



A close-up photograph of a person's hands being washed under a running faucet in a white sink. The water is splashing, and the background is softly blurred.

Sanitary distribution systems



**Our passion
never stops growing.
Just like our Group.**

1951

COMPANY
ESTABLISHMENT

More than **900** **EMPLOYEES**

70 TONS
OF BRASS DAILY

130,000 m² PRODUCTION PLANTS

A TURNOVER
CLOSE TO **200** millions

80 % EXPORT

To be the best you need the **right numbers**.
Such numbers make **our group** one of today's **world leaders** in the production of heating, conditioning and sanitary water distribution components and systems for the residential, industrial and commercial sectors. **A reality constantly expanding**, just like our goals.



BRANCHES, REPRESENTATIVE OFFICES AND EXCLUSIVE PARTNERS

- | | | | | |
|------------|---------------|-------------|------------------|----------|
| ① ITALY | | | | |
| ② FRANCE | ⑥ BELGIUM | ⑩ CHINA | ⑭ CZECH REPUBLIC | ⑱ INDIA |
| ③ SPAIN | ⑦ SWITZERLAND | ⑪ BRAZIL | ⑮ SLOVAKIA | ⑲ RUSSIA |
| ④ PORTUGAL | ⑧ GERMANY | ⑫ ARGENTINA | ⑯ TURKEY | ⑳ UAE |
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Water Management. Innovative systems for Sanitary Distribution of Drinking Water.





Components for optimization of energy consumptions and metering, distribution of hot and cold fluids.



Components for drinking water distribution networks, water-sanitary system devices.



Radiant floor and wall conditioning, false ceilings for residential and commercial use, thermoregulation and air treatment.



Distribution products and systems for safe and performing gas transfers.



Components for energy production systems from renewable sources.



Specialized performing components for the professional fire-prevention sector.





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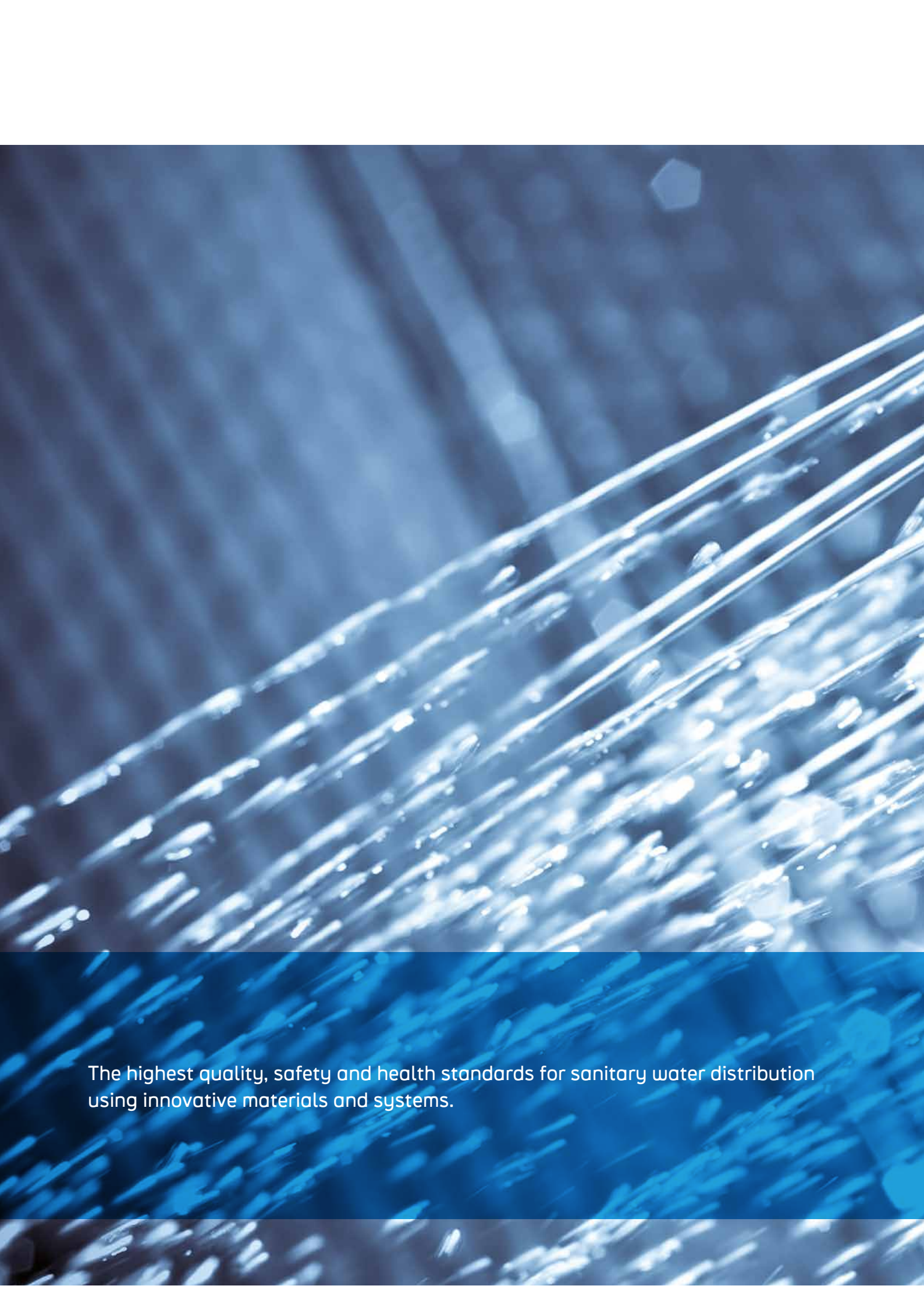
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The highest quality, safety and health standards for sanitary water distribution using innovative materials and systems.



Chapter 1

The evolution of sanitary water distribution: health and energy efficiency

INTRODUCTION

Drinking water represents one of the most valuable resources for human life. The ancient Romans used to say *Salus per aquam*, health through water. Water for human consumption, in the past as today, contains essential health and nutritional benefits.

Even if 70.9 % of the Earth's surface is made up of water, only 0.03 % is accessible and unpolluted enough for human consumption.

Protection of such a precious element (already referred to as blue gold) requires a collective action by public administrations, technical operators of the sector (distribution organizations, planners, installers) and final users. This would include:

- > **quality control of the springs and public networks;** governments, according to WHO (World Health Organization) provisions, set the guidelines (EU directives, laws and standards) for water parameters that must be periodically monitored and tested by the distributors. The latter would be responsible for the public network, up to building inlets of private buildings (metering unit)
- > **planning and sizing of the domestic system¹;** the planner conceives and sizes the sanitary system inside the building based on the customer's requirements, the technical standards and existing guidelines
- > **state-of-the art assembly and commissioning;** the installer uses suitable systems and products that do not alter water quality, from the building inlet up to each delivery point
- > **mindful use;** the final user, after using the system, performs periodical maintenance

In addition to sanitary safety, **energy saving** for hot water production and distribution is becoming more and more important, considering the general willingness to conciliate low consumptions with reasonably low investments or in any case abatable by exploiting regulations and eco-bonuses.

With its drinking water products and systems, Giacomini can offer professional operators cutting-edge technologies for an efficient realization of cold water (SCW) and hot water (DHW) systems in the most varied residential solutions.

NOTES

¹ The term "domestic distribution system" refers to pipes, fittings and devices installed between faucets normally used for dispensing drinking water and the external distribution network. The limit between the domestic distribution system and the external distribution network, also known as delivery point, includes the metering unit, except when differently specified by the supply contract.

THE HIGHEST QUALITY AND SAFETY

Drinking water as one of the Millennium development goals

The United Nations Millennium Declaration, signed in September 2000 by all UN Member States, defined eight fundamental development goals, among which eradication of extreme poverty and hunger in the world, universal primary education, reduction of child and mother mortality, the fight against HIV/AIDS, malaria and other diseases. The seventh of these "Millennium Goals" (*Millennium Development Goals or MDG*), i.e. guarantee environmental sustainability, provided a target by which the global community would cut by half the number of people without sustainable access to a safe drinking water source² within 2015.

The World Health Organization (WHO) and UNICEF have started assessing the drinking water issue in 1990, thus providing regular estimates of the MDG progresses through the *Joint Monitoring Program for Water Supply and Sanitation (JMP)*. As in 1990 the global coverage for use of improved drinking water sources reached 76 %, the MDG target cutting by half the population without such opportunities was increased to 88 % within 2015. This was a great challenge as the global figures concealed large coverage differences between the various countries, many of which were fighting poverty, political instability and fast population growth.

The 88 % MDG global goal for drinking water had already been achieved in 2010 and 2015 witnessed 91 % of the global population enjoying an improved drinking water source³.

Notwithstanding the significant progress, the absolute numbers show that there are still 663 million people without access to drinking water from safe or improved sources, specifically in rural areas (fig. 1.1 - 1.2).

This means that to universally guarantee sustainable access to safe drinking water sources and proper hygienic services, ongoing actions aimed at technological development in this sector represent an unquestionable requirement.

NOTES

² **Drinking water source** is defined as a source which, by the nature of its structure, properly protects it from external contamination, specifically from fecal matter.

³ "Progress in 25 years for sanitary and drinking water - 2015 update and MDG assessment" – UNICEF

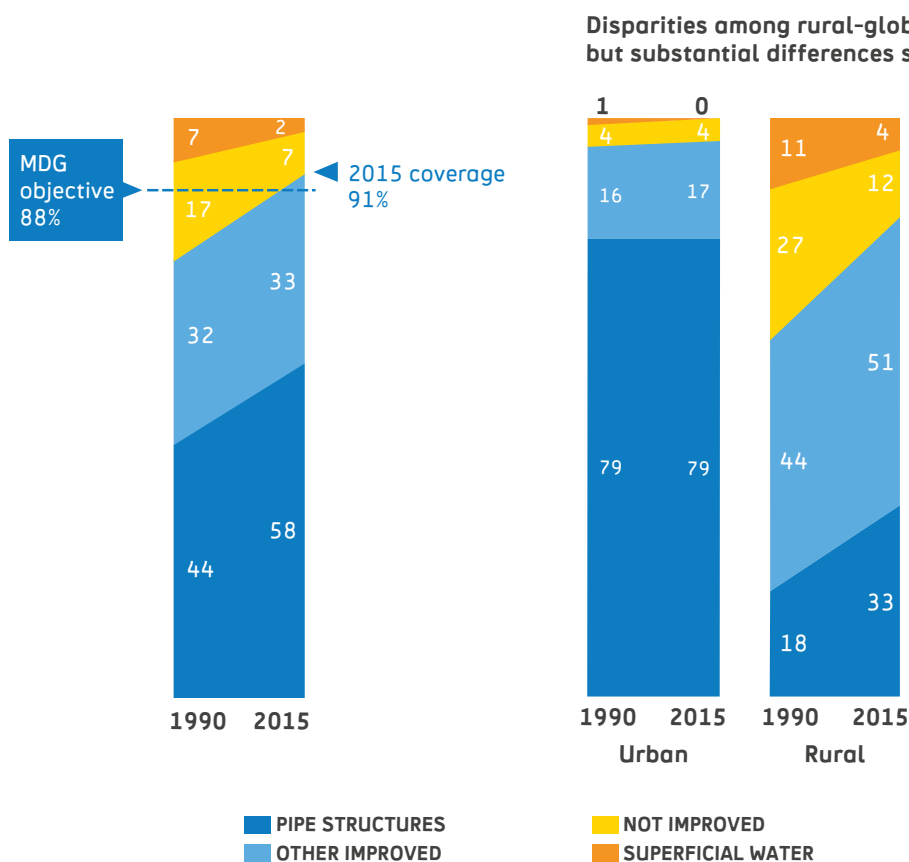


fig. 1.1
Trends of global drinking water coverage and MDG goal (%), 1990-2015

fig. 1.2
Trends of urban and rural areas for drinking water coverage (%)

The legionella hazard

Bacteria responsible for harmful human infections may proliferate in drinking water.

