1. Crosslinked Polyethylene. Composition and Characterization

FILTERMO are composed of crosslinked polyethylene (PE-X).

The crosslinked polyethylene represents the final state of a raw material that suffers a transformation from its source, in this case petroleum, until its final state, as already mentioned.

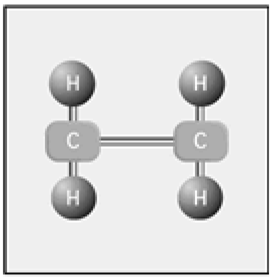
Therefore, the starting point for the production of a FILTERMO pipe have as a basis an high-density polyethylene (PEAD). This is a product from the polymerisation of the Ethylene, linked in chains of Ethylene monomers which come from petroleum in a gaseous state. During polymerisation, large chains of simple ramifications are formed, as exemplified in drawing 2.

The raw material presents the following properties:

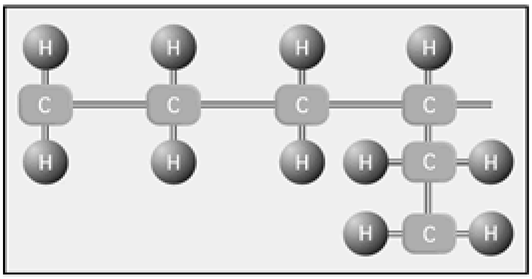
Property	Essay	Unit	Value
Density	ASTM D792	g/cm3	0.952
Enlargement at rupture	ASTM	%	200
Resistance to impact (20° C)	BS 2782	J/m	140
Elasticity modulus			
a 0° C	ASTM D638	N/mm2	1200
a 40° C			1000
Fluidity index (190° C / 5kg)	ASTM D1238	g/10 min.	3.0

Chart 1 - Raw material medium properties

As it can be observed in drawing 1, the Ethylene is a pure hydro-carbonate. Not being an easily flammable material (high auto-ignition point) and, therefore, a combustible material. Its combustion products are not toxic, being therefore a material indicated by the environmental organisms as having excellent characteristics for its use in pipe systems for the transport of fluids in places where there is a possible fire risk, such as domestic housing.



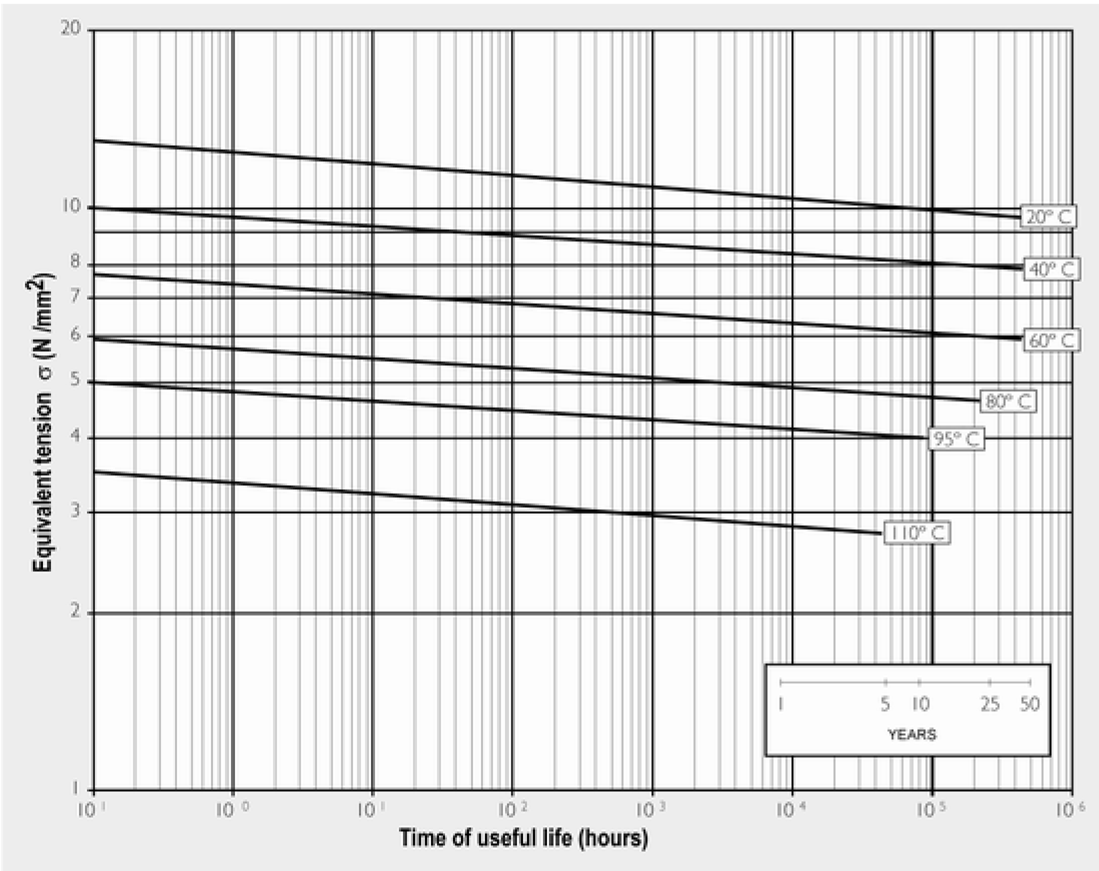
Draw. 1 - Ethylene Monomer



Draw. 2 - PEAD molecule scheme

Polyethylene is a partially crystalline material. This classification comes from the fact of existing in its structure long and perfectly alienated chains whose density is higher (crystalline areas) and chains highly disordered with lower partial densities (amorphous areas). These two areas have different fusion points, about 130ºC for the crystalline area and near 200ºC for amorphous areas, for it will be necessary to carry out an extrusion at temperatures close to the last one so that the raw material becomes fluid. However, it must be kept in mind that too high temperatures during extrusion cause an acceleration of the material's degradation.

