

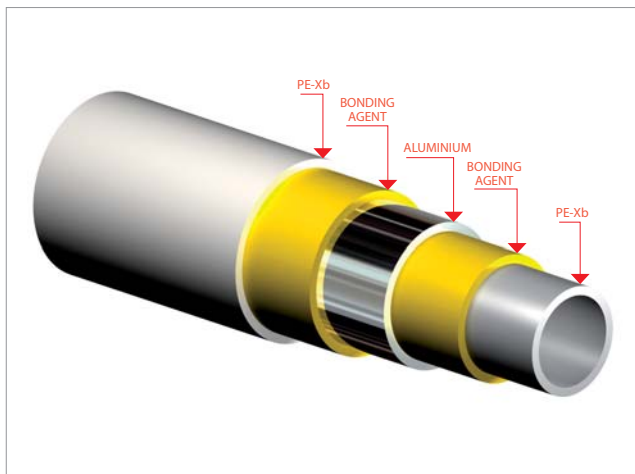
**PE-X/Al/PE-X MULTILAYER PIPES FOR SANITARY DISTRIBUTION, HEATING AND COOLING SYSTEMS**



**R999**

### Description - R999

R999 multi-layer pipe has an internal PE-X (mesh polyethylene) layer, an intermediate aluminium layer, longitudinally welded (butt welding) with laser technology, and an external PE-X layer. The intermediate layers of bonding agent join in a homogeneous way the aluminium layer to the PE-X layers. The presence of the aluminium layer, butt welded with laser technology, guarantees a secure barrier against oxygen and other gases, and also confers to the product an excellent resistance to squashing. PE-X/Al/PE-X multi-layer pipe is appropriate for drinking water transportation according to the rules in force.



### Use

PE-X/Al/PE-X multi-layer pipe can be used for the following systems:

- hot and cold water for sanitary uses;
- heating and cooling systems with radiant panels giacoklima®;
- traditional heating systems with heating bodies in cast iron, aluminium or steel.

### Benefits

Water distribution with pipes in synthetic material is a modern technique featuring huge advantages with respect to traditional distributions with iron or copper pipes. The limited internal roughness of the pipe as a matter of fact determines little pressure losses, thus guaranteeing the minimum delivery capacity to the users also when system's upstream available pressure is quite low. Other important elements are the reduced noise of the systems made with this material and low heat conductivity (around 700 times lower than copper pipe, 100 times lower than iron pipe) totally similar to the ones of the pipes made just of plastic materials.

### Sizes and Product codes

R999 multi-layer pipe is available in 100m and 200m rolls for sizes from 16x2 up to 20x2, and 50m rolls and 4m bars for sizes from 26x3 and 32x3.

| Product code | Size [mm] | Length [m] |
|--------------|-----------|------------|
| R999Y122     | 16x2      | 100        |
| R999Y123     | 16x2      | 200        |
| R999Y124     | 16x2      | 500        |
| R999Y232     | 18x2      | 100        |
| R999Y233     | 18x2      | 200        |
| R999Y142     | 20x2      | 100        |
| R999Y143     | 20x2      | 200        |
| R999Y272     | 26x3*     | 4          |
| R999Y273     | 26x3      | 50         |
| R999Y282     | 32x3*     | 4          |
| R999Y283     | 32x3      | 50         |

\*4-meter bar pipe

### Technical data

R999 multi-layer pipe has an internal PE-X layer, an intermediate aluminium layer, longitudinally welded (butt welding) with laser technology, and an external PE-X layer. The intermediate layers of bonding agent join in a homogeneous way the aluminium layer to the PE-X layers.

