Rev. 08/2021

KILMA HI PERFORMANCE PLUS PIPE

Floor heating/plumbing.

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PRODUCTION RANGE

Code	External diameter	Thickness	Water V	Water volume per metre of pipe	Maximum operating pressure*	Coil length
	[mm]	[mm]	[m/s]	[liter/metre]	[bar]	[m]
2517.17.12	17	2	Please refer to the pressure loss diagram on the last page.	0,133	8 (classes 1, 2 and 4) 6 (class 5)	120
2517.17.02	17	2		0,133	8 (classes 1, 2 and 4) 6 (class 5)	240
2517.17.22	17	2		0,133	8 (classes 1, 2 and 4) 6 (class 5)	600
2517.20.02	20	2		0,201	6 (classes 1, 2, 4 and 5)	240
2517.20.32	20	2		0,201	6 (classes 1, 2, 4 and 5)	500
2517.25.02	25	2,3		0,327	6 (classes 1, 2 and 4) 4 (class 5)	240
2517.25.22	25	2,3		0,327	6 (classes 1, 2 and 4) 4 (class 5)	310

* Operating pressures may change when the product application class changes: please refer to the relevant section in this sheet for further details.

Application field	Heat conductivity	Elasticity coefficient	Pipe roughness (Ra)
+5 ÷ +100°C	0,40 W/mK	645 MPa	1,0 µm

DESCRIPTION

The **KILMA HI PERFORMANCE PLUS** pipe consists of four layers:

- The **innermost laye**r is in **Polyethylene of Raised Temperature Resistance** (non-reticulated polyethylene of raised temperature resistance), has an extremely smooth surface and reduces pressure drops dramatically in comparison with traditional metal pipes used in the plumbing sector.
- The two **intermediate layers** consist of one layer of adhesive material and of one **EVOH** (ethylen-vynyl-alcool) layer. The latter creates a barrier of some tens of µm which make the pipe impermeable to oxygen**, thus drastically reducing corrosion problems in those heating systems where plastic tubes are combined with materials sensitive to this phenomenon.
- The **outer layer** consists of a compound made up of polyethylene, adhesive and colouring agent with a thickness of some tens of µm and protects the EVOH layer from defects resulting from mechanical causes (e.g. scratches, scraping etc.)

This product complies with the **EN ISO 22391-2** Standard: "Plastics piping systems for hot and cold water installations – Polyethylene of raised temperature resistance (PE-RT)" and to the **DIN 4726** Standard on the specifications concerning the resistance of the EVOH barrier to the penetration of oxygen and the minimum bending radii of pipes.

The tests that ensure compliance with the above, are regularly conducted at **the laboratories SKZ** (German Certification Institute).

The **KILMA HI PERFORMANCE PLUS** pipe complies also with **Decree No. 174 of the Ministry Health of 6th April 2004** ("Regulation concerning materials and objects which may be used in fixed systems for collecting, treating, supplying and distributing water destined for human consumption" published on 17th July in the Official Journal of G.U. , General Series no. 166).

PURPOSE

The **KILMA HI PERFORMANCE PLUS** pipe was designed to convey water and other hot fluids under pressure.

In particular, the ideal application is when the pipe is completely laid underground, for example, inside little concrete blocks.

USE

The **KILMA HI PERFORMANCE PLUS** pipe is perfect for floor and wall heat radiating systems, even though it is not subjected to a reticulation process.

In these systems the pipe must be completely "drowned" in the concrete block. Due to its high elasticity coefficient the (new) product makes it possible to keep the stresses generated inside the wall under control. These stresses result from the avoidance of the length variation (caused by the pipe being laid underground) which would otherwise occur within the temperature gradient applied. .

However, the following product characteristics:

- oxygen -resistant barrier
- long life
- high resistance even to temperatures close to 100 °C (in case of malfunctioning)
- very low roughness (which involves often negligible pressure losses);
- non-toxicity (which makes it possible to use the product with food fluids and drinking water);
- lightness, flexibility and resistance to scratches.

make the product more competitive in comparison with traditional metal pipes. In fact, more and more frequently, the **KILMA HI PERFORMANCE PLUS** is chosen for creating plumbing systems and heating systems with radiators or fan coils.