This statement is more perceptible when we analyse the behaviour of the Polyethylene at high temperatures, throughout the years. The following graph presents the behaviour of the crosslinked polyethylene along the years.



Graph 1-Behavior of the tubes in PEX throughout the years (standard DIN 16892)

The pipes in crosslinked polyethylene are obtained by extrusion, with a raw material in high-density polyethylene (PEAD) with additives that allow reticulation. The High Density Polyethylene pipes (PEAD) do not allow operational temperatures higher than 40ºC, having as reference a 50 year old duration. So that the increase of the operational temperature was possible, the raw material would have to have a much higher molecular weight and it would be needed a production process for this type of material. The reticulation increases the resistance higher temperatures for the same operational pressure. On the other hand, the pipe’s flexibility increases as much high is his degree of reticulation.

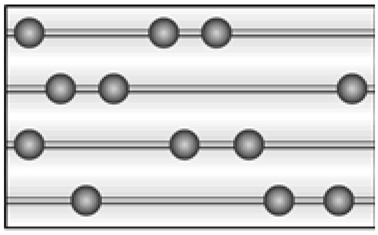


Fig. 3.1

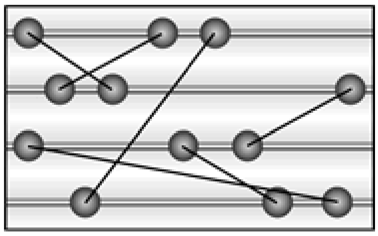


Fig. 3.2

Fig. 3-schematic comparison of molecular dispositions between PEAD

The reticulation process can be made during the production process, adding to the raw material elements which provide the reticulation taking advantage of the high working temperature (peroxide method), or after the extrusion process by immersion in hot water (liquid state), action of low temperature water steam or hot water circulation inside the tube.

It is important to point out that, after reticulation, it won't be possible to consider that the pipe is made composed of thermoplastic material. This material is no longer meltable. It can be considered that it was proceeded to the union of good characteristics of the thermoplastic material with the elastomers, for it is considered that the tubes in crosslinked polyethylene are composed by a “thermoelastic” material.

2. Production range

Crosslinked polyethylene pipes are according to standard DIN 16893.

It is considered a limit tangential tension. For this value, exists an associated security coefficient.

The calculation formula is based on the following:

$$S = \frac{\sigma}{PN} = \frac{1}{2} \cdot \left(\frac{DN}{s} - 1\right) = \frac{SDR - 1}{2}$$

Where,

PN - Nominal pressure

DN - Nominal diameter

s - Thickness

S - Class or series

SDR - Reason between DN and s

It is established that the minimum thickness dimension for PEX pipes is of 1.8 mm.

2.1 FILTERMO

FILTERMO pipe is produced in crosslinked through a co-extrusion process.

Three different layers compose this pipe. To the first layer of crosslinked polyethylene is added an adherent film considering the placement of a final barrier I anti-oxygen (EVOH barrier).

The production range of FILTERMO pipe is as follows:

Classification	Code	Nominal diameter (mm)	Thickness (mm)	Weight (g/m)	Quantity per Packing (m/box)
Milimetric Series	FT 001 0120000 2000	12	2.0	60	100 or 240
	FT 001 0140000 2000	14	2.0	72	100 or 240
	FT 001 0160000 2000	16	2.0	84	100 or 240
	FT 001 0170000 2000	17	2.0	90	100 or 240
	FT 001 0180000 2000	18	2.0	96	100 or 240
	FT 001 0200000 2000	20	2.0	108	100 or 240

Chart 4 - production range of FILTERMO pipe

FILTERMO pipes are packed in cardboard boxes.

FILTERMO pipes can be installed inside a protection pipe in Polypropylene (FILFLEX) of black colour. In this case, they are provided in quantities of 50m/box.

In the external surface of FILTERMO pipe is the branding which respects the standard, indicating:

• Manufacturer •Maximum operation temperature and corresponding Pressure

• Commercial designation • operator

• material •date

• dimensions • order of Production

• Designation “Anti-oxygen” • Metric branding

As an example, the configuration of FILTERMO pipe may be verified:

DUOFIL • FILTERMO • PEX • 12 x2.0 • DIN 4726 • DIN 16982 • 1.0MPa/70° C. • ANTIOXIGÉNIO • OP.68 • 00/04/12 • FTP 00015/00 • 057 mt
FILTERMO is manufactured according to the German standards DIN 16892, DIN 16893, DIN 4726 and DIN 4729 being certified by SKZ (HR 3.2 AT 296).