The characteristics of piping systems in terms of performance are specified over a period of 50 years of continuous operation.

| Application field                                | T <sub>oper</sub> [°C] | Time a T <sub>oper</sub> [years] | T <sub>max</sub> [°C] | Time at T <sub>max</sub> [years] | T <sub>mal</sub> [°C] | Time at T <sub>mal</sub> [h] |
|--|------------------------|----------------------------------|-----------------------|----------------------------------|-----------------------|------------------------------|
| Hot water sanitary                               | 60                     | 49                               | 80                    | 1                                | 95                    | 100                          |
| Underfloor heating and low temperature radiators | 20                     | 2,5                              | 70                    | 2,5                              | 100                   | 100                          |
|  | Followed by            |                                  |                       |                                  |                       |                              |
|  | 40                     | 20                               |                       |                                  |                       |                              |
| High temperature radiators                       | 60                     | 25                               | 90                    | 1                                | 100                   | 100                          |
|  | Followed by            |                                  |                       |                                  |                       |                              |
|  | 20                     | 14                               |                       |                                  |                       |                              |
|  | 60                     | 25                               | 90                    | 1                                | 100                   | 100                          |
|  | Followed by            |                                  |                       |                                  |                       |                              |
|  | 80                     | 10                               |                       |                                  |                       |                              |

#### - Operating Temperature (T<sub>oper</sub>):

operating temperature for the application field, expressed in °C.

#### - Maximum operating Temperature (T<sub>max</sub>):

the highest value of the operating temperature, allowed just for a short period of time.

#### - Malfunction Temperature (T<sub>mal</sub>):

the highest temperature value in case of failure of the control systems (the time period possible and allowed for this value is 110 h over a period of 50 years of continuous operation).

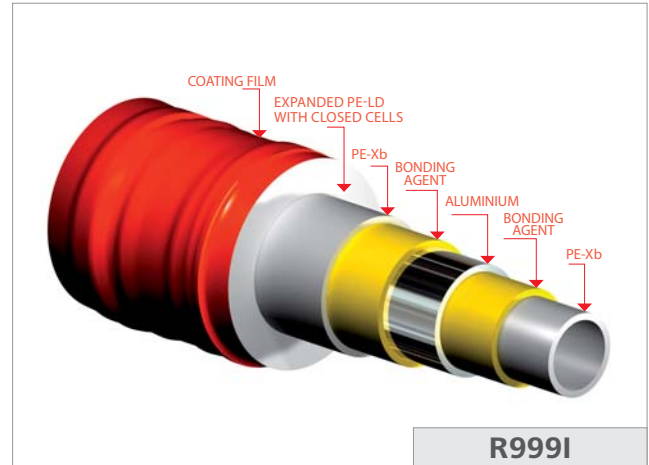
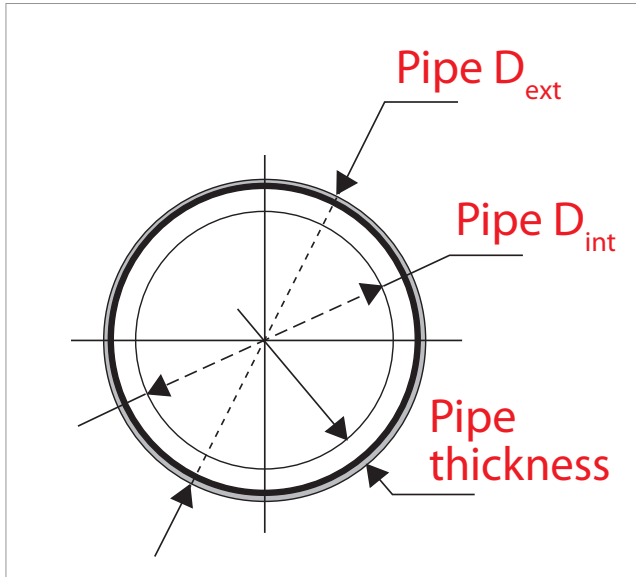
Pipes assure an adequate water conveyance over a period of 50 years at an operating temperature corresponding to the application field and an operating pressure of 6 bars.

Pipes assure an adequate water conveyance over a period of 50 years at an operating temperature of 20°C and an operating pressure of 10 bars.