EXAMPLE OF MARKING

The information given affords only a quick reading of the product characteristics.
The marking may not differ from the marking shown in the example

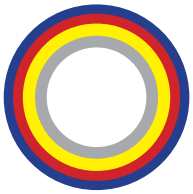
RBM KILMA HI PERFORMANCE PLUS 4 LAYERS polyethylene of raised temperature resistance type II EVOH Ø17X2.0 C – SKZ X 000 – EN ISO 22391-2 – class 1/8 - 2/8 - 4/8 - 5/6 bar – oxygen barrier DIN 4726 – Lammitysputki – XX00X – Made in Italy – (--)/(--)/(--) – (--):(--) – X0.00.000.00 – 000m >I<

RBM KILMA HI PERFORMANCE PLUS 4 LAYERS	Trademark
polyethylene of raised temperature resistance Type II EVOH	Polyethylene of raised temperature resistance with oxygen barrier
Ø17X2.0 C	External diameter and wall thickness; dimensional class: C
SKZ X 000	SKZ institute product certification registration number
EN ISO 22391-2	Reference Standard
class	Application classes (see relevant section in this sheet)
Oxygen barrier DIN 4726	The permeability to oxygen was tested according to the DIN 4726 Standard
XX00X	Anti-fraud alphanumeric code
Made in Italy	Identifies the production country
(- -)/(- -)/(- -) – (- -):(- -)	Production date and time
X.00.0000.00	Loto no.
000m >I<	No of metres

** The quantity of oxygen which goes through the pipe every day at a temperature of 40 °C is not higher than 0.1 grams per cubic meter.

CONSTRUCTION CHARACTERISTICS

type of pipe



Innermost layer:	polyethylene pipe of raised temperature resistance
Intermediate layers:	adhesive surface in polymeric material and EVOH oxygen-resistant barrier
Outer layer:	consisting of a compound made up of polyethylene, adhesive and colouring agent, with a thicknes of some tens of di µm.

TECHNICAL CHARACTERISTICS (FIRST PART)

Dimensions [mm]	16 x 2	17 x 2	20 x 2
Weight per meter of pipe [Kg/m]	0,089	0,096	0,115

Properties	Value	Unit of measurement
Mass density (density) at 23 °C	941	Kg/m^3
Application field	+5 ÷ +100	°C
Fluids which can be conveyed	The pipe is non-toxic, it complies with Ministerial Decree 174/2004 and makes it possible to convey water destinded for human consumption*. In general, all fluids complying with the regulations of the EN ISO 22391-2 Standard as well as fluids compatible with the pipe material (please refer to the ISO/TR 10358 technical report: "Plastics pipes and fittings – Combined chemical – resistance classification table) can be conveyed.	
Pipe roughness (Ra according to DIN EN ISO 4287, ASME B46.1)	1,0	µm
Thermal conductivity (a 60 °C)	0,40	$\frac{W}{m \times K}$
Thermal expansion coefficient	0,18	$\frac{mm}{m \times °C}$
Permeability to oxygen at 40 °C (The barrier is controlled by the Company's internal control system)	≤ 0,1	$\frac{g}{m^3 \times d}$
Elasticity coefficient	645	MPa
Internal stresses over the length (control as shown in the EN ISO 22391-2 Standard)	≤ 2	%
Yield stress	≈ 20,3	MPa
Minimum bending radius permitted** (Reference: DIN 4726)	5d	mm
Elongation after fracture	780	%
Resistance to internal pressure (control as established in the EN ISO 22391-2 Standard)		
A 20 °C with a stress of σ=10,8 MPa	≥ 1	hour
A 95 °C with a stress of σ=3,9 MPa	≥ 22	hours
A 95 °C with a stress of σ=3,7 MPa	≥ 165	hours
A 95 °C with a stress of σ=3,6 MPa	≥ 1000	hours
Control of the pipe appearance and dimensions	The control is carried out according to the EN ISO 22391-2 Standard by means of an ultrasound system, a laser system and manually.	
Advice for storing the product	The pipe is supplied in packing which protects it during the storing period: long exposure to ultraviolet rays could damage it irreparably. **Therefore it must not be exposed to direct sunlight.**	

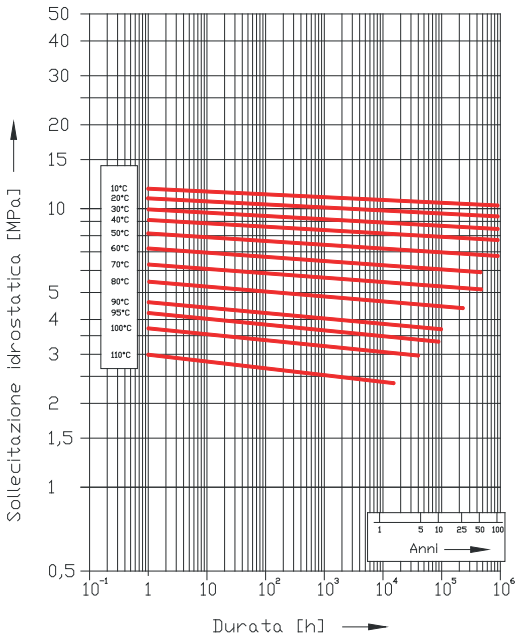
* Water destined for human consumption" means treated and non-treated drinking water, water for preparing food and drinks or for other domestic use, regardless of its origin, that is to say regardless of the fact that it is supplied through a distribution network, a tank, bottles or containers. The term includes water used in food companies for producing, treating, storing or marketing of products or substances destined for human consumption. Please refer to the relevant regulations in force and, in particular, to the standards and decree mentioned.