3. Durability

The crosslinked polyethylene pipes are produced according to the standard DIN 16893 which establishes a relation between the value of nominal pressure, with the working temperature of 20ºC for an estimated lifetime of 50 years.

This situation is not very frequent. In fact, it is usually intended to use higher temperatures. Therefore, it is necessary to value the relationship among these three variables, verifying if the values of the working pressures allow the use of the tube during the required life time.

The chart 6 shows the relationship between the maximum working pressures and the respective working temperatures, estimating a durability of the system.

Working Temperature	DURABILITY									
	1 Year		5 Years		10 Years		25 Years		50 Years	
	PN 12.5	PN 20.0	PN 12.5	PN 20.0	PN 12.5	PN 20.0	PN 12.5	PN 20.0	PN 12.5	PN 20.0
20° C	13.7	21.7	13.3	21.2	13.2	21.0	13.1	20.7	12.5	20.0
30° C	12.3	19.6	12.0	19.0	11.9	18.8	11.7	18.6	11.6	18.4
40° C	11.0	17.5	10.8	17.1	10.7	16.9	10.5	16.7	10.4	16.5
50° C	9.7	15.4	9.5	15.0	9.3	14.8	9.2	14.6	9.1	14.4
60° C	8.7	13.8	8.4	13.3	8.3	13.1	8.1	12.9	8.1	12.8
70° C	7.7	12.2	7.5	11.9	7.3	11.6	7.2	11.4	7.1	11.2
80° C	6.5	10.4	6.4	10.2	6.3	10.1	6.3	9.9	–	–
90° C	5.9	9.4	5.8	9.2	5.7	9.1	–	–	–	–
95° C	5.7	9.0	5.5	8.8	5.4	8.6	–	–	–	–

Chart 6-Maximum service pressure (bar) regarding the desired duration and of the working temperature (extract from standard DIN 16893)

For a working temperature of 20ºC and considering a period of useful life of 50 years, chart 6 indicates the value of nominal pressure as limit value for the working pressure.

In the case of FILTERMO, we should pay attention to the fact that the German standard DIN 4726 indicates that the pipes in crosslinked polyethylene with an anti-oxygen barrier should be used at a maximum temperature of 70ºC with a maximum working pressure of 3 bar. Being this way, the durability of the pipe is guaranteed.

For systems of central heating, the millimetres series of FILTERMO respects the standard DIN 16983, i.e., in this case the thickness dimension of the wall is superior to the minimum value specified by that standard, until nominal diameters DN20 and nominal pressures PN12.5. This way, you can also consider as reference values, for limit working pressures, the values indicated in chart 6 concerning pipes PN12.5.

The values indicated in the Chart 6 do not consider eventual UV influences, that is, the natural degradation caused by the quick aging when in direct contact with the UV rays may compromise the truthfulness of the values presented in Chart 6.

4. Properties

High range of working temperatures.

It can be affirmed that the reticulation of a pipe in PEAD increases the capacity of operating with higher temperatures. Therefore the crosslinked polyethylene pipes will be able to work with temperatures between -50ºC and 95ºC. The crosslinked polyethylene pipes can work until temperatures of 110ºC, for brief periods of production.

Low thermal conductivity coefficient.

Being a plastic material, this characteristic allows to increase the efficiency of fluid transport systems at non-environmental temperatures. In the systems of hot water transport, the availability of water at a certain temperature, with higher pressure of the system, happens with a decrease of the heating power and in a quicker way, when compared with metallic pipe systems.

Low Thermal Conductivity coefficient

This characteristic does not allow the transmission of wandering currents which cause perforations in the metallic tubes.

Low rugosity coefficient in the interior wall.

The low rugosity of the inner wall (almost flat wall) allows to reduce the necessities of the height barometrical pumping systems that are translated in a energy saving. This characteristic also allows the availability of superior working pressures with more pressure of the system, when there are hydrostatic pressures (sanitary systems), when compared with similar metallic materials. The probability of accumulation of residuals, commonly designated by inlays which cause significant reductions of the sections of the pipes, is also reduced.

Possibility of later replacement and floor assembly.

According to the existent regulation, it is not possible to install systems of pipes in floors if the system does not use flexible pipes and with possibility of later removal. The installation of the pipe in crosslinked polyethylene inside the Polypropylene sleeve (FILFLEX) and its flexibility allows the satisfaction of such a condition, allowing a reduction of the effective quantities to install.

Resistance to Corrosion

Being a plastic material, the high resistance to corrosion allows a higher duration of the systems.

Physiologic behaviour.

The pipes in crosslinked polyethylene maintain the characteristics of drinkable water when locked within, not existing any migrations to the fluid being transported. (See verification of the National Institute of Health Dr. Ricardo Jorge).

Anti-oxygen barrier

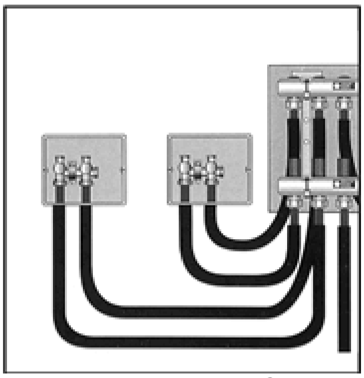
The FILTERMO pipe allows a total barrier anti-oxygen, limiting the entrance of oxygen inside the pipe which, formed by oxides, may cause the formation of corrosions.