(ref. UNE 53961 EX)

**PE-X/Al/PE-X MULTILAYER PIPES FOR SANITARY DISTRIBUTION, HEATING AND COOLING SYSTEMS**

- Coefficient of linear thermal expansion, at 20 °C:  $2,4 \cdot 10^{-5} \text{ K}^{-1}$
- Pipe thermal conductivity:  $0,40 \text{ W/m} \cdot \text{K}$
- Internal roughness  $\epsilon$ :  $7,0 \cdot 10^{-6} \text{ m}$
- Minimum bending radius, without tube bending spring:  $5 \times D_{\text{ext}}$



**Description - R999I**

PE-X/Al/PE-X multi-layer pipe is available also in the R999I isolated version (L.10/91). The layer of insulating material, made in expanded polyethylene with closed cells, not only increases energy efficiency of the system but further improves the already reduced noise of the systems made with synthetic materials. As already mentioned the insulating section is composed of a layer of expanded polyethylene with closed cells (without CFC) protected by a characteristic external red colour coating film.

**Insulating section specification - R999I**

**Material**

- Expanded PE-LD with closed cells without CFC and HCFC

**Reaction to fire**

- "Class 1", according to D.M.26/06/84
- "Euroclass E", according to EN 1350-1

**Thermal Conductivity**

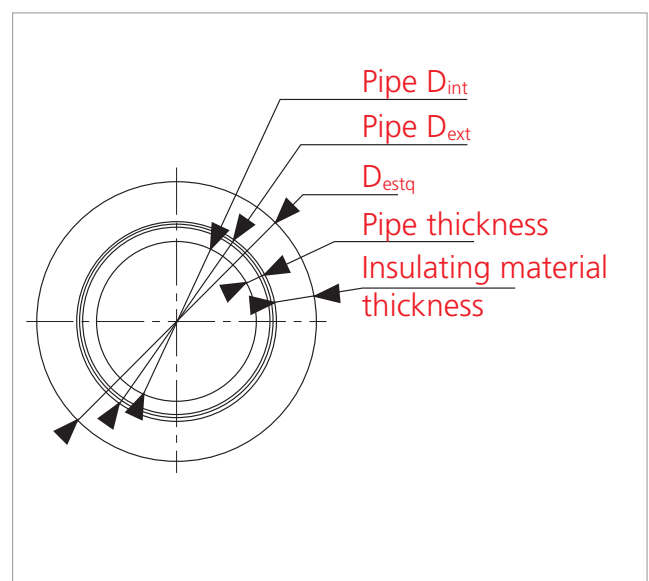
-  $0,040 \text{ W/m} \cdot \text{K}$

**Resistance to the spread of water vapour**

-  $\mu > 5000$

| Item      | Pipe D <sub>ext</sub> [mm] | Pipe D <sub>int</sub> [mm] | Pipe thickness [mm] | Weight [g/m] | Contained water [l/m] | Minimum bending radius* [mm] |
|-----------|----------------------------|----------------------------|---------------------|--------------|-----------------------|------------------------------|
| R999 16x2 | 16,0                       | 12,0                       | 2,0                 | 115          | 0,113                 | 80                           |
| R999 18x2 | 18,0                       | 14,0                       | 2,0                 | 132          | 0,154                 | 90                           |
| R999 20x2 | 20,0                       | 16,0                       | 2,0                 | 148          | 0,201                 | 100                          |
| R999 26x3 | 26,0                       | 20,0                       | 3,0                 | 260          | 0,314                 | 130                          |
| R999 32x3 | 32,0                       | 26,0                       | 3,0                 | 327          | 0,531                 | 160                          |