** This is the minimum radius measured on the plane of the pipe axis on the bending point. "d" is the average external diameter of the pipe.

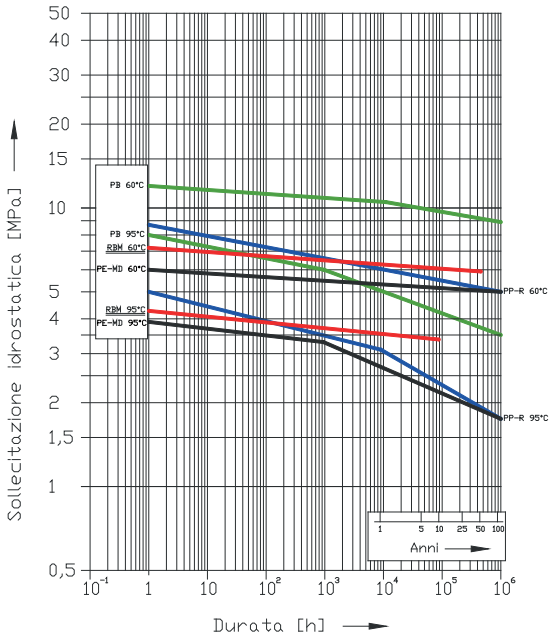
TECHNICAL CHARACTERISTICS (SECOND PART)

Regression diagrams: of the KILMA HI PERFORMANCE PLUS pipe and of the RBM pipe only in comparison with PP-R, PB or PE-MD pipes

Graph 1
Diagram drawn up according to the EN ISO 22391-2 Standard



Graph 2
Comparison regression curves: PE-RT, PP-R, PB, PE-MD



The above graphs contain the regression curves relating to the σ circumferential stresses in the KILMA HI PERFORMANCE PLUS pipes. Graph 2 contains a comparison between the curves relating to the RBM pipes (shown in red), the PP-R (in blue) , the PB (in green) and in PE-MD (in black). As you can see, the RBM regression curves do not have the characteristic "elbow" of the regression curves of the PP-R, PB or PE-MD pipes and make a linear extrapolation possible.

Until recently these diagrams were indispensable to calculate (by simple mathematic formulas) the maximum operating pressure under certain use conditions. Instead, the new Standard establishes that regression graphs be used only to supply qualitative information, while quantitative information must be determined on the basis of the following tables:

Code	Dimension	Operating pressure [bar] For application class*			
		Class 1	Class 2	Class 4	Class 5
2517.16.X2	16 x 2	10	8	8	8
2517.17.X2	17 x 2	8	8	8	6
2517.20.X2	20 x 2	6	6	6	6

Application class**	Operating conditions for a duration of 50 years and 100 hours, of which	Application field
1 ***	49 years at an operating temperature (T_D) of 60 °C, 1 year at a maximum temperature (T_{max}) of 80°C e 100 ore alla temperatura di malfunzionamento (T_{mal}) di 95 °C	Warm water supply (60 °C)
2 ***	49 years at an operating temperature (T_D) of 70 °C, 1 year at a maximum temperature (T_{max}) of 80°C e 100 ore alla temperatura di malfunzionamento (T_{mal}) di 95 °C	Warm water supply (70 °C)
4	2,5 years at an operating temperature (T_D) of 20 °C, 20 years at an operating temperature (T_D) of 40 °C, 25 years at an operating temperature (T_D) di 60 °C, 2,5 years at a maximum temperature (T_{max}) of 70 °C and 100 hours at a failure temperature (T_{mal}) of 100 °C	Floor heating and low temperature radiators
5	14 years at an operating temperature (T_D) of 20 °C, 25 years at an operating temperature (T_D) of 60 °C, 10 years at an operating temperature (T_D) di 80 °C, 1 year at a maximum temperature (T_{max}) of 90 °C and 100 hours at a failure temperature (T_{mal}) of 100 °C	Floor heating and high temperature radiators