Resistance to UV rays

The composition of the pipes in crosslinked polyethylene does not allow a long exhibition to the UV without the existence of a degradation and consequent decrease of the duration of the pipe.

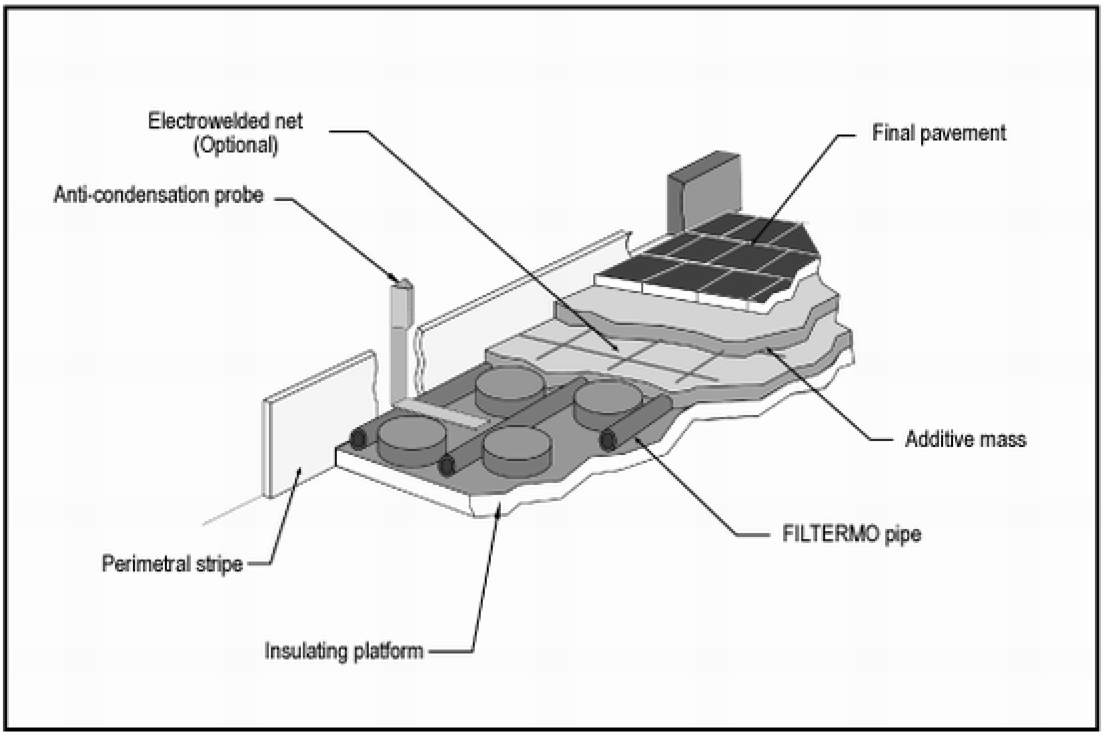
5. Application fields

5.1-Central Heating Systems



Installation example: FILTERMO with FILFLEX

5.2-Radiant Floor Heating Systems



Installation example: FILTERMO

6. Homologations and Certifications

Independent organisms ensure the real quality of the Polyethylene pipes.

Organisms that allow the certification of DUOFIL also control its production process.

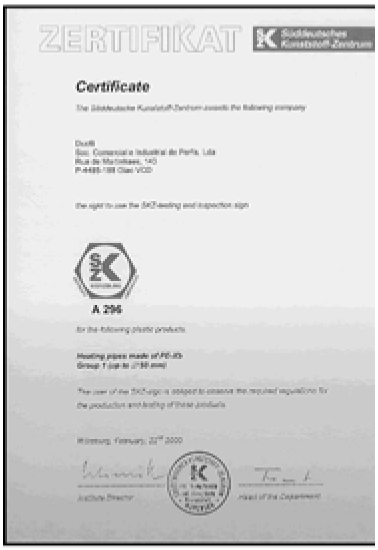


Fig. 9 – Documento de Homologação
SKZ – FILTERMO –HR 3.2 A 296.