The most famous and dangerous is the *Legionella pneumophila* bacterium which causes the Legionnaires' disease pulmonary infection.

It was isolated and identified for the first time ever in 1976, following a severe epidemic (221 people contracted this previously unknown form of pneumonia and 34 died). It had spread among a group of former American Legion combatants (from which the disease name), who attended a conference in a hotel in Philadelphia, in the United States. The bacterial contamination source was identified in the hotel air conditioning system.

Legionella is a bacterium present both in natural and artificial environments: spring water, including spa waters, rivers, lakes, muds, soils. From these types of environment, it reaches artificial ones such as town ducts and building water systems, such as tanks, pipes, fountains and pools, which may act as amplifiers and spreaders of the microorganism, creating a potential hazard for human health.

Humans contract the infection through the air, i.e. when inhaling small water droplets (1-5 micron) contaminated by a sufficient quantity of bacteria; pulmonary infection sets in when this water reaches the lungs of subjects at risk. So far direct interhuman transmission has not been demonstrated.

Pneumonia by legionella cannot be distinguished from other atypical or bacterial forms of pneumonia, but it can be identified by the way it affects extrapulmonary organs. The disease is lethal in 5-15 % of the cases.

The *European Legionnaires' Disease Surveillance Network (ELDSNet)* has been in charge of the European monitoring of the Legionnaires' disease since 2010 and it is coordinated by the *European Centre for Disease Prevention and Control (ECDC)*. All Member States of the European Union, in addition to Ireland and Norway, are taking part in this network through epidemiologists or microbiologists appointed by national public health authorities. The *ELDSNet* also collaborates with partners such as the World Health Organization, public health authorities of non-EU countries and tour operators.

The last *ELDSNet* report, presented in Stockholm in 2016⁴, is based on Legionnaires' disease monitoring data collected up to 2014. The table in fig 1.3 and figures 1.4, 1.5, 1.6 show how the epidemiologic report confirms Legionnaires' disease as one of the most dangerous pathologies in Europe for the human organism, having as source, in 91 % of cases, hot and cold water systems. The number of reported cases in 2014 has been the highest ever registered. Its main drivers are: advanced age (75-80 % of victims are over 50), smoking, immunodeficiency, male gender (60-70 %), chronic degenerative pathologies. Severe epidemics, such as the one experienced in Portugal in 2014 for contamination of a cooling tower, remind us of the challenges to be faced to prevent and control Legionnaires' disease, especially by improving maintenance practices.



NOTES

⁴ European Centre for Disease Prevention and Control. 2015 Annual Epidemiologic Report. Legionnaires' Disease. Stockholm: ECDC; 2016. © European Centre for Disease Prevention and Control, 2016.

LEGIONNAIRES' DISEASE: RATIOS PER 100,000 INHABITANTS PER COUNTRY AND YEAR. EU/EEA 2010-2014

UE/EEA	2010		2011		2012		2013		2014					
	Cases	Report	Cases	Report	Cases	Report	Cases	Report	National data	Type of report	Reported cases	Report	ASP	Confirmed cases
Austria	80	1	101	1.2	104	1.2	100	1.2	Y	C	133	1.6	1.4	122
Belgium	89		79	0.7	84	0.8	155	1.4	Y	C	200	1.8	1.8	167
Bulgaria	1	0	0	0	0	0	1	0	Y	C	1	1	1	1
Croatia	-	-	-	-	-	-	16	0.4	Y	C	25	0.6	0.5	25
Cyprus	2	0.2	1	0.1	7	0.8	6	0.7	Y	C	6	0.7	0.8	6
Czech Republic	38	0.4	57	0.5	56	0.5	67	0.6	Y	C	110	1	1	108
Denmark	133	2.4	123	2.2	127	2.3	113	2	Y	C	158	2.8	2.6	116
Estonia	0	0	7	0.5	3	0.2	10	0.8	Y	C	8	0.6	0.6	7
Finland	24	0.4	9	0.2	10	0.2	15	0.3	Y	C	10	0.2	0.2	9
France	1540	2.4	1170	1.8	1298	2	1262	1.9	Y	C	1348	2	2	1325
Germany	688	0.8	637	0.8	628	0.8	811	1	Y	C	833	1	0.9	606
Greece	9	0.1	18	0.2	29	0.3	38	0.3	Y	C	27	0.2	0.2	26
Hungary	60	0.6	37	0.4	33	0.3	29	0.3	Y	C	32	0.3	0.3	31
Iceland	2	0.6	3	0.9	2	0.6	-	-	Y	C	4	1.2	1.3	2
Ireland	11	0.2	7	0.2	15	0.3	14	0.3	Y	C	8	0.2	0.2	8
Italy	1238	2.1	1021	1.7	1346	2.3	1363	2.3	Y	C	1476	2.4	2.1	1435
Latvia	6	0.3	49	2.4	48	2.3	34	1.7	Y	C	38	1.9	1.9	23
Liechtenstein	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithuania	1	0	2	0.1	9	0.3	1	0	Y	C	8	0.3	0.3	6
Luxembourg	10	2	6	1.2	5	1	7	1.3	Y	C	5	0.9	0.9	4
Malta	6	1.4	9	2.2	4	1	2	0.5	Y	C	9	2.1	-	9
Netherlands	466	2.8	311	1.9	304	1.8	308	1.8	Y	C	348	2.1	2	327
Norway	48	1	33	0.7	25	0.5	40	0.8	Y	C	51	1	1	41
Poland	36	0.1	18	0	8	0	11	0	Y	C	12	0	0	10
Portugal	128	1.2	89	0.8	140	1.3	94	0.9	Y	C	588	5.6	5.5	557
Romania	1	0	1	0	3	0	1	0	Y	C	1	0	0	1
Slovakia	4	0.1	7	0.1	4	0.1	6	0.1	Y	C	14	0.2	0.3	14
Slovenia	58	2.8	44	2.1	81	3.9	77	3.7	Y	C	59	2.9	2.7	59
Spain	1150	2.5	706	1.5	972	2.1	815	1.7	Y	C	925	2	1.9	916
Sweden	100	1.1	127	1.3	102	1.1	122	1.3	Y	C	136	1.4	1.3	95
United Kingdom	376	0.6	251	0.4	401	0.6	331	0.5	Y	C	370	0.6	0.6	356
UE/EEA	6305	1.3	4923	1	5848	1.1	5849	1.1	-	C	6943	1.4	1.2	6412

NOTES

Many countries have reported an occurrence lower than 0.5, many even lower than 0.1 cases out of 100,000, a situation that has not varied in the last five years and which is unlikely to reflect the actual impact of the Legionnaires' disease in these countries. The priority to solve this apparent difference in the monitoring is to support the countries with values lower than one out of each million inhabitants in order to improve the diagnostics and the reporting of Legionnaires' disease.

fig. 1.3

ASP: Age standardized percentage

CONFIRMED REPORT OF CASES OF LEGIONNAIRES' DISEASE EVERY 100,000 INHABITANTS PER STATE. EU/EEA. 2014

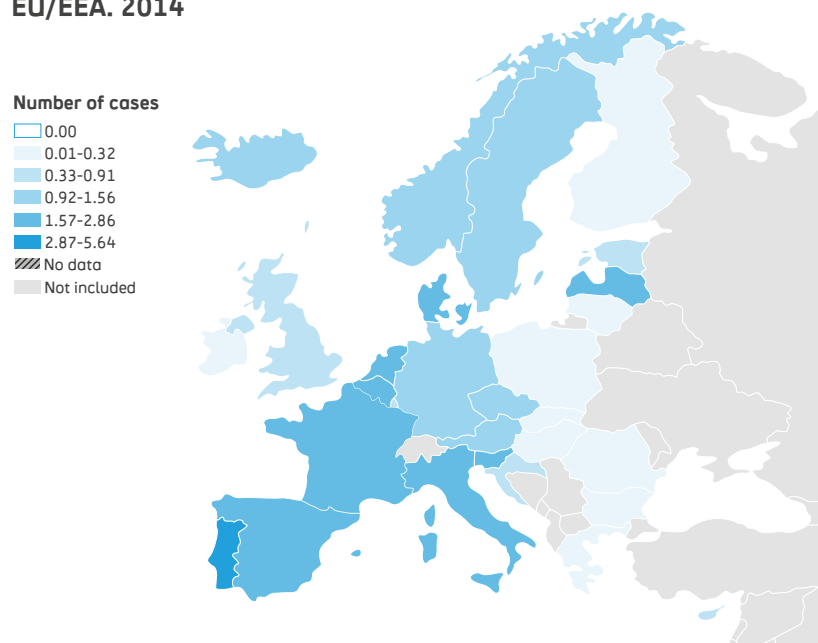


fig. 1.4

REPORT OF LEGIONNAIRES' DISEASE CASES EVERY 100,000 INHABITANTS PER AGE AND GENDER. EU/EEA. 2014

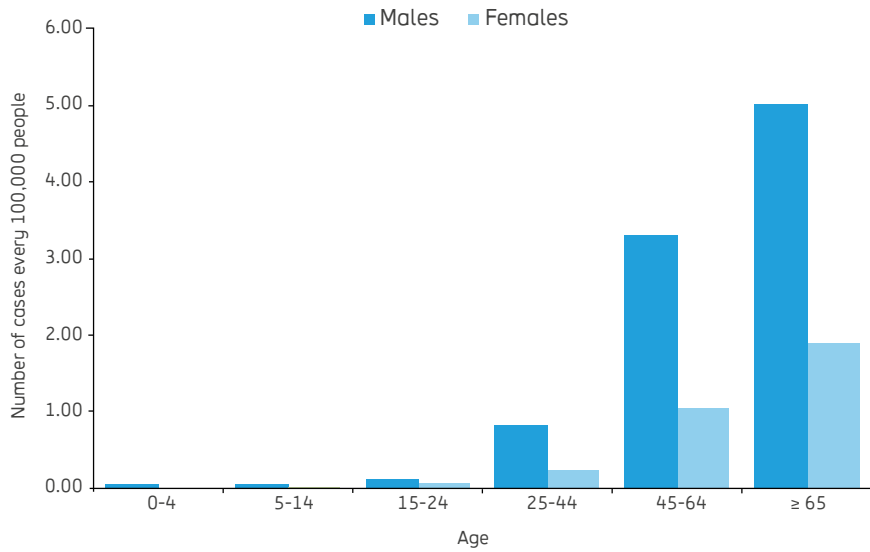


fig. 1.5

DISTRIBUTION OF SAMPLE SITES POSITIVE TO LEGIONELLA. EU/EEA. 2013

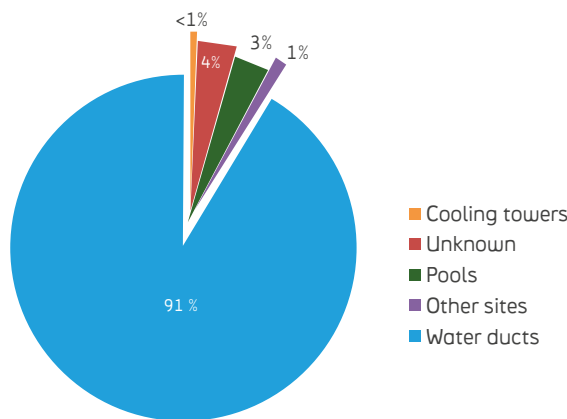


fig. 1.6

As shown by figure 1.6 the legionella bacterium is potentially dangerous in hot and cold water systems. Proliferation of the legionella bacterium in water is enhanced by the following conditions:

- > water temperature between 22 °C and 50 °C (up to 22 °C the bacterium exists but it is inactive)
- > oxygen and other substances in water
- > pipe material (predisposition to deposits and crusting)
- > water stagnation

Considering the factors described above one can easily understand that there are critical zones inside sanitary systems that must be properly faced during their planning construction maintenance and commissioning. European standard EN 806 (*Specifications for instal-*

lations inside buildings conveying water for human consumption) 2 (Planning) and 5 (Operation and Maintenance) with regards to the legionella bacterium provides that every Member State must indicate the measures to be adopted to **prevent proliferation** of the bacterium. Basically specific actions are required to **face the risk of Legionnaires' disease** mainly by:

- > carefully selecting the materials used to realize the installation and prevent the formation of biofilms and crusting
- > periodically heating water at a temperature higher than that of the bacteria proliferation value for boilers and pipes at risk (heating methods and temperatures must comply with the provisions of national law)
- > properly insulating hot and cold water pipes: max. cold water temperature 22 °C and min. hot water temperature 55 °C
- > preventing contact between water and air or accumulation in unsealed tanks
- > avoiding use of pipes with blind ends or without circulation
- > preventing stagnation by calculating the possible minimum dimensions of the pipes based on the required flow rates and the user's habits. Planning with adequate diameters and avoiding excessive pipe lengths enables a reduction in water contents and in turn stagnation times, to enhance the user's comfort while optimizing installation costs⁵
- > applying hot water recirculation
- > controlling the system at regular intervals to check its safety and performance

There are three disinfection procedures that can be adopted, for example in Germany, for the **recovery of contaminated water systems**:

- > thermal disinfection (at every delivery point for at least 3 minutes at a minimum of 70 °C)
- > chemical disinfection (for example by adding a sodium hypochlorite solution or other suitable chemical products)
- > UV irradiation (after cleaning and flushing the system)

NOTES

⁵ For the simplified pipe sizing method, refer to the EN 806 European standard (*Specifications for installations inside buildings conveying water for human consumption*), part 3 (*Pipe sizing – Simplified method*).

PEX-b pipes: high resistance to chlorine

The use of chlorine-based disinfectants, increasingly popular as anti-bacterial actions, has corrosive effects on distribution systems.

PEX-b, a polymer used by Giacomini to manufacture water supply pipes, is highly recommended to face the increase of chlorine in drinking water and is therefore the best choice for sanitary installations.

Lead, public enemy

The presence of lead in drinking water may affect consumers' health. In fact, the scientific community agrees on a possible correlation between lead exposure and pathologic effects such as neurologic and behavioral disturbances, cardiovascular diseases, renal insufficiency, hypertension, reduced fertility and abortions, delayed sexual maturation and altered dental development. Fetuses, newborns and children up to 6 represent sensible subgroups. In the adult population, instead, individuals with kidney disorders and high blood pressure are more at risk.

Based on the toxicological risk evaluations given above, the WHO (World Health Organization) recommends as a collective health prevention action the implementation of measures aiming at reducing the total exposition to lead, especially for population sensitive groups⁶.

In rare cases, possible lead contamination of drinking water may be traced back to presence of the mineral in rocks and sediments in contact with the aquifer of origin. More generally, contamination is caused by transfer **phenomena of the element from the materials of pipes, faucets and/or by release from welding, fittings or other materials that release lead in distribution systems**. Transfer phenomena are generally driven by extended permanence of water inside the distribution network (stagnation) and by specific chemical-physical conditions of water which tend to favor dissolution of the element from the material to the watery means. More specifically, larger quantities of lead are released within the water system in piped water with poor acid contents characterized by a high presence of dissolved chloride and oxygen, high temperatures, low tenors of water hardness (softened water). There are proofs also indicating that the tendency to release lead in water by a contact material, with the other conditions unvaried, reduces with the material ageing.

The use of lead in pipes and other components of water networks, both of aqueducts and domestic distribution systems, was quite popular in many European countries in the past, and it drastically decreased starting from the Sixties. Currently, the use of lead in materials in contact with drinking water is strictly regulated from a normative stand point, to limit the risk of water contamination. As the provision of the Drinking Water Directive 98/83/CE and related enforcing decrees of the Member States, the lead limit parameter for faucet water is currently equal to 10 µg/liter.

Removal of lead in contact with drinking water represents the only viable and effective solution to eliminate the risk. Considering that, as already discussed above, the main cause of contamination is connected to transfer of the element from the network materials – especially those inside buildings – removal or mitigation of the risks on a long term provides for replacement of the entire or part of the water distribution system, a measure requiring heavy resources in terms of money and time. However, in case of construction renovation, it is strongly recommended to realize new sanitary installations with materials complying with the rules in force.

Once the system has been realized in compliance with law, its devices must be regularly cleaned as they may experience lead-content material deposits (for example, diffuser meshes or possible filters installed on the faucets).

NOTE

⁶ Since 1970, in Europe various standards have been adopted to remove lead from varnish, gasoline and materials in contact with food and water, thus achieving satisfying results in reducing exposition. It is however essential to contribute in the reduction of lead within the food chain, including drinking water.

IT'S A LEAD PIPE IF ...



The bare pipe features an even grey color



Magnets do not stick to the pipe



It produces a dull sound if beaten with a metal object

ENERGY-SAVING DHW PRODUCTION AND DISTRIBUTION

DHW production

Sanitary hot water production devices may be broken down into various categories, based on different criteria:

> INSTANTANEOUS PRODUCTION / ACCUMULATION PRODUCTION

DHW instantaneous DHW production systems produce hot water upon actual consumption, with a flow rate varying based on the installed power and temperature differential between hot and cold water.

DHW production systems with accumulation tanks instead produce and maintain a hot water reserve for deferred use. Consequently, the hot water temperature can be considered constant, but the quantity of water that may be used at a specific time is limited by the tank content, the storing temperature and the re-provisioning method.

Examples:

Gas-fired tankless water heaters

Gas-fired accumulation tanks

> DIRECT HEATING / INDIRECT HEATING

In DHW production systems with direct heating, sanitary water and heat source are put into direct contact through the heat exchanger wall.

In DHW production systems with indirect heating, instead, sanitary water and heating source are separated by an intermediate means acting as exchanging heat transfer agent.

Examples:

Gas boiler with Instantaneous DHW production

Puffer with heat exchanger

> DEDICATED DHW PRODUCTION / DHW AND HEATING PRODUCTION COMBINED

In dedicated DHW production systems, the heat generator is dedicated only to DHW.

In combined production systems, the generator task is to both feed the heating circuit and produce DHW, giving priority to the latter (to limit the energy factor of the device).

Examples:

Instantaneous electric water heater

Wall-mounted water heater with heat exchanger

This type of schematization is purely theoretical, as there is an actual tendency to combine the different categories. The choice of a type of generator and its sizing depend on the actual usage needs and various conditions:

- > number of users and simultaneity factor
- > frequency of DHW use
- > type of dwelling (single-family house, multifamily house)
- > energy efficiency class of the building (for example, a passive house requires almost exclusively production of DHW)
- > availability of renewable energy sources

The planning choice, also in case of hot water systems, must always be oriented at **enhancing comfort and energy efficiency**.

DHW distribution

DHW distribution systems are broken down based on the type of dwelling unit installation:

- > **individual or single-user systems.** DHW production and distribution occur locally inside the single dwelling unit
- > **collective or multiuser systems.** DHW production occurs inside the boiler room and then distributed to the individual users through specific inlet points to the dwelling unit (modules)
- > **combined collective or multiuser systems.** The heating water production (primary circuit) is centralized, while DHW production occurs locally at the individual dwelling unit through proper heat exchangers inside specific inlet points to the dwelling unit (satellites)

Single-family residential units are obviously provided with individual production/distribution systems, while multifamily units (condominiums) may have both individual and collective systems.

To enjoy a greater efficiency of the building-installation and curb emissions, central heating is being used again in new multi-family constructions. Modules and satellites contain fuel consumption meters and volumetric meters to directly measure the consumptions of each dwelling unit.

In the multi-family installation field of application, the legislative orientation towards multiuser centralized systems is justified by overcoming the drawbacks typical of individual production:

- > higher costs for individual systems (multiple fuel and fume extraction devices)
- > individual generator sizing according to peak load, i.e. the DHW production power
- > intervention proliferation for periodical service and repairs
- > possible remote-heating connection failure
- > difficulties in opting for alternative energy sources (biomass, geothermal energy, thermal solar energy)

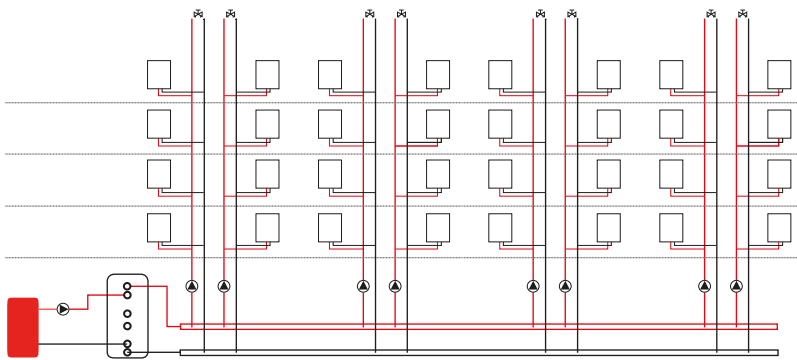


fig. 1.7
Satellite distribution system

Giacomini modules and satellites

Giacomini's product portfolio includes a full range of modules and satellites for direct metering of energy for the multi-family segment. Satellites may provide the apartment with heating and DHW or DHW only.

For DHW production, each satellite is equipped with a heat exchanger and priority valve. The heat exchanger guarantees physical separation between primary water for heating and DHW, allowing for production of the latter when requested by the user. The absence of a reserve accumulation (water heater) limits energy loss, also enabling a more compact, lighter and economical satellite.

Some types of satellites may include an additional heat exchanger on the heating side: this is advisable when there are special conditions on the primary side, such as corrosion risks or pressure values excessively high for the devices involved.

DHW and heating temperatures and flow rates may be controlled by means of different regulation systems integrated in the satellite.