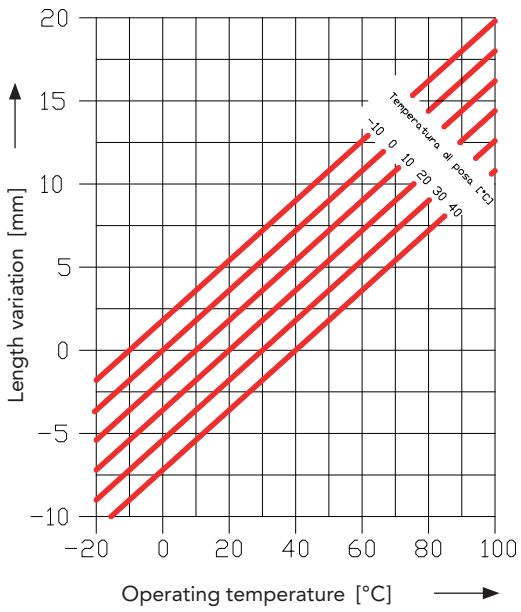
* The classification of the application classes has been taken from the EN ISO 22391-2 Standard. Please refer to the latter

** All the systems corresponding to one of the above mentioned application classes can be used to convey cold water at 20°C for a period of 50 years at an operating pressure of 10 bar.

*** The operating temperature is according to the national legislation.

Linear thermal expansion diagram

Graph 3
Expansion of 1 m of KILMA HI PERFORMANCE PLUS pipe



The diagram on the side shows the linear extension of 1 m of pipe (measured at a T_{posa} laying temperature as soon as the pipe is put into operation.

The changes in length were calculated according to the following known formula:

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

Where

ΔL is the change in length of the pipe in mm;
α is the linear extension coefficient $(0{,}18 \frac{mm}{m\,°C})$
L_{posa} is the length of the pipe at the laying temperature;
T_{posa} is the temperature at which the pipe is installed;
$T_{esercizio}$ is the temperature at which the pipe is used.

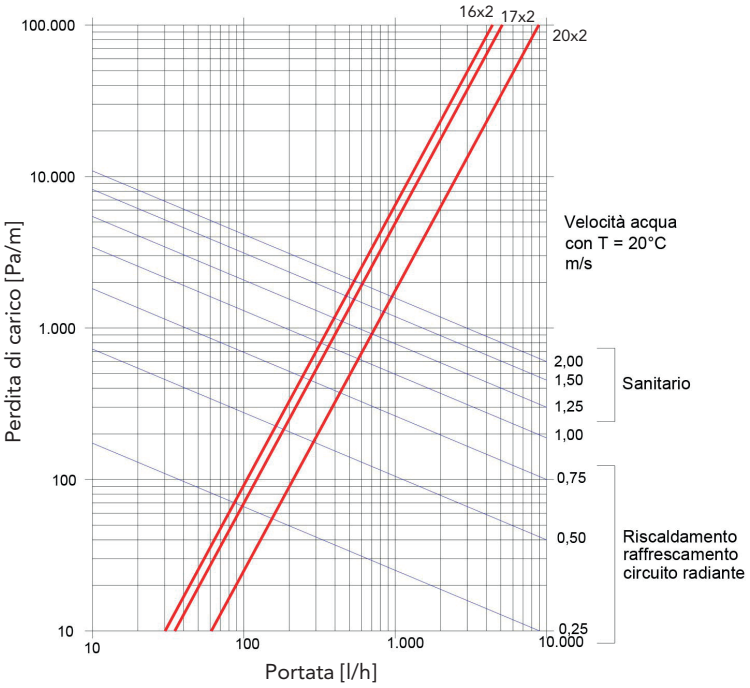
We would like to remind you that the extension for the parts of the system beneath the surface is negligible, because the pipe has no possibility to expand and therefore absorbs this effect autonomously.

Furthermore, as already mentioned in the description of the product, because of the high elasticity coefficient, the pipe keeps the stresses generated in the wall completely under control.

FLUID DYNAMIC CHARACTERISTICS

Pressure drops in the KILMA HI PERFORMANCE PLUS pipes – new water paths under environmental conditions (T=293,16 K; P=1 atm)

Graph 4
Pressure drops in the KILMA HI PERFORMANCE PLUS pipe



D [mm]	Di [mm]	Kv [m³/h]
16x2	12,00	4,40
17x2	13,00	5,10
20x2	16,00	8,90

* head loss expressed in "Pa per linear meter of piping"

RBM Spa
Via S.Giuseppe, 1 • 25075 Nave (Brescia) Italy
Tel 030 2537211 • Fax 030 2531798 • info@rbm.eu • www.rbm.eu