Fig. 9 - Holmogation document 3 SKZ–FILTERMO–HR 3.2 A296

7. Thermal expansions

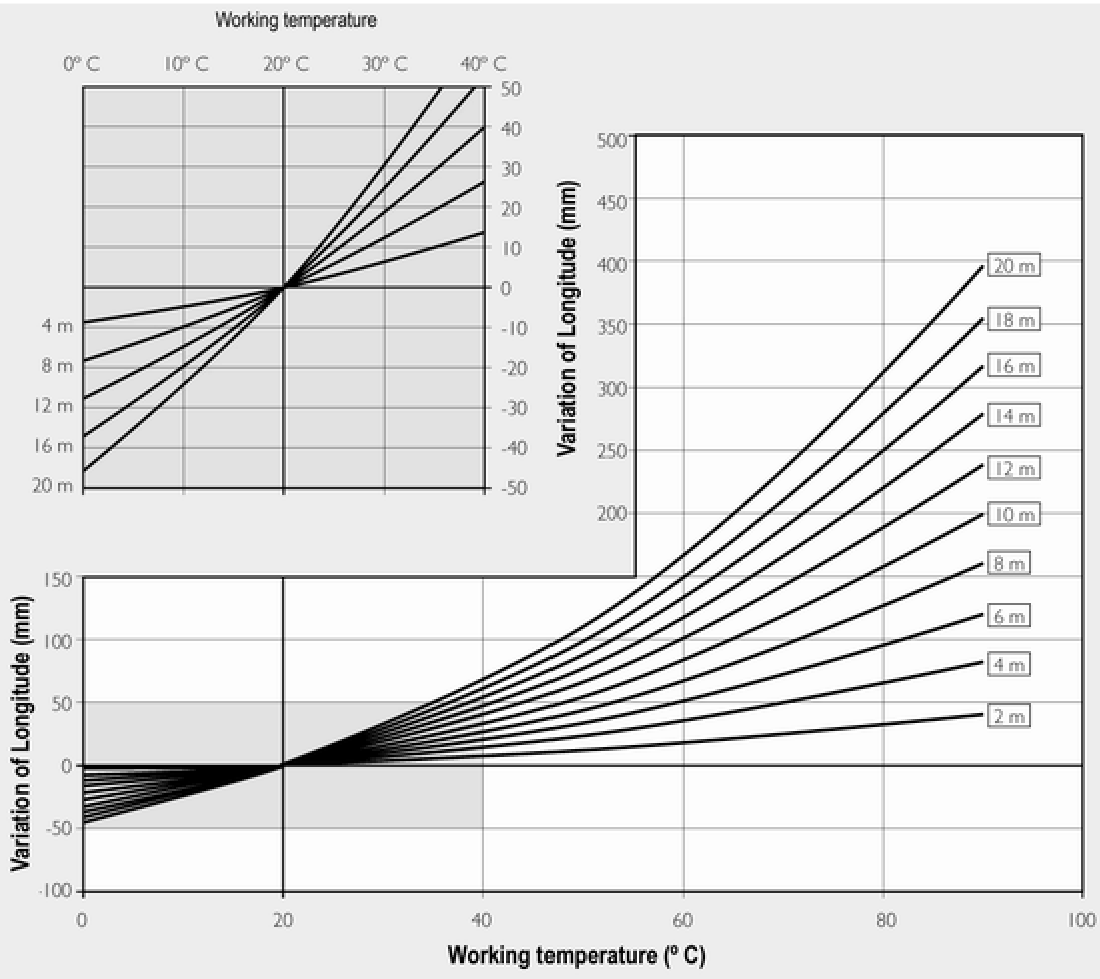
The crosslinked polyethylene pipes present values of thermal expansion that must calculated keeping in mind the possible rupture of the system.

In order to simplify, it is considered that the thermal expansion happens only in the longitudinal sense of the pipe. Although this does not totally correspond to the truth as there are three-dimensional expansions due to the temperature variations, it is the longitudinal thermal expansion the most visible and important concerning the crosslinked polyethylene pipes.

It is easily understood that the thermal expansions or contractions in a milimetric dimension when the respective coefficient of thermal dilation is about tenth millesimal meters, present values that can be considered worthless (sometimes values around µm). On the other hand, being the longitude of the pipe around of dozens of meters, the thermal dilation will present important millimetrical which must be «absorbed» by system so that the rupture doesn't happen. These concepts can easily be understood through the analysis of the linear dilations of the crosslinked polyethylene pipes.

The pipes present linear thermal expansions coefficients of around 0.2 mm/mºC. This coefficient represents a medium value as it varies according to the basis temperature.

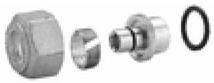
As it is observed, there will be a dilation of 1 mm for each meter of pipe and for each unitary increase of temperature. The same verification can and should be done in case there is any temperature decrease, being necessary to absorb the contractions of the system.



Graph 2-Linear thermal expansions of the Crosslinked Polyethylene pipes, considering Ambient Temp=20ºC

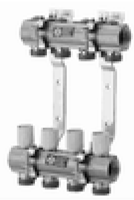
9. FILTERMO Systems

FILTERMO pipes have a group of fittings associated which allows the realization of the necessary systems, being usually used mechanical opening fittings.



