a few tens of µm which makes the pipe practically impermeable to oxygen**, allowing a drastic reduction of corrosion problems in heating systems where the plastic pipes are combined with materials susceptible to such phenomena.
- The *intermediate layer* is instead a very thin layer of polymeric material (highly adhesive) that keeps the layers described above together.

The product complies with standard *EN ISO 15875-2* ("Plastics piping systems for hot and cold water installations") and with standard *DIN 4726* (regarding requirements on the oxygen permeability of the EVOH barrier and on minimal radial curvature of the pipes) and with standard EN 1264 standard ("Water-based heating and cooling systems embedded into the enclosure surfaces").

PURPOSE

The *RBM Kilma-Flex* pipe was designed to convey water and other pressurised hot fluids.
In particular, the product was conceived to allow for an ideal application when it is completely buried, for example, within concrete screeds.

USE

The *RBM Kilma-Flex* pipe is perfect for radiant floor and wall heating systems.
In such systems, indeed, the pipe must be completely "sunken" in the concrete screed and, thanks to the high modulus of elasticity that characterises it, the product (new) allows perfect containment of any stresses generated in the wall due to the impediment (caused by burying the pipe) of the variations of length that would be recorded in temperature gradients application.

However, the particular features of the product:

- the oxygen barrier;
- the lengthy duration;
- the high resistance (also to temperatures nearing 100°C);
- the very low roughness (which entails head loss that is often insignificant);
- the lightness, flexibility and resistance to scratches;

make the product competitive compared to the conventional metal pipe; in fact, more and more frequently, the RBM Kilma-Flex pipe is preferred for setting up heating systems with radiators or fan coil units.

* The operating pressures may vary with variation of the product's class of use: for further details, refer to the relative section of this technical data sheet.

** At a temperature of 40°C, the amount of oxygen that bypasses the pipe in a day is no more than 0.1 grams per cubic metre.

CONSTRUCTION FEATURES

Type of pipe	PE-Xa EVOH  ADHESIVE	- Inner layer: pipe in PE-Xa; - Middle layer: adhesive surface in polymeric material; - Outer layer: oxygen barrier in EVOH.

TECHNICAL FEATURES (First Part)

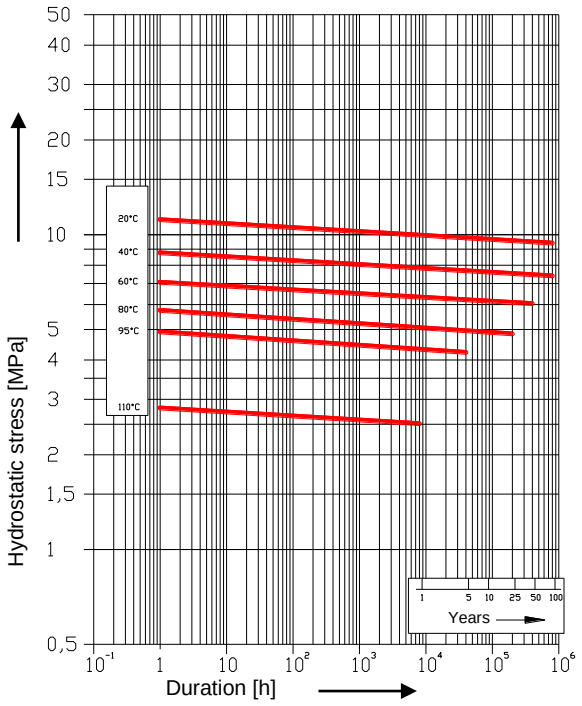
Dimensions	[mm]	17 x 2	20 x 2
Weight per metre of pipe	[Kg/m]	0.094	0.118

Properties	Value	Unit of measure
Field of application	+5 to +90	°C
Transportable fluids	In general, all fluids that meet the requirements imposed by ISO 15875 Standard and are also compatible with the composition material of the pipe are transportable (in this regard see the technical report ISO/TR 10358: "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	$\frac{W}{m \times K}$
Coefficient of thermal expansion	0.14	$\frac{mm}{m \times °C}$
Oxygen permeability at 40°C (Barrier check is performed by a verification system within the company)	≤ 0.1	$\frac{g}{m^3 \times d}$
Degree of cross-linking (tested as specified in EN ISO 15875-2)	≥ 70	%
Modulus of elasticity	> 600	MPa
Internal stress on the length (tested as indicated in EN ISO 15875-2)	≤ 3	%
Minimum bend radius allowed* (reference: DIN 4726)	5d	mm
Check of the appearance and dimensions of the pipe	The test is performed according to EN ISO 15875-2 using an ultrasound system, manually and with a camera.	
Recommendations for product storage.	The pipe is supplied in packaging to protect it during the storage period: the product has been stabilised against ultraviolet rays, but continuous exposure over time will damage it irreparably, **therefore it must not be exposed to direct sunlight.**	