\*Without tube bending spring



**PE-X/Al/PE-X MULTILAYER PIPES FOR SANITARY DISTRIBUTION, HEATING AND COOLING SYSTEMS**

| Item       | Pipe D <sub>ext</sub> [mm] | Pipe D <sub>int</sub> [mm] | Pipe thickness [mm] | Pipe D <sub>extq</sub> [mm] | Insulating material thickness [mm] | Insulating R [m <sup>2</sup> K/W] |
|------------|----------------------------|----------------------------|---------------------|-----------------------------|------------------------------------|-----------------------------------|
| R999I 14x2 | 14,0                       | 10,0                       | 2,0                 | 26                          | -                                  | 0,150                             |
| R999I 16x2 | 16,0                       | 12,0                       | 2,0                 | 28                          | 34                                 | 0,150 0,225                       |
| R999I 18x2 | 18,0                       | 14,0                       | 2,0                 | 30                          | 36                                 | 0,150 0,225                       |
| R999I 20x2 | 20,0                       | 16,0                       | 2,0                 | 38                          | 46                                 | 0,225 0,325                       |
| R999I 26x3 | 26,0                       | 20,0                       | 3,0                 | 44                          | 52                                 | 0,225 0,325                       |
| R999I 32x3 | 32,0                       | 26,0                       | 3,0                 | 50                          | -                                  | 0,225                             |

Recommended series for heating systems

Recommended series for cooling systems

## Sizes and Product codes

Insulated PE-X/Al/PE-X multi-layer pipe (L.10/91) is available in rolls of 50 m, for the measures from 16x2 to 20x2, and in rolls of 25 m, for the measures from 26x3 and 32x3.

| Product code | Size [mm] | Length [m] |
|--------------|-----------|------------|
| R999IY220    | 16x2      | 50         |
| R999IY230    | 18x2      | 50         |
| R999IY240    | 20x2      | 50         |
| R999IY270    | 26x3      | 25         |
| R999IY280    | 32x3      | 25         |

## Connections

To use the PE-X/Al/PE-X multi-layer pipe both connections with mechanical pressure and compression connections are available. In both kinds of connection a separation sector insulates the aluminium of the pipe from the connection, so to avoid the triggering of galvanic corrosion.



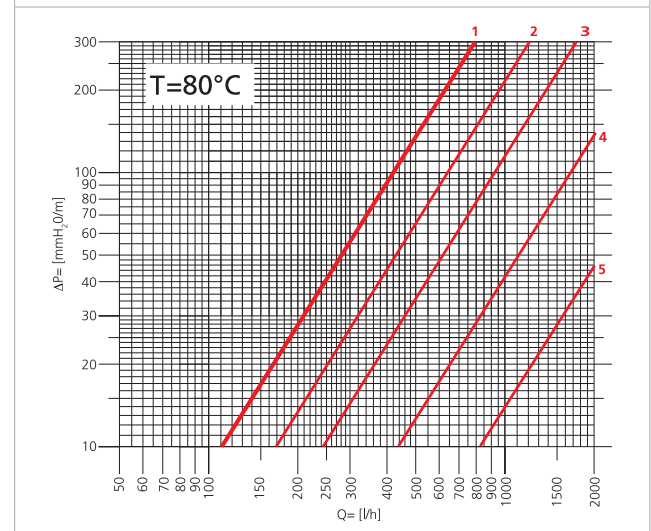
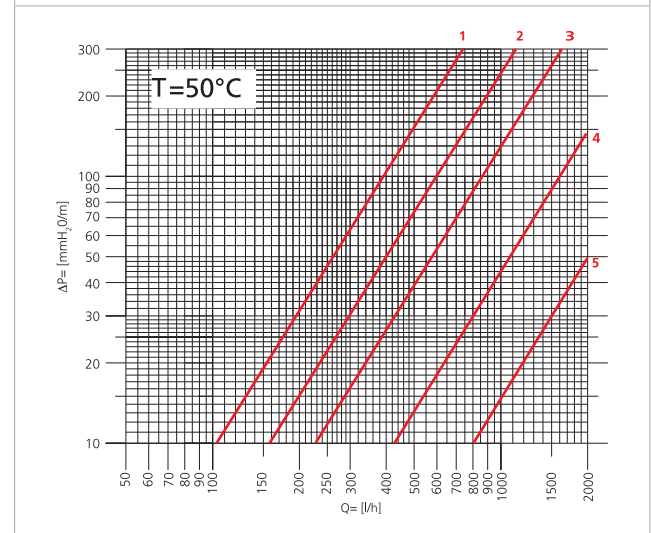
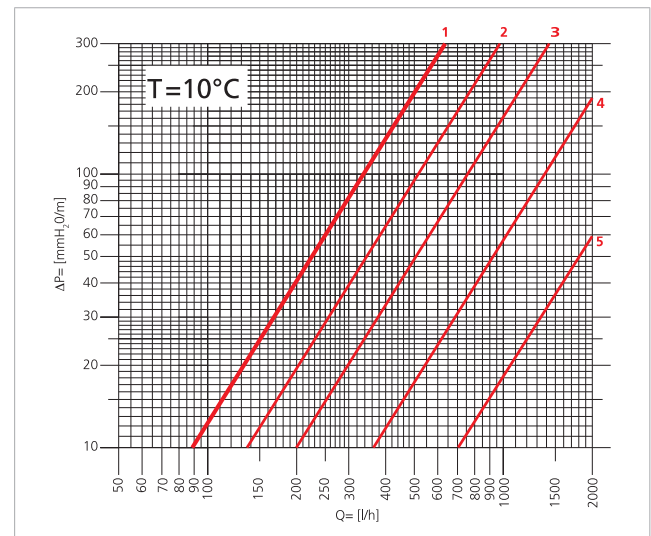
### NOTE