Adaptor R 179 for FILPEX and FILTERMO pipes					
CODE	DIMENSIONS	CODE	DIMENSIONS	CODE	DIMENSIONS
'9 012012 0018	12.0 x (12.0 x 1.8)	GR 179 016017 0020	16.0 x (17.0 x 2.0)	GR 179 018020 0019	18.0 x (20.0 x 1.9)
'9 012012 0020	12.0 x (12.0 x 2.0)	GR 179 016018 0020	16.0 x (18.0 x 2.0)	GR 179 018020 0020	18.0 x (20.0 x 2.0)
'9 012016 0018	12.0 x (16.0 x 1.8)	GR 179 016020 0019	16.0 x (20.0 x 1.9)	GR 179 018020 0028	18.0 x (20.0 x 2.8)
'9 012016 0020	12.0 x (16.0 x 2.0)	GR 179 016020 0020	16.0 x (20.0 x 2.0)	GR 179 022020 0019	22.0 x (20.0 x 1.9)
'9 012016 0022	12.0 x (16.0 x 2.2)	GR 179 018012 0020	18.0 x (12.0 x 2.0)	GR 179 022020 0020	22.0 x (20.0 x 2.0)
'9 016012 0018	16.0 x (12.0 x 1.8)	GR 179 018014 0020	18.0 x (14.0 x 2.0)	GR 179 022025 0023	22.0 x (25.0 x 2.3)
'9 016012 0020	16.0 x (12.0 x 2.0)	GR 179 018016 0018	18.0 x (16.0 x 1.8)	GR 179 022025 0035	22.0 x (25.0 x 3.5)
'9 016014 0020	16.0 x (14.0 x 2.0)	GR 179 018016 0020	18.0 x (16.0 x 2.0)	GR 179 028032 0029	28.0 x (32.0 x 2.9)
'9 016016 0018	16.0 x (16.0 x 1.8)	GR 179 018016 0022	18.0 x (16.0 x 2.2)	GR 179 028032 0044	28.0 x (32.0 x 4.4)
'9 016016 0020	16.0 x (16.0 x 2.0)	GR 179 018017 0020	18.0 x (17.0 x 2.0)		
'9 016016 0022	16.0 x (16.0 x 2.2)	GR 179 018018 0020	18.0 x (18.0 x 2.0)		

Union male R556 for FILPEX and FILTERMO pipes					
CODE	DIMENSIONS	CODE	DIMENSIONS	CODE	DIMENSIONS
'6 038012 P020	3/8" x (12.0 x 2.0)	GR 556 012016 P020	1/2" x (16.0 x 2.0)	GR 556 034018 P020	3/4" x (18.0 x 2.0)
'6 038016 P022	3/8" x (16.0 x 2.2)	GR 556 012017 P020	1/2" x (17.0 x 2.0)	GR 556 034020 P023	3/4" x (20.0 x 2.3)
'6 038016 P020	3/8" x (16.0 x 2.0)	GR 556 012018 P020	1/2" x (18.0 x 2.0)	GR 556 034020 P020	3/4" x (20.0 x 2.0)
'6 012012 P020	1/2" x (12.0 x 2.0)	GR 556 012020 P020	1/2" x (20.0 x 2.0)	GR 556 034020 P019	3/4" x (20.0 x 1.9)
'6 012014 P020	1/2" x (14.0 x 2.0)	GR 556 012020 P019	1/2" x (20.0 x 1.9)	GR 556 034025 P035	3/4" x (25.0 x 3.5)
'6 012016 P022	1/2" x (16.0 x 2.2)	GR 556 034016 P022	3/4" x (16.0 x 2.2)	GR 556 034025 P023	3/4" x (25.0 x 2.3)



Pre-set manifold R553D for heating floor installations with FILTERMO pipe					
CODE	DIMENSIONS	CODE	DIMENSIONS	CODE	DIMENSIONS
53 100018 PD02	1" x 18 (2 exits)	GR 553 100018 PD10	1" x 18 (10 exits)	GR 553 114018 PD07	1 1/4" x 18 (7 exits)
53 100018 PD03	1" x 18 (3 exits)	GR 553 100018 PD11	1" x 18 (11 exits)	GR 553 114018 PD08	1 1/4" x 18 (8 exits)
53 100018 PD04	1" x 18 (4 exits)	GR 553 100018 PD12	1" x 18 (12 exits)	GR 553 114018 PD09	1 1/4" x 18 (9 exits)
53 100018 PD05	1" x 18 (5 exits)	GR 553 114018 PD02	1 1/4" x 18 (2 exits)	GR 553 114018 PD10	1 1/4" x 18 (10 exits)
53 100018 PD06	1" x 18 (6 exits)	GR 553 114018 PD03	1 1/4" x 18 (3 exits)	GR 553 114018 PD11	1 1/4" x 18 (11 exits)
53 100018 PD07	1" x 18 (7 exits)	GR 553 114018 PD04	1 1/4" x 18 (4 exits)	GR 553 114018 PD12	1 1/4" x 18 (12 exits)
53 100018 PD08	1" x 18 (8 exits)	GR 553 114018 PD05	1 1/4" x 18 (5 exits)		
53 100018 PD09	1" x 18 (9 exits)	GR 553 114018 PD06	1 1/4" x 18 (6 exits)		