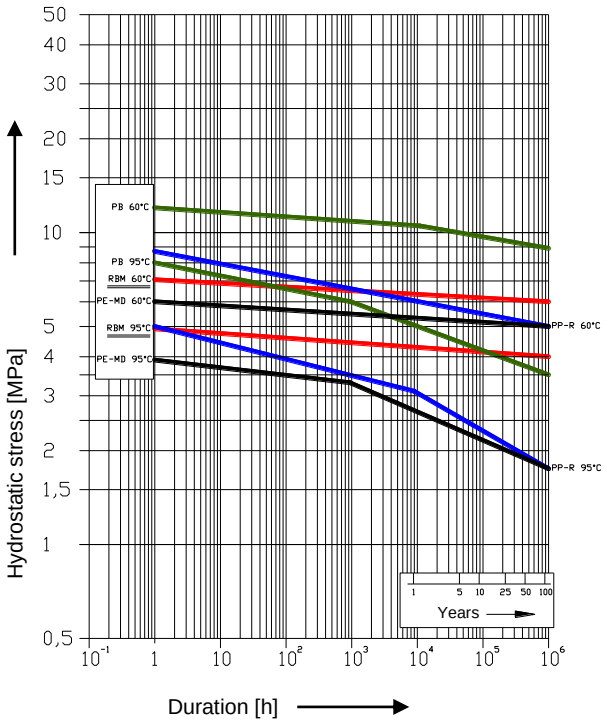
* Means the minimum radius measured on the plane of the pipe axis at the point of curvature; furthermore, d refers to the external diameter of the pipe.

TECHNICAL FEATURES (Second Part)

Diagrams of regression: of only the RBM Kilma-Flex pipe (PE-Xa) and RBM pipe compared to PP-R, PB or PE-MD pipes



Graph 1 - Diagram according to EN ISO 15875-2



Graph 2 - Compared regression curves: PE-Xa, PP-R, PB, PE-MD

The above graphs show the regression curves relative to the circumferential stress σ in the RBM Kilma-Flex pipes in PE-Xa. Graph 2 compares the curves relative to the RBM Kilma-Flex PE-Xa pipes (shown in red), PP-R pipes (in blue), PB pipes (in green) and PE-MD pipes (in light blue).

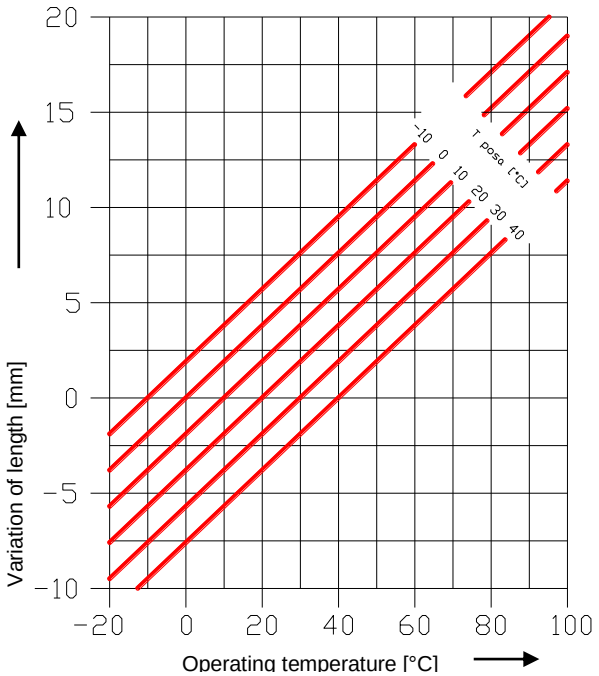
As can be noted, the regression curves of the RBM pipes do not have the "knee" feature of the PP-R, PB or PE-MD pipes regression curves and allow for linear extrapolation.
Until not long ago, moreover, these diagrams were necessary to calculate (by means of simple mathematical formulas) the maximum operating pressure against certain conditions of use.
Under the new legislation, however, the regression graphs are used only to provide qualitative indications, whilst to have quantitative information, the following tables can be used:

Code	Size	Operating pressure [bar] For application class*	
		Class 4	Class 5
2009.17.02	17 x 2	6	6
2009.20.02	20 x 2	6	6

Application Class **	Operating conditions for a period of 50 years and 100 hours of which	Field of Application
4	2.5 years at operating temperature (T_D) of 20°C, 20 years at operating temperature (T_D) of 40°C, 25 years at operating temperature (T_D) of 60°C, 2.5 years at maximum temperature (T_{max}) of 70°C and 100 hours at malfunction temperature (T_{mal}) of 100°C	Low temperature underfloor heating and radiators
5	14 years at operating temperature (T_D) of 20°C, 25 years at operating temperature (T_D) of 60°C, 10 years at operating temperature (T_D) of 80°C, 1 year at maximum temperature (T_{max}) of 90°C and 100 hours at malfunction temperature (T_{mal}) of 100°C	High temperature underfloor heating and radiators

* The classification per application class is obtained by Standard ISO 15875 to be referred to for further details.
** All systems which satisfy the conditions of any of the above listed application classes are also usable for conveying cold water at 20°C for a period of 50 years and at an operating pressure of 10 bar.