Since the array of figures representing the families of mechanical pressure and compression connections is huge, we recommend referring to the latest update of the commercial catalogue to identify available sizes and codes, with the relative application field.

## Pressure losses

In the charts beside the pressure losses of the PE-X/Al/PE-X multi-layer pipe are reported for the various sizes.

- 1: pipe 16x2
- 2: pipe 18x2
- 3: pipe 20x2
- 4: pipe 26x3
- 5: pipe 32x3



**Thermal expansions**

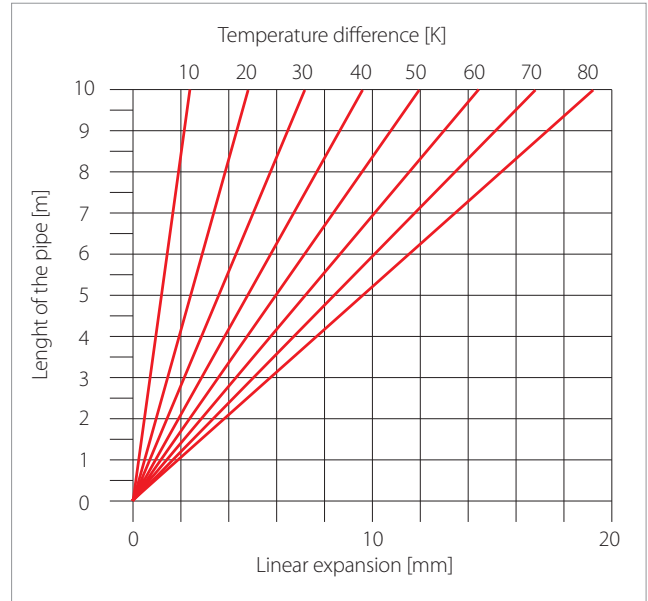
In the design and installation of PE-X/Al/ PE-X multi-layer pipes the occurrence of thermal expansion has to be taken into account. Through the attached table and the chart the necessary estimates can be made.

Remember that thermal expansion can be estimated through the formula:

$$\Delta l = \alpha \cdot L \cdot \Delta t$$

where:

- $\Delta l$  = expansion expressed in mm
- $\alpha$  = thermal expansion coefficient corresponding to 0,024 mm/m K
- L = length of the pipe expressed in m
- $\Delta t$  = variation of the temperature expressed in Kelvin [K] or Celsius [°C] degrees



