

R986

Polybutylene pipes



Radiant Systems Energy Management

Datasheet
0399EN 10/2022



Giacomini polybutylene pipes with intermediate anti-oxygen barrier can be used for the distribution of water in HVAC systems.

Besides the known advantages of using synthetic material pipes, the PB has a high flexibility that makes the installation quick and easy.

These pipes are extruded with an intermediate anti-oxygen barrier made of EVOH, in compliance with DIN 16968, DIN 16837 and DIN 4726 Standards.

Thanks to the barrier, the modest oxygen quantity that outside permeates towards the inside of the pipe, becomes completely negligible.

Versions and product codes

Pipe rolls

SERIES	PRODUCT CODE	SIZE [mm]	PACK [m]	PIPE COLOR
R986	R986Y116	16 x 2	100	Dark gray
	R986Y117		240	
	R986Y130		500	
	R986Y118	18 x 2	100	
	R986Y119		240	
	R986Y122	22 x 2	100	

Technical data

- Application classes (EN ISO 15875): 4, 5
- Not suitable for the transport of domestic water
- Density (ISO 1183): > 0,925 g/cm³
- Melt flow rate (ISO 1133): 0,6 g/10 min
- Fusion point (DSC): 127-129 °C
- Thermal expansion coefficient (D696): 0,13 mm/(m °C)
- Thermal conductivity (C177): 0,22 W/(m °C)
- Elasticity module (ISO 178): 450 MPa

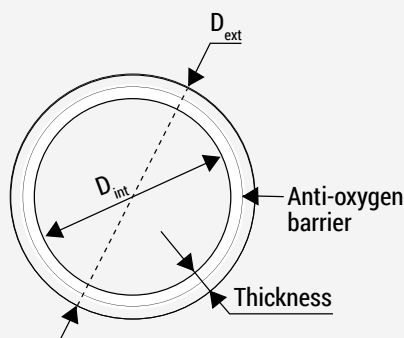
For each application classes, maximum usage pressure can be evinced from the table below:

SIZE	CLASS 4	CLASS 5
16 x 2	10 bar	10 bar
18 x 2	10 bar	10 bar
22 x 2	10 bar	8 bar

- All pipes are suitable for carrying water for a period of 50 years at a temperature of 20 °C and an operating pressure of 10 bar.
- All heating systems shall use as transfer fluid only water or treated water.

Main features

- Pressure loss reduced
- Lightweight: the specific weight of polybutylene is approximately 9 times lower than the weight of iron and copper
- Non-toxic: Polybutylene is a sure and non-toxic material
- Corrosionless: polybutylene is a bad conductor of electric energy
- Scaleless: linked both to the impossibility of calcareous deposit formation and to the chemical inertia of the material
- Resistance to high abrasion: this specific characteristic of polybutylene allows to increase the flow speed without abrasion problems
- UV ray resistant: when systems are exposed to solar rays, we recommend the piping be protected in order to avoid a premature ageing of the material
- Resistance to shock: the high material flexibility allows the pipe to return again to its original shape after a shock
- Chlorine resistant: as with all the plastic materials, the polybutylene can be damaged by chlorine concentrations higher than 1,5 ppm (mg/l)
- High flexibility especially at low temperatures
- Recycleable material
- Very good resistance to long-term stresses in combination with pressure and temperature. This feature remains unchanged also with high water temperature
- Giacomini polybutylene pipes are compatible with all Giacomini manifolds, fittings, valves and lockshields.
- Connections are made using Giacomini adapters for plastic pipes (R179, R179AM).



PIPE [mm]	D_{ext} [mm]	D_{int} [mm]	THICKNESS [mm]	WEIGHT [g/m]	WATER VOLUME [l/m]
16 x 2	16	12	2	85	0,113
18 x 2	18	14	2	98,4	0,154
22 x 2	22	18	2	124,5	0,254

Working pressure

The continuous working duration of Giacomini polybutylene pipe is established according to hydrostatic strength curves connecting the duration (expressed in hours) to pressure and to temperature of the transported fluid.