Manifold R585 with retainers for central heating and/or sanitary systems with FILPEX or FILTERMO					
CODE	DIMENSIONS	CODE	DIMENSIONS	CODE	DIMENSIONS
85 034012 P002	3/4" x 12 (2 exits)	GR 585 034012 P012	3/4" x 12 (12 exits)	GR 585 100016 P002	1" x 16 (2 exits)
85 034012 P003	3/4" x 12 (3 exits)	GR 585 034016 P002	3/4" x 16 (2 exits)	GR 585 100016 P003	1" x 16 (3 exits)
85 034012 P004	3/4" x 12 (4 exits)	GR 585 034016 P003	3/4" x 16 (3 exits)	GR 585 100016 P004	1" x 16 (4 exits)
85 034012 P005	3/4" x 12 (5 exits)	GR 585 034016 P004	3/4" x 16 (4 exits)	GR 585 100016 P005	1" x 16 (5 exits)
85 034012 P006	3/4" x 12 (6 exits)	GR 585 034016 P005	3/4" x 16 (5 exits)	GR 585 100016 P006	1" x 16 (6 exits)
85 034012 P007	3/4" x 12 (7 exits)	GR 585 034016 P006	3/4" x 16 (6 exits)	GR 585 100016 P007	1" x 16 (7 exits)
85 034012 P008	3/4" x 12 (8 exits)	GR 585 034016 P007	3/4" x 16 (7 exits)	GR 585 100016 P008	1" x 16 (8 exits)
85 034012 P009	3/4" x 12 (9 exits)	GR 585 034016 P008	3/4" x 16 (8 exits)	GR 585 100016 P009	1" x 16 (9 exits)
85 034012 P010	3/4" x 12 (10 exits)	GR 585 034016 P009	3/4" x 16 (9 exits)	GR 585 100016 P010	1" x 16 (10 exits)
85 034012 P011	3/4" x 12 (11 exits)	GR 585 034016 P010	3/4" x 16 (10 exits)		

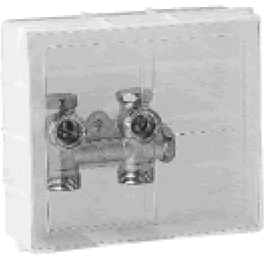
Pre-set terminal R554B for manifolds with automatic air purge	
Reference	Dimensions
GR 554 034000 PB00	3/4”
GR 554 100000 PB00	1”
GR 554 114000 PB00	1 1/4”

Pre-set terminal R554C for manifolds with manual air purge	
Reference	Dimensions
GR 554 034000 PC00	3/4”
GR 554 100000 PC00	1”
GR 554 114000 PC00	1 1/4”

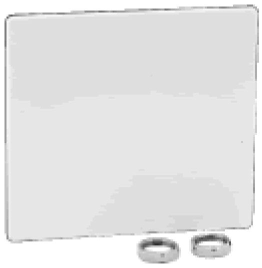
R500 box for manifolds R553D	
Reference	Dimensions
GR 500 000000 0A00	400 x 450 x 110
GR 500 000000 0B00	600 x 450 x 110
GR 500 000000 0C00	800 x 450 x 110
GR 500 000000 0D00	1000 x 450 x 110

Terminal box R573D for sanitary systems	
Reference	Dimensions
GR 573 012012 PD00	1/2" x 12
GR 573 012016 PD00	1/2" x 16
GR 573 012018 PD00	1/2" x 18

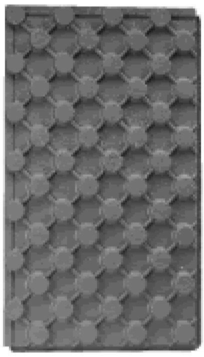
Double terminal box R544 for sanitary systems	
Reference	Dimensions
GR 544 012016 P000	1/2" x 16
GR 544 012018 P000	1/2" x 18



R 317M in wall hydraulic saddle for central heating systems	
Reference	Dimensions
GR 317 016016 0M00	16 x 16
GR 317 018016 0M00	18 x 16
GR 317 034016 PM00	3/4" x 16



R317C cover for in wall hydraulic saddle	
Reference	Dimensions
GR 317 000000 0C00	–



R982 Pre-set plaque for the installation of the FILTERMO pipe in heating systems	
Reference	Dimensions
GR 982 075060 0000	*h = 60 p = 75*
GR 982 075060 0000	*h = 45 p = 75*
GR 982 075060 0000	*h = 60 p = 50*
GR 982 075060 0000	*h = 45 p = 50*

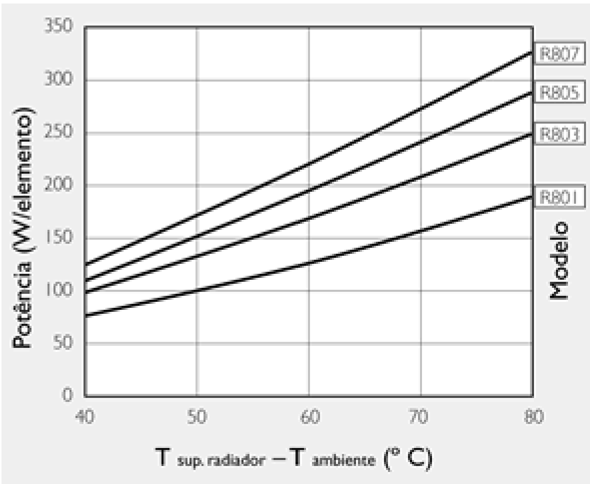
h = height ; p = step

10. Application examples

10.1 - Installation of central heating systems with radiators.

After ensuring which are the nominal necessities for heating a certain space, the dimension of the system to install goes by the section of the radiators to install and of the fluid (in this case water) heating system itself (boiler).

As example, graph 6 indicates the heating power debited by each element of a radiator.



Graph 6 - Power for elements of the radiators GIACOSTAR

The dimension of the pipes has to consider the dimension of the system's heat transfer to be installed.