The reasons to choose a multiuser system with satellites:

- > reduced technical spaces
- > optimization of system costs: only 3 pipes (heating delivery, heating return, SCW), no need for 4 or 5 pipes (no need for DHW installation, possible DHW recirculation) as for modules
- > energy saving and reduced riser diameters when the primary return temperature is controlled during DHW production in electronic satellites (through flow rate regulation)
- > local DHW production, as opposed to centralized production, pipes are shorter and stagnation risk is lower (legionella prevention)
- > only one heat meter (volumetric or ultrasonic) for individual DHW and heat metering

DHW PRODUCTION SATELLITE:

Main characteristics

- thermostatic mixer regulation (with NF-approved check valves) for DHW temperature control
- heat exchanger for DHW instantaneous DHW production
- flow switch for DHW 2-way priority valve
- static balancing valve on primary side
- plastic spacers to install energy meter and flow meter
- DHW production capacity: 49 kW

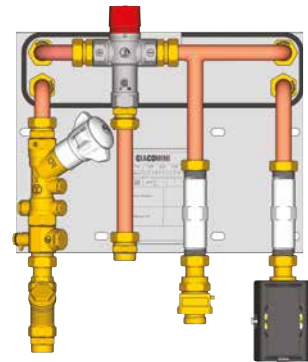


fig. 1.8
DHW production satellite with integrated priority valve (GE556Y155 code)

HEATING AND DHW SATELLITES WITH ELECTRONIC REGULATION:

Main characteristics

- electronic thermoregulation with SET POINT to control DHW and heating temperature
- remote control with chronothermostat and display to manage parameters
- external temperature probe for climatic compensation
- heat exchanger for DHW instantaneous DHW production
- control flow switch for DHW production priority
- DHW production capacity: 58 kW or 67 kW
- motorized 3-way priority valve, on primary side delivery circuit
- motorized 2-way modulating valve on primary side return circuit
- ErP-complying self-modulating circulator (2009/125/CE)
- minimum flow switch on primary side
- thermal and electric thermal safety valve on heating side
- fully insulated heat exchanger and pipes
- WRAS-certified components for sanitary circuit
- synthetic spacers to install energy meter and flow meter
- RAL 9010 varnished metal cabinet with key lock

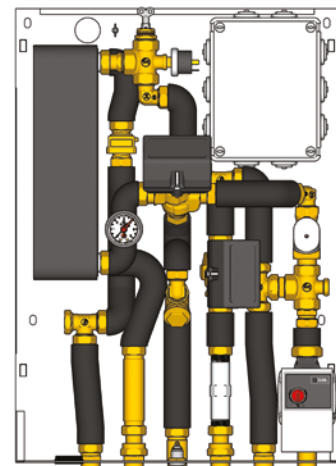


fig. 1.9
Heating and DHW satellites with electronic regulation (GE556Y401 and GE556Y402)

HEATING AND DHW SATELLITES WITH THERMOSTATIC CONTROL

Main characteristics

- thermostatic regulation to control DHW temperature
- thermostatic regulation to control heating temperature – for low temperature model
- heat exchanger for DHW/Instantaneous DHW production
- control flow switch for DHW production priority
- DHW production capacity: 56 kW or 67 kW
- motorized 3-way priority valve
- ErP-complying self-modulating circulator (2009/125/CE) - for low temperature model
- minimum pressure switch on primary side - for low temperature model
- safety valve with actuator on heating side
- by-pass on primary side to keep the heat exchanger warm
- differential pressure control valve on primary side
- static balancing valve on heating side - for low temperature model
- fully insulated heat exchanger and pipes
- WRAS-certified components for sanitary circuit
- brass spacers to install energy meter and flow meter
- RAL 9010 varnished metal cabinet with key lock

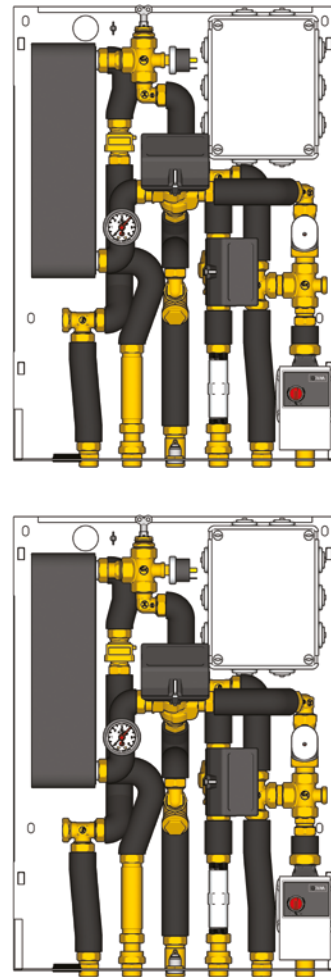


fig. 1.10

High temperature (GE556Y320 - GE556Y321) or low temperature (GE556Y322 - GE556Y323) DHW and heating satellites with thermostatic control

Ecodesign - Ecolabel

The European Union has developed an energy and climate policy aiming at complying with the Kyoto Protocol and therefore at achieving the goals of enhanced energy efficiency, reduction of carbon dioxide emissions and increased use of renewable sources.

Since 26 September 2015, the Implementation Rules of Directive 2009/125/CE “ErP” (Energy related Products) have been enforced in Europe for energy devices and systems in sanitary water installations (for heating and DHW production).

This Directive regulates eco-friendly planning and provides the minimum requirements for energy efficiency and emissions allowed for heating and DHW production up to 400 kW and accumulators up to 2000 liters.

Directive 2010/30/UE “ELD” (Energy Labelling Directive) also prescribes that heat generators up to 70 kW and accumulators up to 500 liters must provide a technical sheet and energy efficiency label, including room heating devices, combined heating devices, temperature control devices and solar devices.

The enforced European Rules are:

- > 811/2013: energy labelling for heating and DHW production devices
- > 812/2013: energy labelling for devices dedicated only to DHW production and storage
- > 813/2013: eco-friendly planning of heating and DHW production devices
- > 814/2013: eco-friendly planning for devices dedicated only to DHW production and storage

The term “eco-friendly planning” refers to compliance with the minimum energy efficiency requirements and with the maximum noise limits (sound power emitted in environment).

As for household appliances, the energy efficiency label becomes an essential criterion to address consumers’ choices in a crystal clear and transparent way when purchasing more efficient systems within the HVAC sector.

The energy efficiency label on displayed apparels must be applied on the front in a visible way. In case of sale through specialized installers, the technical sheet and label must be included in the quotation to the final customer. Infringements can be sanctioned.

Sale of a group (for example, by combining a condensation boiler to a solar thermal system) must include a label on both the displayed items or single components offered and a label specifically created for such group of apparels.

The product categories covered by ErP are:

- > room heating devices
- > combined heating devices (room heating and sanitary water)
- > hot water accumulators

- > groups including room heating devices, combined heating devices, temperature control devices and solar devices
- > combined heating devices such as B1<30 kW as replacements in multi-family buildings

Not interested by the rule are:

- > biomass heating devices
- > gas, steam or air-powered heating systems
- > cogeneration devices starting from a 50 kW minimum electric power
- > room heating systems starting from 400 kW, hot water accumulators starting from 2000 liters

The energy efficiency label is applied on the product and on multiple product bundles.

For individual products, the current ErP label for room heating devices shows the energy efficiency class on a scale from A++ to G (for heat pumps up to D, while for accumulators from A to G). Starting from 2019 an additional limit will apply, from A+++ to G, for accumulators from A+ to G, while for low-temperature heat pumps the label will have to include information on the climate zone. Other values will also be included, such as sound performance and heating power.

Combined devices for room heating and sanitary water heating must include efficiency classes for both functions. This label is provided together with the technical documentation enclosed to the product. The distributor/concessionaire/retailer must apply the label on the displayed product.

Every quotation for product bundles must indicate the energy efficiency class. For such purpose, the label and technical sheet provided by the system promoter must be clearly visible. As opposed to product labels, system labels are not filled in by manufacturers of single products (system elements), but by the person defining the group of products that will be later installed. This may be, for example, the manufacturer himself who is offering the system, the retailer or the installer.

Supporting tools are available for those who need to create system labels, helping them to create and fill them in (ErP software available on the market).

ENERGY LABELLING: OBLIGATIONS BY THE PARTIES INVOLVED

The Manufacturer:

- provides products complying to all requirements
- provides product energy efficiency labels and technical sheets
- provides energy efficiency labels of the system possibly promoted
- provides support tools (documentation and information) to clients

The Retailer, Wholesaler or Installer:

- must display and offer to the clients products bearing energy efficiency labels
- must generate and apply the system energy efficiency label

In this volume, considering its purposes, some information will be given as example for devices dedicated to sanitary hot water production only and their storage tanks.

Apparels dedicated to sanitary hot water production only

In compliance with EcoDesign, the energy efficiency of such apparels, featuring a 400 kW maximum nominal power, must be determined based on a 24-hour test and according to the load profile for which the device has been designed. Load profiles vary from 3XS to 4XL and are based on the sanitary system dimensions: for single-family houses, for example, the load profile may vary from S to L.

The minimum efficiency values set by the European Rules are given in the table of fig. 1.11:

load profile	min. efficiency 2015	min. efficiency 2017	min. efficiency 2018
3XS	22 %	32 %	32 %
XXS	23 %	32 %	32 %
XS	26 %	32 %	32 %
S	26 %	32 %	32 %
M	30 %	36 %	36 %
L	30 %	37 %	37 %
XL	30 %	37 %	37 %
XXL	32 %	37 %	60 %
3XL	32 %	37 %	64 %
4XL	32 %	38 %	64 %

fig. 1.11

As of 26 September 2015, the maximum acoustic power level for heat pump water heaters has been set based on the nominal thermal power. As of 26 September 2018, nitrogen oxide emissions from water heaters cannot exceed the maximum values set.

For the Energy Labelling standard, the heating energy efficiency class, a value to be specified on the energy efficiency label, should be determined for each load profile based on the η index of water heating energy efficiency indicated in the table of fig. 1.12:

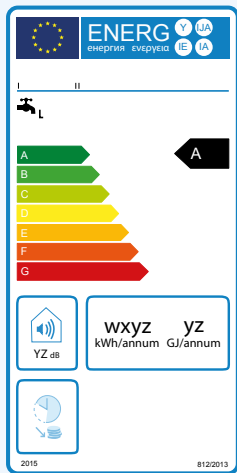
	3XS	XXS	XS	S	M	L	XL	XXL
A+++	$\eta_{wh} \geq 62$	$\eta_{wh} \geq 62$	$\eta_{wh} \geq 69$	$\eta_{wh} \geq 90$	$\eta_{wh} \geq 163$	$\eta_{wh} \geq 188$	$\eta_{wh} \geq 200$	$\eta_{wh} \geq 213$
A++	$53 \leq \eta_{wh} < 62$	$53 \leq \eta_{wh} < 62$	$61 \leq \eta_{wh} < 69$	$72 \leq \eta_{wh} < 90$	$130 \leq \eta_{wh} < 163$	$150 \leq \eta_{wh} < 188$	$160 \leq \eta_{wh} < 200$	$170 \leq \eta_{wh} < 213$
A+	$44 \leq \eta_{wh} < 53$	$44 \leq \eta_{wh} < 53$	$53 \leq \eta_{wh} < 61$	$55 \leq \eta_{wh} < 72$	$100 \leq \eta_{wh} < 130$	$115 \leq \eta_{wh} < 150$	$123 \leq \eta_{wh} < 160$	$131 \leq \eta_{wh} < 170$
A	$35 \leq \eta_{wh} < 44$	$35 \leq \eta_{wh} < 44$	$38 \leq \eta_{wh} < 53$	$38 \leq \eta_{wh} < 55$	$65 \leq \eta_{wh} < 100$	$75 \leq \eta_{wh} < 115$	$80 \leq \eta_{wh} < 123$	$85 \leq \eta_{wh} < 131$
B	$32 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 35$	$35 \leq \eta_{wh} < 38$	$35 \leq \eta_{wh} < 38$	$39 \leq \eta_{wh} < 65$	$50 \leq \eta_{wh} < 75$	$55 \leq \eta_{wh} < 80$	$60 \leq \eta_{wh} < 85$
C	$29 \leq \eta_{wh} < 32$	$29 \leq \eta_{wh} < 32$	$32 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 35$	$36 \leq \eta_{wh} < 39$	$37 \leq \eta_{wh} < 50$	$38 \leq \eta_{wh} < 55$	$40 \leq \eta_{wh} < 60$
D	$26 \leq \eta_{wh} < 29$	$26 \leq \eta_{wh} < 29$	$29 \leq \eta_{wh} < 32$	$29 \leq \eta_{wh} < 32$	$33 \leq \eta_{wh} < 36$	$34 \leq \eta_{wh} < 37$	$35 \leq \eta_{wh} < 38$	$36 \leq \eta_{wh} < 40$
E	$22 \leq \eta_{wh} < 26$	$23 \leq \eta_{wh} < 26$	$26 \leq \eta_{wh} < 29$	$26 \leq \eta_{wh} < 29$	$30 \leq \eta_{wh} < 33$	$30 \leq \eta_{wh} < 34$	$30 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 36$
F	$19 \leq \eta_{wh} < 22$	$20 \leq \eta_{wh} < 23$	$23 \leq \eta_{wh} < 26$	$23 \leq \eta_{wh} < 26$	$27 \leq \eta_{wh} < 30$	$27 \leq \eta_{wh} < 30$	$27 \leq \eta_{wh} < 30$	$28 \leq \eta_{wh} < 32$
G	$\eta_{wh} \geq 19$	$\eta_{wh} \geq 20$	$\eta_{wh} \geq 23$	$\eta_{wh} \geq 23$	$\eta_{wh} \geq 27$	$\eta_{wh} \geq 27$	$\eta_{wh} \geq 27$	$\eta_{wh} \geq 28$

fig. 1.12

Water heaters are broken down into the following categories:

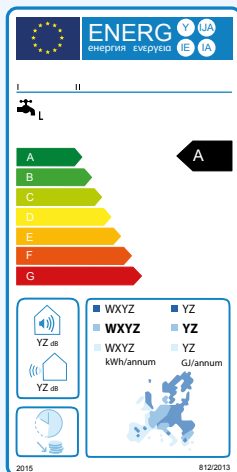
- 1) conventional water heaters with energy efficiency classes ranging from A to G
- 2) solar water heaters with energy efficiency classes ranging from A to G
- 3) heat pump water heaters with energy efficiency classes ranging from A to G

EXAMPLE OF CONVENTIONAL WATER HEATER LABEL INCLUDING THE FOLLOWING INFORMATION:



- with
- I, II I. Supplier's name or brand
 - III II. Supplier's model identification
 - IV III. The water heating function, including the load profile stated by a special letter, included between 3XS and XXL
 - IV. The water heating energy efficiency class determined in compliance with the table of fig. 1.12; the arrow tip indicates the water heating energy efficiency class of the water heater
 - VI, V V. The electric energy yearly consumption in kWh in terms of final energy and/or the fuel yearly consumption in GJ in terms of superior calorific power, rounded up to the closest integer
 - VI. The level of LWA sound power, indoor, expressed in dB, rounded up to the closest integer
 - VII VII. Pictogram for conventional water heaters able to work only during off-peak hours

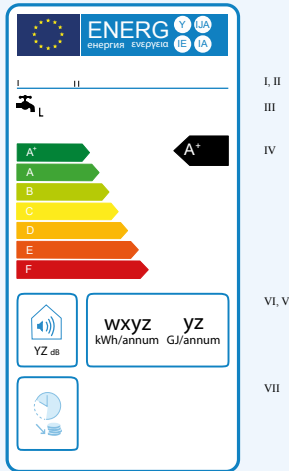
EXAMPLE OF HEAT PUMP WATER HEATER LABEL INCLUDING THE FOLLOWING INFORMATION:



- with
- I. Supplier's name or brand
 - I, II II. Supplier's model identification
 - III III. The water heating function, including the load profile stated by a special letter, included between 3XS and XXL
 - IV IV. The energy efficiency class of the water heater heating function with average climate conditions, determined in compliance with the table of fig. 1.12; the arrow tip indicates the water heating energy efficiency class of the water heater
 - V. The electric energy yearly consumption in kWh in terms of final energy and/or the fuel yearly consumption in GJ in terms of superior calorific power, under average climate conditions, colder and warmer, rounded up to the closest integer
 - VI. The European temperature map indicating the three approximate temperature zones
 - VII VII. The level of LWA sound power, indoor and outdoor (if applicable), expressed in dB, rounded up to the closest integer
 - VIII, VI VIII. Pictogram for heat pump water heaters able to work only during off-peak hours

NOTE: Starting from 2017 an A+ energy efficiency class will be added for water heaters (and also for simple tanks), so as to enhance market penetration of more efficient apparels.

LABELS WILL BE MODIFIED AS FOLLOWS (EXAMPLE FOR CONVENTIONAL WATER HEATERS):



I, II
III
IV
VI, V
VII

Devices dedicated to DHW storage

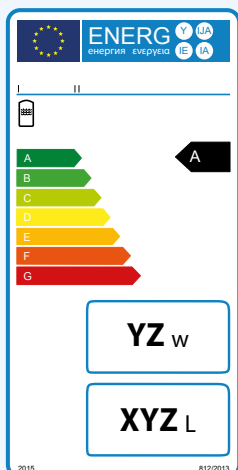
The tank energy efficiency class to be included on the energy efficiency label must be determined based on dispersion and usable volume of hot water accumulation, based on the indications in the Table in fig. 1.13:

energy efficiency class	dispersion S, in watt, with useful volume V, in liters
A+	$S < 5.5 + 3.16 \cdot V^{0.4}$
A	$5.5 + 3.16 \cdot V^{0.4} \leq S < 8.5 + 4.25 \cdot V^{0.4}$
B	$8.5 + 4.25 \cdot V^{0.4} \leq S < 12 + 5.93 \cdot V^{0.4}$
C	$12 + 5.93 \cdot V^{0.4} \leq S < 16.66 + 8.33 \cdot V^{0.4}$
D	$16.66 + 8.33 \cdot V^{0.4} \leq S < 21 + 10.33 \cdot V^{0.4}$
E	$21 + 10.33 \cdot V^{0.4} \leq S < 26 + 13.66 \cdot V^{0.4}$
F	$26 + 13.66 \cdot V^{0.4} \leq S < 31 + 16.66 \cdot V^{0.4}$
G	$S > 31 + 16.66 \cdot V^{0.4}$

fig. 1.13

As of 26 September 2017 tank dispersion for hot water will be limited to specific values. Sanitary hot water tanks are classified in energy efficiency classes ranging from A to G.

EXAMPLE OF A TANK LABEL INCLUDING THE FOLLOWING INFORMATION:



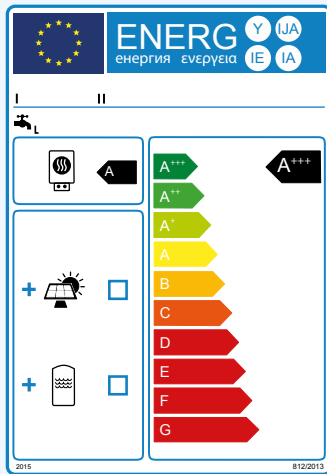
I, II
III
IV
V
VI

with

- I. Supplier's name or brand
- II. Supplier's model identification
- III. Hot water tank function
- IV. The water heating energy efficiency class, determined in compliance with the table in fig. 1.13; the arrow tip indicates the water heating energy efficiency class of the water heater
- V. Dispersion, in W, rounded up to the closest integer
- VI. The usable volume of the hot water tank, in liters, rounded up to the closest integer.

Systems with DHW production

In case of bundle products forming a system, the manufacturer or retailer must create the system energy efficiency label. **FOR EXAMPLE, FOR GROUPS OF GAS WATER HEATERS AND SOLAR DEVICES, THE SYSTEM'S ENERGY EFFICIENCY LABEL WILL INCLUDE THE FOLLOWING INFORMATION:**



with

- I. Supplier's name or brand
- II. Supplier's model identification
- III. The water heating function, including the load profile indicated by between 3XS and XXL
- IV. The energy efficiency class of the water heater's heating function determined in compliance with the Table of Fig. 1.12
- V. Indication of whether or not a solar manifold and a hot water tank may be included in the group of water heaters and solar devices;
- VI. The water heating energy efficiency class of the water heater/solar device group, determined based on the energy efficiency class of the water heater heating function and the solar contribution (from the solar device technical datasheet), in compliance with the table of fig. 1.14

Table of fig. 1.14:

Based on the η energy efficiency index calculated for the system and based on the stated load profile of the water heater (M, L, XL or XXL), the arrow tip indicates the sanitary water heating energy efficiency class of the water heater/solar device group.

	G	F	E	D	C	B	A	A ⁺	A ⁺⁺	A ⁺⁺⁺
M	< 27%	≥ 27%	≥ 30%	≥ 33%	≥ 36%	≥ 39%	≥ 65%	≥ 100%	≥ 130%	≥ 163%
L	< 27%	≥ 27%	≥ 30%	≥ 34%	≥ 37%	≥ 50%	≥ 75%	≥ 115%	≥ 150%	≥ 188%
XL	< 27%	≥ 27%	≥ 30%	≥ 35%	≥ 38%	≥ 55%	≥ 80%	≥ 123%	≥ 160%	≥ 200%
XXL	< 28%	≥ 28%	≥ 32%	≥ 36%	≥ 40%	≥ 60%	≥ 85%	≥ 131%	≥ 170%	≥ 213%

fig. 1.14

HEALTH PROTECTION STANDARDS

Drinking water directive - 98/83/EC (*)

On 3 November 1998 the European Council voted Council Directive 98/83/EC, better known as “Drinking Water Directive”, with the goal of protecting European citizens’ health from the harmful effects caused by water contamination.

The Directive text, with the latest amendments including Commission Directive (EU) 2015/1787 of 6 October 2015, is by now part of the European Union consolidated legislation.

The Drinking Water Directive is applied to:

- > all distribution systems serving more than 50 individuals or supplying more than 10 cubic meters per day, but also to distribution systems serving and supplying lower quantities if the provided water is part of a business activity
- > drinking water from tank trucks
- > drinking water in containers or bottled
- > water used in the food industry, except when competent national authorities are positive that water quality will not affect finished product integrity

The Directive sets the essential quality standards at EU level: a total of 48 microbiologic, chemical and indication parameters must be periodically monitored and tested. In general, the standards have been sketched starting from WHO drinking water guidelines and the Commission Scientific Advisory Committee.

Each member state may include additional requirements, such as more restrictive standards or rules regarding specific substances relevant in a given territory. However, member states may not set less restrictive standards, as the health protection level must be the same for the entire European Union.