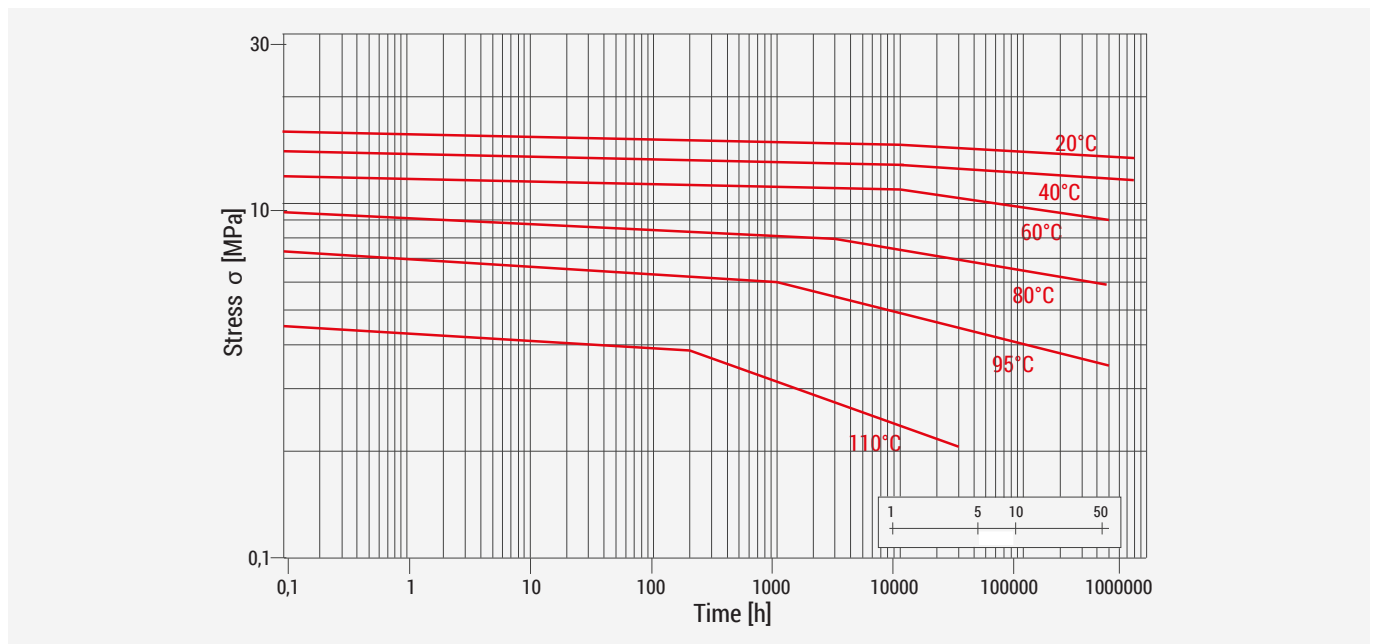
Pipe thickness characterising Giacomini polybutylene pipe is designed according to the required coefficient of security in order to guarantee the necessary reliability in the time.

The calculation of admitted working pressure is restrained to a series of parameters such as the temperature and the working period. Evaluation of admitted working pressures can be done by the formula and by the diagram as follows.

$$P_{\text{calc}} = \frac{20 \cdot sp \cdot \sigma}{DN \cdot sf} \quad P_{\text{max}} = \frac{P}{sf}$$

Where: P_{calc} = pressure in bar
 sp = pipe thickness in mm
 P_{max} = max. working pressure in bar
 DN = pipe external diameter in mm
 σ = extrapolated stress resulting from the diagram in MPa
 sf = security factor

Hydrostatic strenght curves Polybutylene



As shown in the examples of calculation extracted and reported in the table, after a continued working period of the system equal to 50 years with fluids at 95 °C (which will be lesser than the effective life of the system, except for systems with hot water recirculation), Giacomini polybutylene pipes are able to support pressures of at least 4,7 bar at 95 °C.

➤ Loss of pressure

The following diagram shows the losses of pressure distributed in Giacomini polybutylene pipes.

In order to evaluate a pressure loss at a temperature different from 10 °C (for this temperature is valid the below diagram), it is sufficient to multiply the result obtained by the diagram for the suitable coefficient of correction:

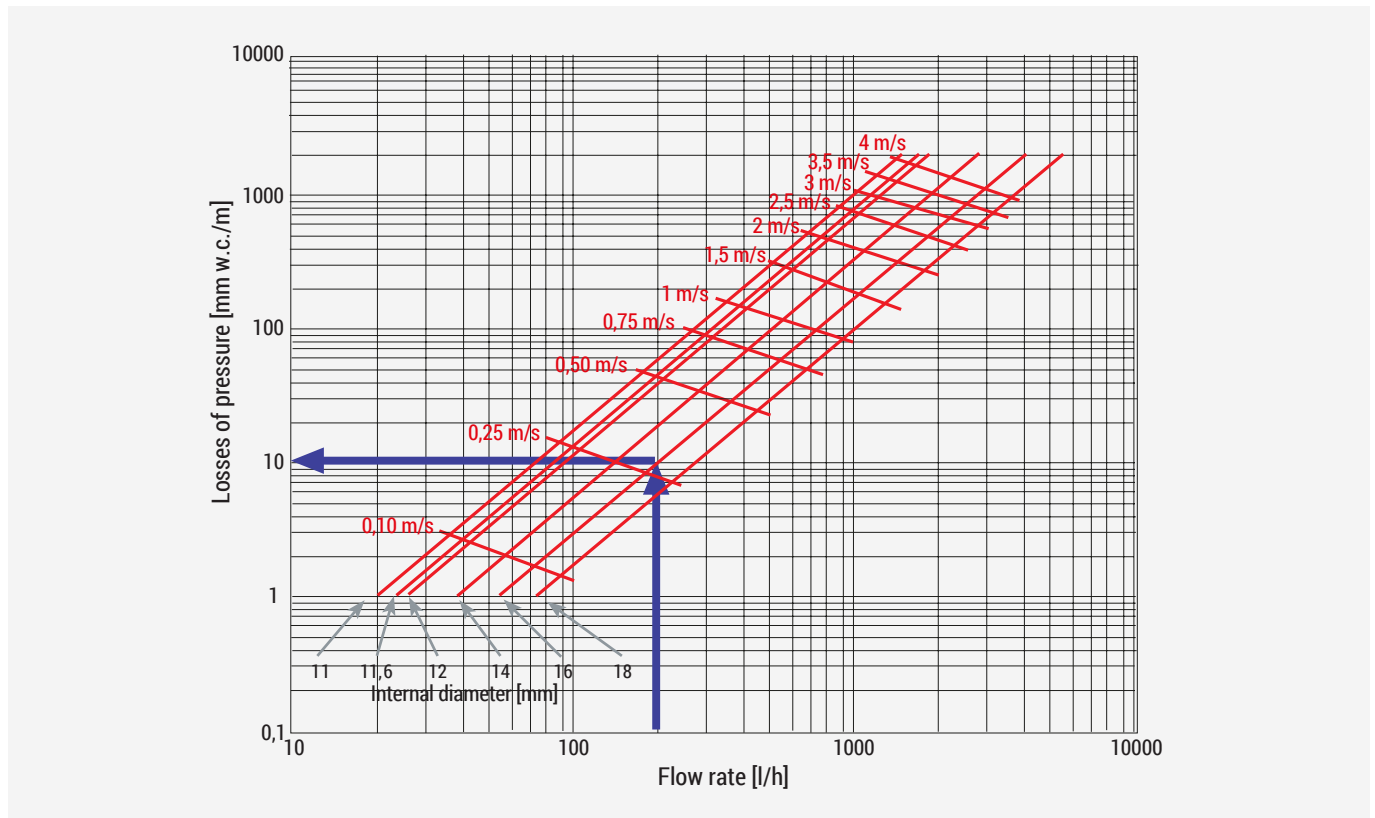
$$\Delta P_{50\text{ °C}} = \Delta P_{10\text{ °C}} \cdot 0,89$$

$$\Delta P_{80\text{ °C}} = \Delta P_{10\text{ °C}} \cdot 0,78$$

Graphic determination example of pressure losses

Examine a Giacomini polybutylene pipe 20 x 2 mm (internal diameter 16 mm) with a flow of 200 l/h at a temperature of 80 °C. In the diagram it is possible to determine immediately a pressure loss equal to 10 mm w.c./m at a temperature of 10 °C.

At 80 °C it will result in: $\Delta P_{80\text{ °C}} = \Delta P_{10\text{ °C}} \cdot 0,78 = 10 \cdot 0,78 = 7,8\text{ mm w.c./m}$



➤ Thermal expansions

Always take into account thermal expansion for planning and installation of polybutylene pipes.

Use the chart below to carry out proper evaluations.