In a simple way, considering the installation of a radiator GIACOSTAR R805 with 12 elements, working with medium superficial temperature of 80ºC for a comfort temperature of 20ºC, you can determine the heating power debited by it.

Pheating=12 elementsx192w/element

Pheating=2304w

Using a FILTERMO pipe 16x 2,0 for the union circuit between the distribution collectors and radiators, you can use a circulation speed of 1m. s-1 and check the working conditions,

FILTERMO pipe	Minimum speed (m/s)	Minimum flow (l/s)	Δt Maximum (° C)
16.0 x 2.0	1.0	0.1	5

It seems obvious that the increase of the circulation water flow will decrease when varying the temperature of the same between the entrance and exit value. The circulation speed should be maintained low, not only to reduce the possibility of noises in the installations but also to decrease the loss of load of the system keeping in mind the installation of a bomb with reduced dimensions.

The dimension of this system has to consider the commitment between the equipment to install, as previously mentioned.

The installation of the central heating system will be able to use the principle of the hydraulic takings, with R317M fitting. This system guarantees the installation of a system polyvalent that allows the terminal installation of the radiator or the non-inclusion of this for questions of layout of the space. This system is ideal for systems of pre-installation of central heating, allowing the final option to the installers of installing the radiators where he really wants to, combining them with the layout of the space to occupy.

You can verify in the following images, some aspects that are shown with the installation of this type of systems.

Fig. 16 - Installation of hydraulic takings

Fig. 17 - Final aspect of the hydraulic takings

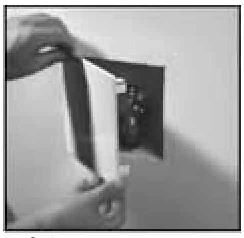


Fig. 18 - Installation of the tampa R317C for the non use presently of the hydraulic taking R317M

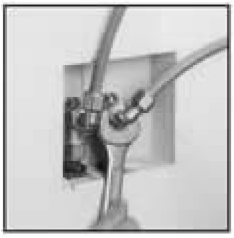
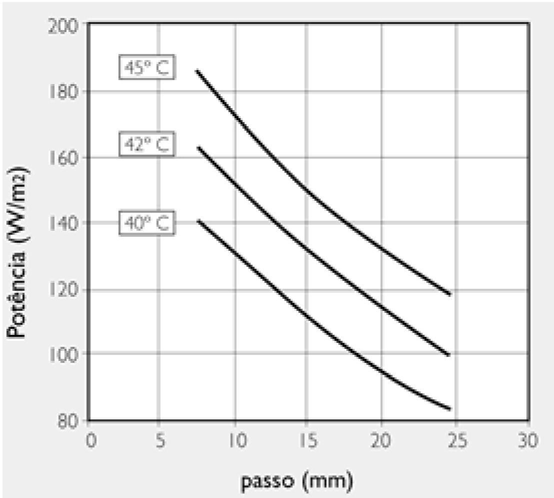


Fig. 19 - Terminal union between the hydraulic taking and the radiator

10.2 - Installation of a heating floor system

The heating installations with heating floor have the advantage of uniformity of the system to install, that is, the variation of temperature between the area being heated is much smaller when compared with a traditional heating system.

The dimension of this system pipes has to consider the dimension of the system itself. After considering the variation of temperature between the entrance and the exit water of the system and the ambient temperature, a variation of logarithmic medium temperature is calculated allowing to value the necessities to increase or to decrease the step of the pipe to be installed (distances between two parallel lines of the pipe) keeping in mind to obtain the necessary power to correspond to the necessities of the heating.



Graph 7 - Values of power finish of heating in function of the applied step and of the temperature of going of the water, for ceramic pavements and ambient temperature of 19ºC

The installation of the heating system by heating floor should be made with a FILTERMO pipe.

The calculation of it's diameter should be made according to the definition of the number of lines of pipes to install in the system, imposing the circulation speeds, having attention and verifying its entrance and exit temperature.

Fig. 20 - Outline of installation of the system of radiant floor

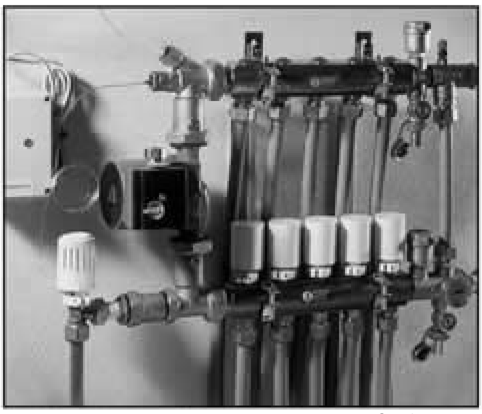


Fig. 21 - Distribution colectores de distribución for heating floor

Fig. 22 - Installation of FILTERMO pipe for a heating floor system

The welded net is only used when necessary to keep in the same position, not being usually used.

The installation of these systems considers the use of collectors with «n» exits trying to decrease the temperature variation of the entrance and exit water, increasing the uniformity of the heating, and also decreasing the loss of load associated to the system, allowing the installation of pumping equipment of reduced dimensions, as observed in image 20.