At the time of this catalogue, the characteristics of drinking water are defined by the current legislation through Law Decrees No. 31 of 2 February 2001 and No. 27 of 2 February 2002, as defined by the Italian standard UNI 9182: 2014 “Hot and cold water supply and distribution installations – Design, installation and testing”.

The Directive includes various parts: planning, rules (Member States and Commission’s obligations), monitoring and information for the consumers.

Planning

Member States must define the water supply zones and suitable monitoring programs in compliance with the minimum requirements set by the Directive.

NOTES

(*) http://ec.europa.eu/environment/water/water-drink/legislation_en.html

Rules

Each EU Member State is required to acknowledge the Drinking Water Directive in its own legislation.

In short, each State must:

- > undertake every required action to guarantee that water is healthy and clean and that under no circumstance will the deterioration of water quality will be tolerated
- > guarantee that any non-compliance with the parameters will be investigated and corrected through specific measures in the shortest time possible
- > forbid/limit the use of said water supply, (should health protection reasons require it) and promptly inform consumers and offer advice
- > undertake all the required actions to guarantee, in case of specific materials in new installations, that no impurity associated to such materials remains in the drinking water

Monitoring

Member States must guarantee periodical quality monitoring to verify compliance with Drinking Water Directive requirements.

To comply with these requirements, the competent authorities will have to define specific monitoring programs. The Directive defines minimum requirements for these programs. Every three years, each Member State must publish a water quality report. The European Commission evaluates the results according to the standards and draws up a synthesis report to summarize drinking water quality and its improvements at a European level.

Information

The Directive provides for guaranteeing updated and adequate information on water quality. More specifically:

- > possible exemptions from application of the Directive
- > compliance with quality standards and monitoring requirements
- > corrective actions and usage restrictions in case of non-compliance with the defined parameters

Practical implications for professional operators

European Directive 98/83/EC article covering materials and items possibly used in sanitary systems for drinking water concerns designers and installers directly.

Article 10 – Treatment, equipment and material quality warranty

Member States shall take all measures necessary to ensure that no substances or materials for new installations used in the preparation or distribution of water intended for human consumption or impurities associated with such substances or materials for new installations remain in water intended for human consumption in concentrations higher than is necessary for the purpose of their use and do not, either directly or indirectly, reduce the protection of human health provided for in this Directive; the interpretative document and technical specifications pursuant to Article 3 and Article 4 (1) of Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (10) shall respect the requirements of this Directive.

In Italy, for example, article 10 has been implemented by Decree No. 174 of 6 April 2004 – Ministry of Health - “Regulation concerning materials and items that may be used in fixed plants for catchment, treatment, feeding and distribution for drinking water”, published in the Official Gazette no. 166 dated 17 July 2004 and enforced on 17 July 2007.

The collateral effect of having such European regulations normed by the single Member States is a lack of uniformity across European countries: this makes a transparent application of such articles quite complicated.

Some Member States have decided to collaborate to solve this issue by creating shared standards to accept materials and testing practices.

NOTES

⁷ GU L 40 dell'11.2.1989, page 12. Directive amended from latest version of Directive 93/68/CEE (GU L 220 del 30.8.1993, page 1).

Observation:

The European Commission has appointed a consortium for this task. Its goal is to assess the possible revision, with special attention to the article appointing single states with the autonomous legislation on materials in contact with drinking water.

The 4MS initiative and the UBA list

1998 witnessed, together with the Drinking Water Directive, the definition of the **European Acceptance Scheme (EAS)**, a framework for hygienic evaluation of products in contact with drinking water.

Its goal was to create a universal approval scheme for materials used for drinking water distribution, thus satisfying the growing awareness for protection of drinking water quality, from source to faucet. These works, originally carried out under the patronage of the European Commission, gradually lost their political power to the point of becoming a more generic and limited “harmonization” project of the Construction Product Directive, satisfying only in part the ambitious goals of the EAS.

In 2007 France, Germany, the Netherlands and UK, great supporters of the EAS ideas since its origin, decided autonomously to follow a common approach for product evaluation, with the firm intention to achieve the EAS hygiene safety goals within their borders. After many years of informal work, the four Member States (later referred to as the **“4MS” group**) made their cooperation official through a statement of purpose in January 2011 with the formalization of the agreements for the harmonization of the hygiene sustainability tests of products in contact with drinking water. The 4MS’ primary goal of guaranteeing the hygiene and safety of water in sanitation plants focused on the continuity of their efforts to actively achieve a European agreement.

Bases of the Common Approach

The 4MS intend to adopt common, or directly comparable, practices for:

- > acceptance of the components used for materials in contact with drinking water
- > material testing
- > adoption of common testing methods and acceptance levels
- > specification of product tests to apply
- > revision of factory quality assurance and laying down test requirements
- > assessment of certification capacity and testing organizations

The common approach goal is not to introduce a single assessment system working in the same identical way for every country: it rather defines a set of policies and practices that may be adopted within the national legal and institutional structures. The ultimate purpose is therefore to guarantee that the products are evaluated in a consistent way and with the same results, regardless of where the work is carried out.

Component acceptance

Approval of the substances and materials used for products in contact with drinking water is obviously essential for the common approach.

The nature of the requirements will change based on the materials to be broken down into:

- > organic materials
- > metallic materials
- > cementitious materials
- > other materials

The approved materials will become part of a **Positive List**, which thus include substances admitted for products in contact with drinking water.

This catalogue will only discuss organic and metallic materials, i.e. the materials used by Giacomini to manufacture drinking water system components.

Organic materials

This category includes: monomers, other basic substances, additives, polymer production aids (PPA) and polymerization aids (PA). These are used to produce the organic material to (partially) manufacture a product which enters into contact with drinking water (for example, sealing components or gaskets, floats, diffuser heads, etc.).

The 4MS have compared their individual practices for substance assessment and their positive lists, also identifying the shared basic principles for their common approach. As it would have been impossible to entirely evaluate all substances on the various national lists, they decided to start with a Combined List (that is a consolidated list of all products included in the various national positive lists) which, following product assessment based on agreed approval criteria, will then become a Core List. This means that substances assessed in whole or substances which do not require further assessment will be included in the 4MS Core List. The Core List will become the future Positive List, it will be periodically updated and it will have to be integrated into the standards or guidelines of each Member State.

The Core List is not available yet. Its (re)evaluation is expected to take place between 2017 and 2022, with a transition period which will enable manufacturers to submit an application to include a substance in the Core List. The 4MS are also working on common testing requirements for organic materials.

In the meantime, for this category, Giacomini is exclusively using products complying with national laws of the countries where such products are sold.

Metallic materials

Pending a European acceptance scheme, the 4MS have collaborated in converging their national frameworks, defining the testing procedures and approving the metallic material composition.

The document “Acceptance of Metallic Materials used for Products in Contact with Drinking Water” ratifies the provisions established by the 4MS.

In part A of the document (“Procedure for the acceptance”, 2nd revision 03/07/2016), the 4MS have defined the acceptance concept for metallic materials for their national standards. The document is subject to revisions agreed by the 4MS.

Part B of the document (“**4MS Common Composition List**”, 6th Revision 05/27/2016) includes a **Positive List** of metallic materials accepted by all the 4MS, based on the procedure described in part A. This Positive List is often referred to as the **UBA-list**, from the name of the German organization Umwelt Bundesamt which represents Germany for the 4MS initiative. The list is now ready for implementation on a national level in the 4MS. For certification or approval of products in contact with drinking water in the 4MS countries, the only requirement is guaranteeing the use of the metallic materials that are on the UBA-list.

The metallic materials of this Positive List, broken down into various categories, can be used to manufacture products which enter in contact with drinking water. They are divided into groups based on the surface area of product or product component in contact with drinking water (see table in fig. 1.15).

product groups	examples of products or product components	provided contact surface
A	Building installation pipes Unlined water system duct pipes	100 %
B	Fittings auxiliary components in building systems (e.g. pump units, valve units, water flow meters in building installations)	10 %
C	<ul style="list-style-type: none"> • Components from the B product group (e.g. the pin of a pump or moving parts of building installation water flow metering units). The sum of the drinking water contact surfaces of all these components must not exceed 10 % of the total wet surface of the product. • Fittings, auxiliary components in water ducts and water treatment mechanisms with permanent flows (e.g. pump bodies, valve bodies used in water systems) 	1 %
D	Fitting components and aids in water ducts of water treatment mechanisms (C2)	-

fig. 1.15

As for brass or copper-zinc-lead alloys, products from the B and C categories may be used in contact with drinking water if made with the CW617N alloy (CuZn40Pb2), featuring the following characteristics of reference (fig. 1.16):

components (%)				
Cu	Zn	Pb		
57.0 % - 60.0 %	Remaining	1.6 % - 2.2 %		
impurities (%)				
Al	Fe	Ni	Si	Sn
≤ 0.05 %	≤ 0.3 %	≤ 0.1 %	≤ 0.03 %	≤ 0.3 %
any other impurity < 0.02 %				

fig. 1.16

The migration elements in drinking water to be monitored are Cu, Ni, Pb and Zn with special attention to Pb (between 1.6 % and 2.2 %) and Ni (≤ 0.1 %).

All Giacomini products intended for drinking water are part of the B and C groups and are manufactured with the **CW617N** alloy (**CuZn40Pb2**), which means that they can be used in sanitary systems in contact with drinking water.

Diffusion of the Common Approach

The 4MS are confident that their work will lead to a more widespread adoption of the Common Approach in Europe. This would offer tangible benefits in terms of the achievement of high-level standards for consumer protection with fewer tests required.

The other EU Member States can collaborate for this project in the following ways:

- > with “Full Group Membership” for Member States committing to adopt the Common Approach for their product assessment activities
- > as “Registered User” for the Member States which intend to adopt some or all of the Common Practices but do not wish to have full membership or do not have the requirements to obtain it

Harmonization within the EC

Development of the 4MS Common Approach is carried out in parallel with the revision of the practices throughout Europe to achieve “**harmonization**” in compliance with the “**Construction Product Directive**” and “**Construction Product Standards**” required to obtain the EC marking. The 4MS representatives are actively involved in the harmonization project, so much so that the 4MS Common Approach can be partially integrated in the harmonized practices.

Access to information

The 4MS are committed to the transparency of information related to the Common Approach implementation. Reports and documents on the progress of the 4MS initiative are posted on the website <http://www.umweltbundesamt.de/en/node/13888>.



Comfort, hygiene, practicality.
Three fundamental criteria to choose the ideal system for your needs.



Chapter 2

Main types of distribution systems

INTRODUCTION

The type of cold and hot water system may vary based on the building where it is installed and the type of application. For a single-family house, “individual” distribution systems are the most popular, where DHW production and distribution are carried out inside the dwelling unit. As for multi-family dwellings, office buildings, sport centers, etc., “collective” distribution systems are generally used with centralized DHW production. It is not uncommon to combine both types.