Thermal expansion can be determined by applying the formula $\Delta L = \alpha \times L \times \Delta t$

where:

ΔL = expansion expressed in mm

α = linear thermal expansion coefficient corresponding to 0,026 mm/m K

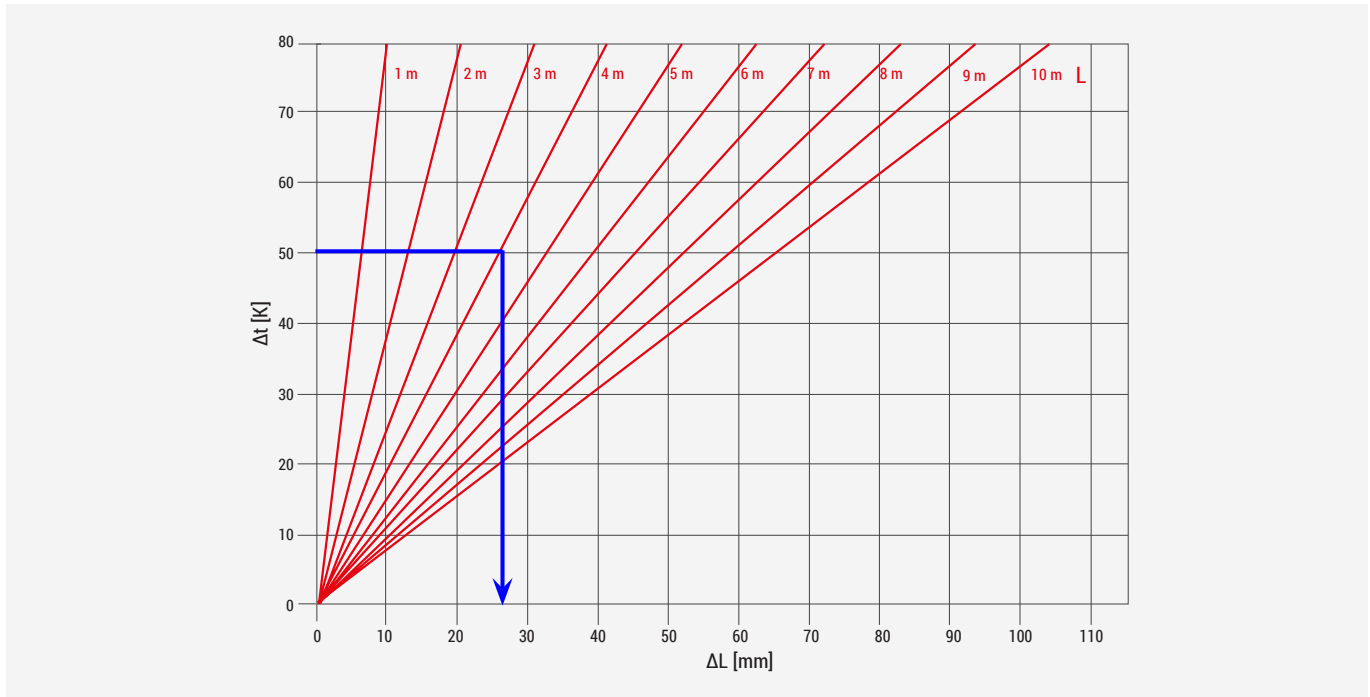
L = pipe length expressed in m

Δt = temperature variation expressed in Kelvin [K] or Celsius [°C] degrees

PIPE LENGTH [m]	TEMPERATURE DIFFERENCE [K]								
	5	10	20	30	40	50	60	70	80
0,1	0,07	0,13	0,26	0,39	0,52	0,65	0,78	0,91	1,04
0,2	0,13	0,26	0,52	0,78	1,04	1,3	1,56	1,82	2,08
0,3	0,2	0,39	0,78	1,17	1,56	1,95	2,34	2,73	3,12
0,4	0,26	0,52	1,04	1,56	2,08	2,6	3,12	3,64	4,16
0,5	0,33	0,65	1,3	1,95	2,6	3,25	3,9	4,55	5,2
0,6	0,39	0,78	1,56	2,34	3,12	3,9	4,68	5,46	6,24
0,7	0,46	0,91	1,82	2,73	3,64	4,55	5,46	6,37	7,28
0,8	0,52	1,04	2,08	3,12	4,16	5,2	6,24	7,28	8,32
0,9	0,59	1,17	2,34	3,51	4,68	5,85	7,02	8,19	9,36
1	0,65	1,3	2,6	3,9	5,2	6,5	7,8	9,1	10,4
2	1,3	2,6	5,2	7,8	10,4	13	15,6	18,2	20,8
3	1,95	3,9	7,8	11,7	15,6	19,5	23,4	27,3	31,2
4	2,6	5,2	10,4	15,6	20,8	26	31,2	36,4	41,6
5	3,25	6,5	13	19,5	26	32,5	39	45,5	52
6	3,9	7,8	15,6	23,4	31,2	39	46,8	54,6	62,4
7	4,55	9,1	18,2	27,3	36,4	45,5	54,6	63,7	72,8
8	5,2	10,4	20,8	31,2	41,6	52	62,4	72,8	83,2
9	5,85	11,7	23,4	35,1	46,8	58,5	70,2	81,9	93,6
10	6,5	13	26	39	52	65	78	91	104
LINEAR EXPANSION [mm]									