Linear thermal expansion diagram



Graph 3 – Expansion of 1 m of RBM Kilma-Flex PE-Xa pipe

The diagram considers the linear expansion of 1 m of pipe (measured at a laying temperature of T_{laying}), as soon as it is put into operation.

The variations in length were calculated using the known formula:

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

Where:

ΔL is the variation in length of the pipe in mm;

α is the linear expansion coefficient (0.14 $\frac{mm}{m°C}$);

L_{posa} is the length of the pipe at the laying temperature (1 m);

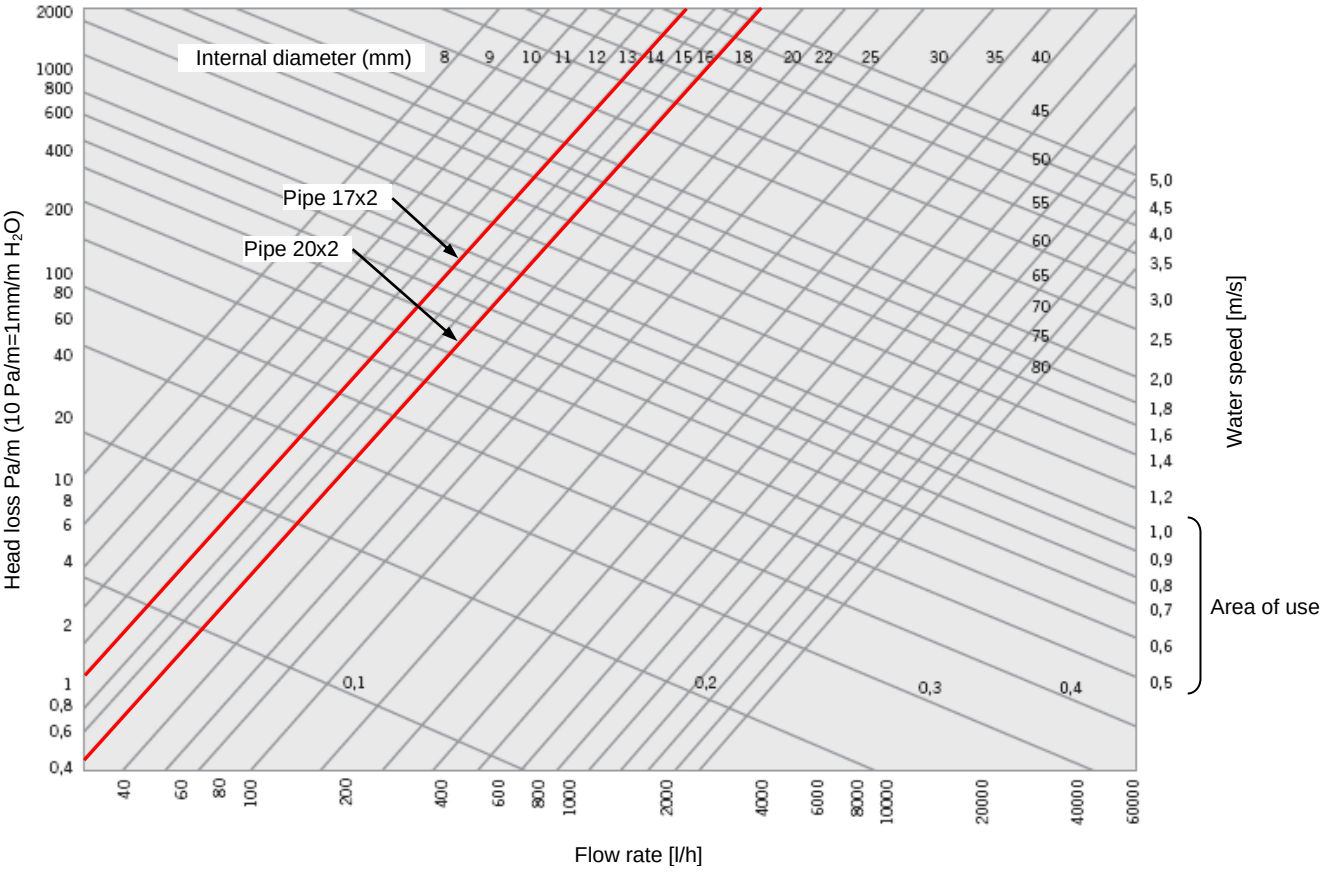
T_{posa} is the temperature at which the pipe is installed;

$T_{esercizio}$ is the temperature at which the pipe is used.

Please remember, however, for the parts of the system that are ducted, the expansion effect is insignificant because, as the pipe is unable to dilate, it autonomously absorbs this effect.
Furthermore, as already mentioned in the description of the product, thanks to the high modulus of elasticity, the new pipe allows perfect containment of the stresses generated in the wall

FLUID DYNAMICS FEATURES

Head loss in the RBM Kilma-Flex PE-Xa pipes new water routes in environmental conditions (T=293.16 K; P=1 atm)



Graph 4 – Head loss in the RBM Kilma-Flex PE-Xa pipe