This chapter will present an in-depth analysis of a few installation types that can be outlined as follows:

INDIVIDUAL SYSTEMS

> **Manifold installations**

- connection to single inlet units
- connection to single + double inlet units
- closed-loop connection

> **Manifold-free installations**

- derivation distribution (T-shaped outputs)
- distribution in series
- loop distribution

> **Individual installations with hot water recirculation risers**

COLLECTIVE SYSTEMS

> **Collective systems with hot water recirculation risers**

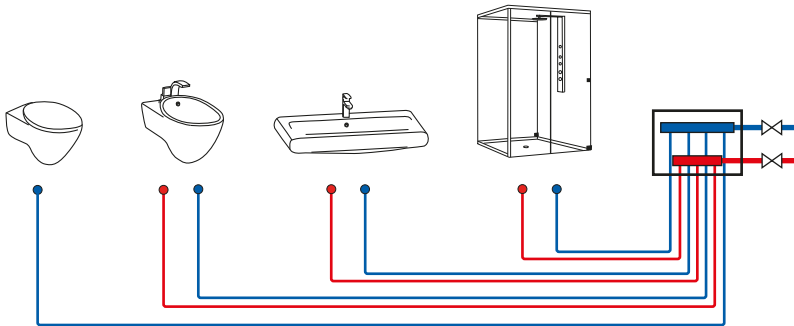
As described in Chapter 1, DHW production in collective systems may be realized centrally (module distribution) or locally (satellite distribution). The single-user systems will then feature an individual system layout.

Regardless of the selected distribution system, sanitary installations should be realized based on economy and hygiene reasons so that:

- draw-off points used rarely are not integrated in a closed loop
- the main extraction point or *flushing system* is at the end of the section
- a hot water recirculation system is provided (and is practically mandatory for *collective* systems with centralized installation)

MANIFOLD DISTRIBUTION SYSTEMS

Single-unit connection



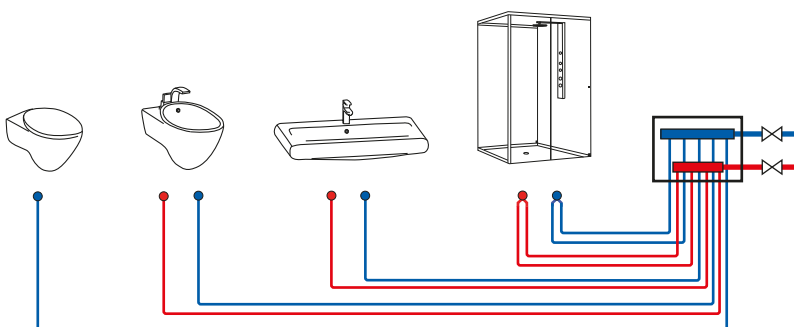
WHY CHOOSE IT?

- reduced length of distribution circuits
- high comfort with reduced hot water availability times
- possibility to easily intercept draw-off points on the manifold
- suitable for removable systems with PEX-b pipes

The manifold hydraulic system provides for installation of a distribution element (hydraulic manifold) in a special wall-mount cabinet which supplies all draw-off points of the hydraulic system. All draw-off points, both for hot and cold water, are connected individually to the manifold which is equipped with an interception valve for every single outlet. In this specific case, connection to the sanitary elements is obtained by using terminals (elbows with wall-mount bracket) with a **single** inlet. Water flows through the single pipe only when the draw-off point collects it.

The major benefit of this type of hydraulic system is the installation of whole pipes, i.e. in-wall connection-free pipes. In fact, the only featured connections are inside the cabinet where the manifold is installed and at the terminal.

Single + double terminal connection



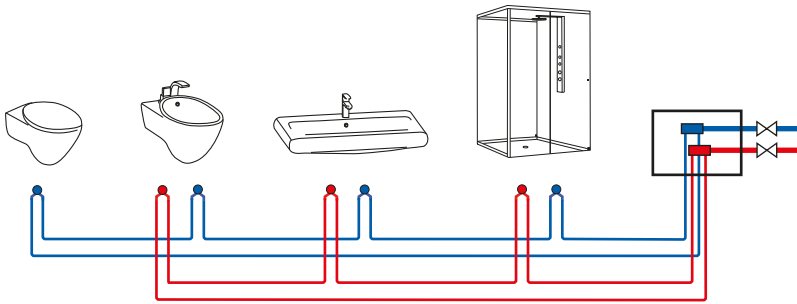
WHY CHOOSE IT?

- suitable for draw-off points with high water flow rates
- reduced circuit length
- high comfort with reduced hot water availability times
- possibility to easily intercept draw-off points on the manifold
- suitable for removable systems with PEX-b pipes

This specific type of manifold system also requires using **double** inlet terminals (elbows with wall-mount bracket) for connection to hot-water elements: in case of draw-off points with high water flow rates (e.g. Jacuzzi tubs, large shower heads, etc.), the manifold and draw-off point are connected through two pipes.

All usage points, both for hot and cold water, are connected to the manifold separately. The water required by a draw-off point with high flow rates runs through both connection pipes and, in any case, only upon collection from the draw-off point.

Closed-loop connection



The manifold hydraulic system with closed-loop connection provides for connection of all draw-off points through double inlet terminals (elbow fittings with wall-mount bracket).

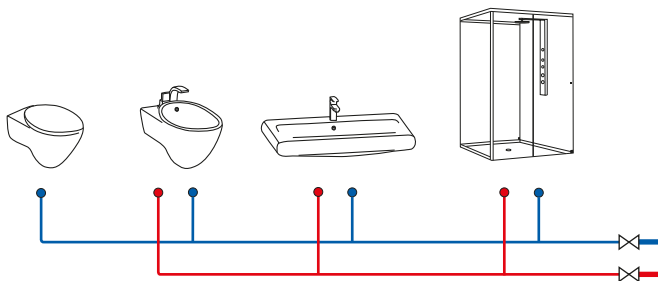
This guarantees, for all connected draw-off points, high flow rates. In addition, it drastically limits the risk of bacterial proliferation as water flows through all feed pipes, even for unused draw-off points.

WHY CHOOSE IT?

- hygienically ideal because free of “dead” sections
- reduced risk of bacterial proliferation
- manifold with a reduced number of outputs
- suitable for removable systems with PEX-b pipes

MANIFOLD-FREE DISTRIBUTION SYSTEMS

Derivation distribution (T-shaped outputs)



Hydraulic derivation systems provide for installation of a main pipe diverted at every draw-off point.

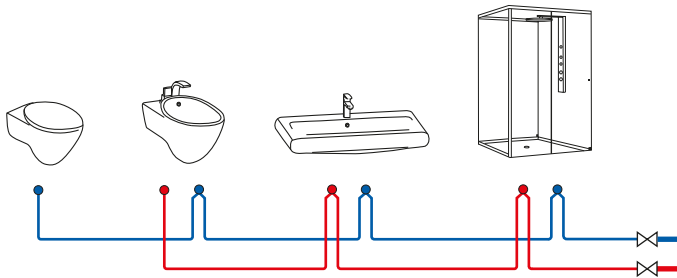
Derivations are obtained by means of T-shaped fittings. That is why they generally feature in-wall connections, which however, as opposed to manifold systems, cannot be accessed easily in case of maintenance of single draw-off points.

Terminals are of a single type (elbow fittings with wall-mount bracket).

WHY CHOOSE IT?

- ideal hygienic standards in case of frequent use
- easy to install
- less pipes with larger diameters and limited “off-cuts”

Series distribution



WHY CHOOSE IT?

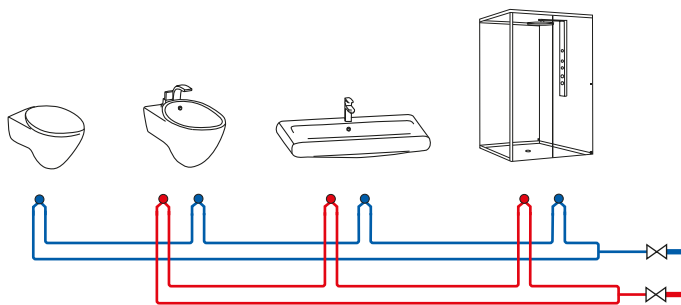
- very reduced risk of bacterial proliferation
- regular water exchange
- fewer pipes
- rapid installation
- suitable for removable systems with PEX-b pipes

Series connection provides for connection of each draw-off point to the previous and subsequent ones through a pipe.

The most exploited draw-off point is the last connected of the series through a single terminal, while the others use double terminals.

This way water often flows along the entire circuit without stagnation zones, thus greatly reducing the risk of bacterial proliferation.

Closed-loop distribution



WHY CHOOSE IT?

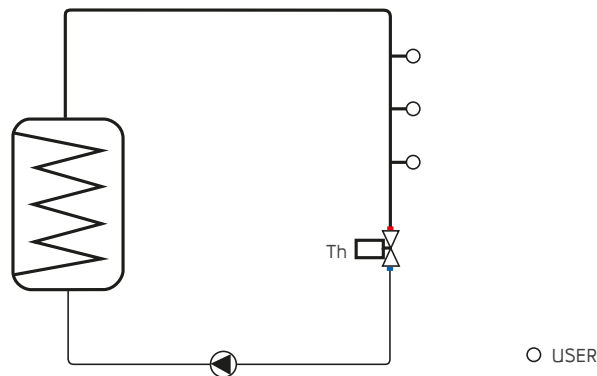
- hygienically ideal because free of "dead" sections
- reduced risk of bacterial proliferation
- suitable for removable systems with PEX-b pipes
- limited losses of pressure

The closed-loop connection hydraulic system provides for connection of all circuits to the draw-off points through double inlet terminals (elbow fittings with wall-mount bracket).

This provides all draw-off points with high flow rates. Water is supplied on both sides of the loop.

On top of that, it drastically reduces the risk of bacterial proliferation as water always flows through all abduction pipes, even for unused draw-off points.

INDIVIDUAL SYSTEMS WITH HOT WATER RECIRCULATION RISERS



WHY CHOOSE IT?

- reduced DHW availability times and with even temperatures at all draw-off points
- reduced sanitary water consumption
- hygienically ideal for its high temperatures and as it is free of “dead” sections

Individual hydraulic systems with hot water recirculation risers are specifically suitable when a high level of comfort is required and in case of long pipe sections.

A sanitary recirculation pump (possibly controlled by a timer) supplies all draw-off points, practically maintaining the DHW temperature constant.

COLLECTIVE SYSTEMS WITH HOT WATER RECIRCULATION RISERS

Collective distribution systems (multi-family dwellings, offices, sport centers, etc.) require DHW recirculation to enable water to move frequently and prevent stagnation effects, such as heat loss and hygiene risks.

However, **recirculation** is not always a feasible feature for specific cases provided for by the EN 806 standard.

To name a few examples: systems where DHW consumption is mainly “continuous” and/or with interruptions not exceeding 15 min. or, within the floor distribution section, when the total hot water volume inside the pipes (from connection point to draw-off point) does not exceed 3 liters. Reference is however made to the specific standard for more details (see Chapter 5).

It is especially important that all risers are connected on the higher part of the circuit by installing automatic air vent valves (which must be easy to inspect and service) to remove the air, flow control devices (balancing valves) and a thermometric casing to read the temperature.

WHY CHOOSE IT?