During the planning and outside installation phases of Giacomini polybutylene pipes the thermal expansion must not be overlooked.

If the working pressure of the system can pass through variations up to 10±15 °C (typical case of systems for the addition of domestic hot water), the planner will evaluate the piping behaviour. This is possible using the following table and the diagram.



Δt = working temperature variation in degrees Kelvin (°K) or Celsius (°C)
 ΔL = variation of length in mm
 L = initial length of the pipe in mm

Graphic determination example of thermal linear expansion

When a pipe length L = 4 m and a probable temperature variation Δt = 50 °C has been fixed, it is possible to go back to a variation of length ΔL = 26 mm using the table and the diagram.

Thermal linear expansion calculation

Thermal expansion of Giacomini polybutylene pipes can also be valued with the following formula: $\Delta l = L \cdot \Delta t \cdot \alpha$

where:

Δt = working temperature variation in degrees Kelvin (°K) or Celsius (°C)

Δl = variation of length in mm

L = initial pipe length in mm

α = linear thermal expansion coefficient of 0,13 mm/mK for Giacomini polybutylene pipes (mm for every °C of thermal fall)

Example of thermal linear expansion calculation

When a piping length L = 4 m and a possible variation of temperature Δt = 50 °C, has been fixed the formula used is the following:

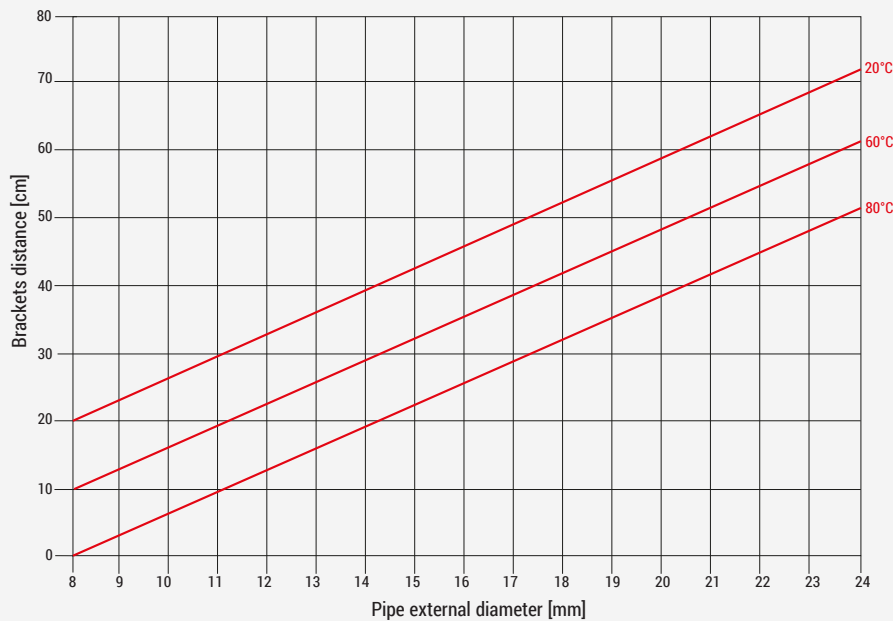
$$\Delta l = L \cdot t \cdot \alpha = 4 \cdot 50 \cdot 0,13 = 26 \text{ mm}$$

⚠ WARNING. The above mentioned thermal expansions refer to the visible pipe installation and it is recommended to cover the pipe to protect it from solar rays.

In case of an installation where the outer sleeve is not used, the expansion is absorbed by the pipe due to its high flexibility. When using an outer sleeve the expansion will be discharged in the air space between the pipe and the sleeve.