**Linear expansion in mm**

| Length of the pipe [m] | Temperature difference [K] |      |      |      |       |       |       |       |
|------------------------|----------------------------|------|------|------|-------|-------|-------|-------|
|                        | 10                         | 20   | 30   | 40   | 50    | 60    | 70    | 80    |
| 0,5                    | 0,12                       | 0,24 | 0,36 | 0,48 | 0,60  | 0,72  | 0,84  | 0,96  |
| 1,0                    | 0,24                       | 0,48 | 0,72 | 0,96 | 1,20  | 1,44  | 1,68  | 1,92  |
| 1,5                    | 0,36                       | 0,72 | 1,08 | 1,44 | 1,80  | 2,16  | 2,52  | 2,88  |
| 2,0                    | 0,48                       | 0,96 | 1,44 | 1,92 | 2,40  | 2,88  | 3,36  | 3,84  |
| 2,5                    | 0,60                       | 1,20 | 1,80 | 2,40 | 3,00  | 3,60  | 4,20  | 4,80  |
| 3,0                    | 0,72                       | 1,44 | 2,16 | 2,88 | 3,60  | 4,32  | 5,04  | 5,76  |
| 3,5                    | 0,84                       | 1,68 | 2,52 | 3,36 | 4,20  | 5,04  | 5,88  | 6,72  |
| 4,0                    | 0,96                       | 1,92 | 2,88 | 3,84 | 4,80  | 5,76  | 6,72  | 7,68  |
| 4,5                    | 1,08                       | 2,16 | 3,24 | 4,32 | 5,40  | 6,48  | 7,56  | 8,64  |
| 5                      | 1,20                       | 2,40 | 3,60 | 4,80 | 6,00  | 7,20  | 8,40  | 9,60  |
| 5,5                    | 1,32                       | 2,64 | 3,96 | 5,28 | 6,60  | 7,92  | 9,24  | 10,56 |
| 6,0                    | 1,44                       | 2,88 | 4,32 | 5,76 | 7,20  | 8,64  | 10,08 | 11,52 |
| 6,5                    | 1,56                       | 3,12 | 4,68 | 6,24 | 7,80  | 9,36  | 10,92 | 12,48 |
| 7,0                    | 1,68                       | 3,36 | 5,04 | 6,72 | 8,40  | 10,08 | 11,76 | 13,44 |
| 7,5                    | 1,80                       | 3,60 | 5,40 | 7,20 | 9,00  | 10,80 | 12,60 | 14,40 |
| 8,0                    | 1,92                       | 3,84 | 5,76 | 7,68 | 9,60  | 11,52 | 13,44 | 15,36 |
| 8,5                    | 2,04                       | 4,08 | 6,12 | 8,16 | 10,20 | 12,24 | 14,28 | 16,32 |
| 9,0                    | 2,16                       | 4,32 | 6,48 | 8,64 | 10,80 | 12,96 | 15,12 | 17,28 |
| 9,5                    | 2,28                       | 4,56 | 6,84 | 9,12 | 11,40 | 13,68 | 15,96 | 18,24 |

## Precautions

PE-X/Al/PE-X multi-layer pipes, as all the pipes, require minor precautions necessary to guarantee their duration and functionality:

- leave the pipe in the appropriate packages and store it in covered and dry areas to avoid that humidity damages the packages;
- protect from sunlight;
- cut the pipe only with the special pipe cutters able to make a clear cut, perpendicular to the axis of the piping and without trims;
- after each cutting operation, before inserting the connection, carry out the calibration with the special tool and lubricate the leak-proof elements of the hose nozzle;
- avoid the formation of ice inside the pipe, since the expansions due to the change of state could damage it permanently;
- do not store at temperatures below -30°C;
- the pipe should never be in contact with open flames;
- once the installation is over make a test at a pressure of 1,5 times the operating pressure.

## Guarantee

All the products and components supplied by GIACOMINI S.p.A. are subject to the European regulations in force concerning guarantee and liability (1994/44/CE Directive, 2001/95/CE Directive and CEE 85/374).


The guarantee is not valid in the following cases:

- if the operating conditions are different than those prescribed;
- if the pipe is used to distribute fluids not compatible with the material;
- if the installation instructions are not adequately followed;
- if the pipe shows defects already at the installation stage due to accidental factors that can be visually found at the stage of installation or of the pressure test of the system;
- if the pipe is installed using components not in the Giacomini production or other than authorized ones.

### Additional information

For additional information please check the Giacomini website at the following address: [www.giacomini.com](http://www.giacomini.com)

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