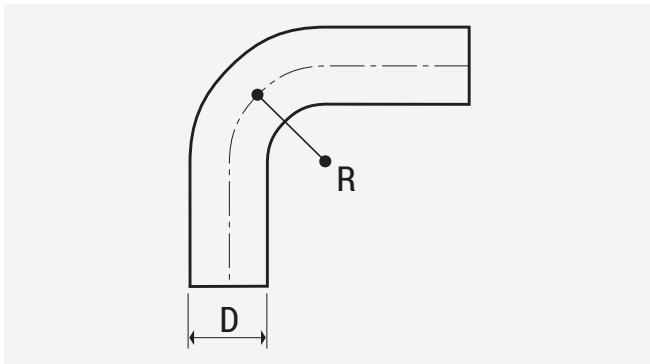
➤ Brackets for external pipe work

For an outside installation, the designer and the plumber have to carefully value the distances between the pipe brackets. In order to do this valuation, it is necessary to know the working temperature of the pipe.



⚠ WARNING. In order to prevent early ageing of the pipe, we recommend to install Giacomini polybutylene pipe away from direct sun light.

➤ Bending



Due to the high flexibility of Giacomini polybutylene pipes simple bending can be carried out manually. The minimum radius of curvature to be realized is equal to 5 times the pipe diameter (as recommended in the specification DIN 4726), if pipe has been installed without sleeve.

➤ Precautions

Giacomini polybutylene pipes, as with all plastic pipes, need some small precautions in order to guarantee duration and operation:

- store the pipe in suitable packaging in order to avoid direct exposure to sun rays.
- store the pipe packaging in covered and dry places.
- prevent the pipe from coming into contact with sharp objects, and pay particular attention during transportation and installation of the pipe.
- avoid tight bends during the installation of the sheathed pipe; it is recommended to have curves at least 8 times the external diameter of the pipe used, in order to guarantee pliability.
- cut the Giacomini polybutylene pipe using the correct pipe cutters to ensure there are no burrs and that the cut is perpendicular to the pipe axis.
- prevent the pipe from coming into contact with open flames or other heat sources.
- protect pipe from U.V. rays during installation. Avoid direct exposure to the sun in order to stop "pipe ageing".

➤ Warranty

The warranty shall be void when:

- 1) the working conditions vary from those provided for;
- 2) the pipe is used to transfer fluids not compatible with the construction material;
- 3) the installation instructions are not fully complied with;
- 4) the pipe shows visible defects caused by accidental factors upon installation or when the system is pressurized;
- 5) the pipe is installed using components not produced by Giacomini or different from the ones allowed.

➤ Classification of working conditions (EN ISO 21003-1)

The performance specifications for pipe-based systems complying with EN ISO 21003-1 refer to a project with a 50-year operational life.

RANGE OF APPLICATION	WORKING TEMPERATURE T_D [°C]	DURATION OF T_D [years]	MAX WORKING TEMPERATURE T_{MAX} [°C]	DURATION OF T_{MAX} [years]	FAILURE TEMPERATURE T_{FAIL} [°C]	DURATION OF T_{FAIL} [h]
CLASS 4 Floor heating and low-temperature systems	20	2,5	70	2,5	100	100
	+	+				
	40	20				
	+	+				
CLASS 5 Radiator heating and high-temperature systems	60	25	90	1	100	100
	+	+				
	60	25				
	+	+				
	80	10				

- Working temperature (T_D): working temperature provided for the range of application, expressed in °C.
- Max. working temperature (T_{MAX}): the working temperature highest value, allowed only for a short time.
- Failure temperature (T_{FAIL}): the highest temperature possible when control systems fail (the time allowed for this value is 100 h over 50 years of uninterrupted operation).

⚠ Safety Warning. Installation, commissioning and periodical maintenance of the product must be carried out by qualified operators in compliance with national regulations and/or local standards. A qualified installer must take all required measures, including use of Individual Protection Devices, for his and others' safety. An improper installation may damage people, animals or objects towards which Giacomini S.p.A. may not be held liable.

♻ Package Disposal. Carton boxes: paper recycling. Plastic bags and bubble wrap: plastic recycling.

ℹ Additional information. For more information, go to giacomini.com or contact our technical assistance service. This document provides only general indications. Giacomini S.p.A. may change at any time, without notice and for technical or commercial reasons, the items included herewith. The information included in this technical sheet do not exempt the user from strictly complying with the rules and good practice standards in force.

♻ Product Disposal. Do not dispose of product as municipal waste at the end of its life cycle. Dispose of product at a special recycling platform managed by local authorities or at retailers providing this type of service.