- essential to guarantee hygienic safety
- rapid DHW supply for enhanced comfort
- reduced sanitary water consumption

Examples of DHW recirculation systems in large buildings

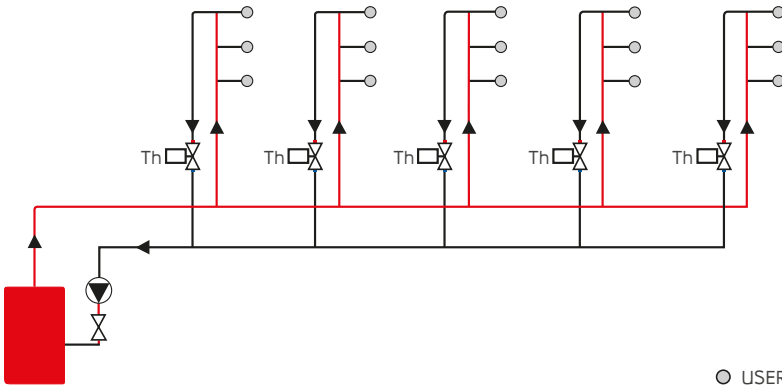


fig. 2.1
Traditional DHW recirculation: parallel recirculation with every DHW pipe and significant energy losses

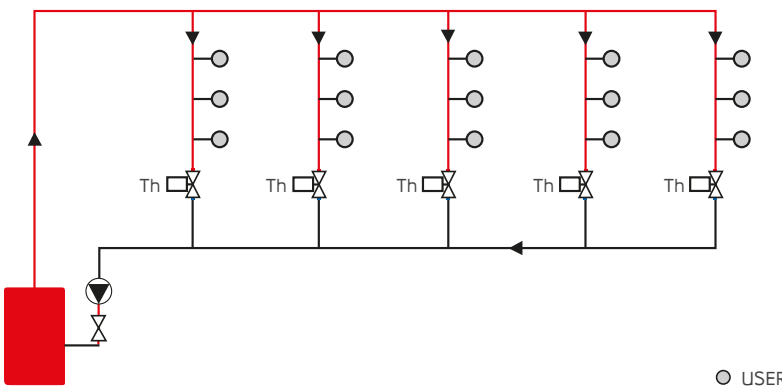


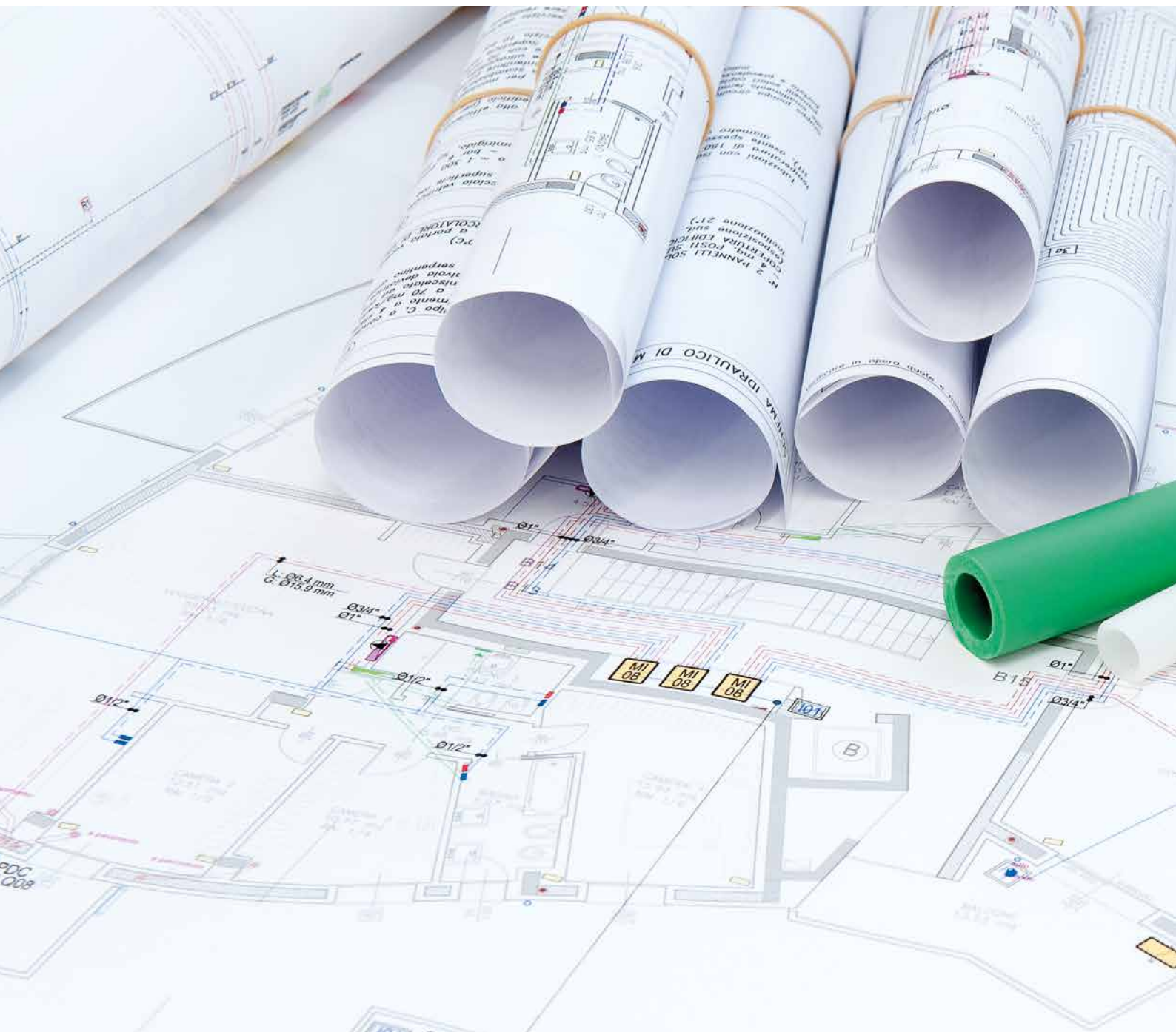
fig. 2.2
Central recirculation: a larger central recirculation device may replace multiple parallel ones, thus reducing the investment and energy losses (up to 40 %)

In conclusion, using the Table provided in (fig. 2.3), it is possible to choose the most suitable system for one's needs. It summarizes the most important characteristics of the various systems in terms of hot water materials, hygiene and comfort. In addition, the various types of sanitary distribution systems described above can be easily paired to the Giacomini systems described in Chapter 4 of this catalogue.

	material		hygiene		DHW comfort			Giacomini systems				
	pipe quantity required	use of one pipe diameter	frequent use of draw-off point	rare use of draw-off points	available flow rate	availability times	available pressure	PEX and multilayer system with T-shaped derivation	PEX and multilayer system with manifolds	PEX expansion system - GX	PEX crimping ring system	PPR welding system
manifold systems												
connection to single inlet terminals	Low level	✓	✓	✗	Average level	High level	High level	✓	✓	✓	✓	✗
connection to single + double inlet terminals	Low level	✓	✓	✗	Average level	High level	High level	✓	✓	✓	✗	✗
closed-loop connection	Average level	✓	✓	✓	High level	High level	High level	✓	✓	✓	✗	✗
manifold-free systems												
derivation distribution (T-shaped outputs)	Average level	✗	✓	✗	Low level	High level	Low level	✓	✗	✓	✓	✓
series distribution	Average level	✗	✓	✓	Low level	High level	Low level	✓	✗	✓	✗	✗
loop distribution	High level	✗	✓	✓	High level	High level	High level	✓	✗	✓	✗	✗

LEGEND: Low level Average level High level ✓ Suitable ✗ Unsuitable

fig. 2.3



0101 COLONNA MONTANTE - SCALA "B"
ACQUA FREDDA SANITARIA
AF3
Ø1"14
CORR. Ø9mm

The benefits of plastic: a material guaranteeing long-term resistance and installation versatility at reduced costs.



Chapter 3

Plastic pipes

INTRODUCTION

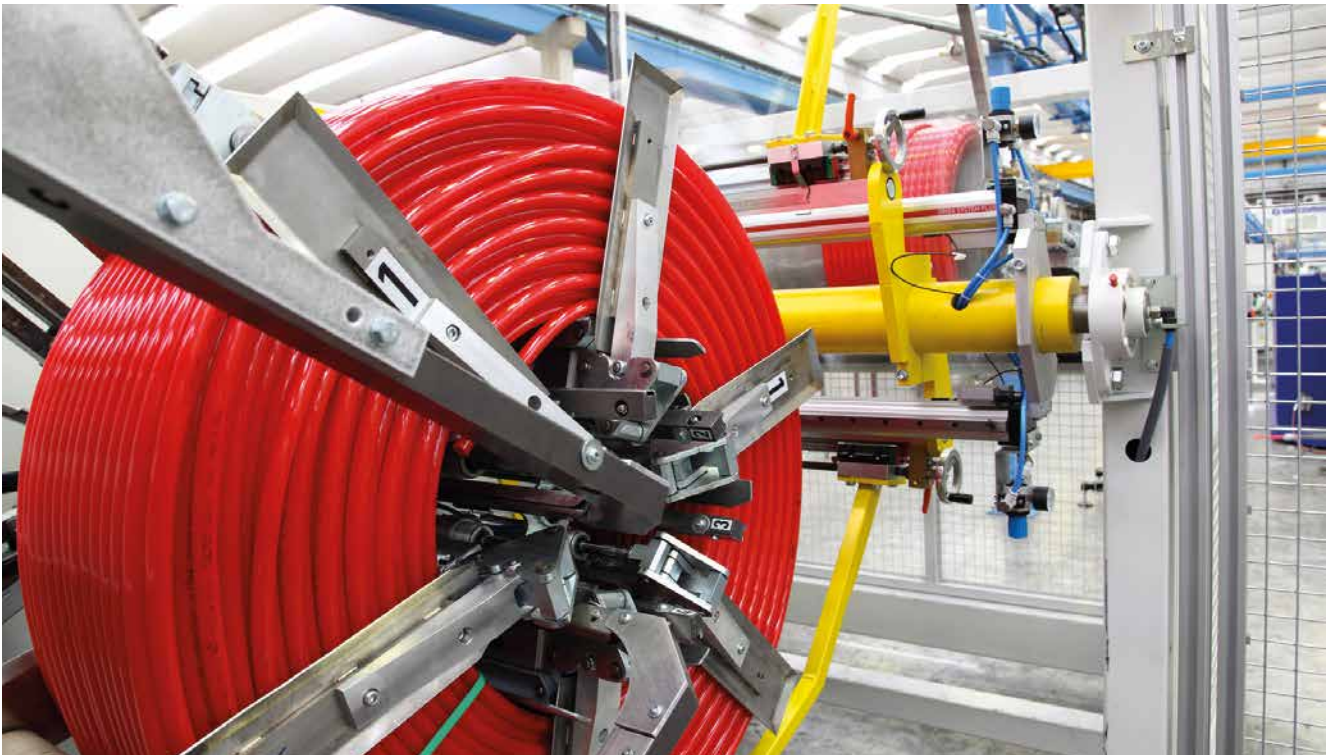
Sanitary water in domestic systems may flow inside metal or plastic pipes.

In modern installations, the market tends to use plastic pipes due to some important peculiarities:

- > exceptionally long-term reliability, i.e. mechanic resistance to specific stress determined by temperatures and working pressures
- > total absence of corrosion phenomena typical of metal (as the pipes are built into the floor, this represents an essential benefit)
- > remarkable installation versatility
- > reduced cost considering the growing production capacity of modern installations

The Giacomini pipe range used for hot water systems includes:

- > PEX-b cross-linked polyethylene
- > PEX/Al/PEX multi-layer
- > PPR





Production is carried out in-house at Giacomini's plants with complex machines – the extruders – which manufacture the pipes in line starting from the pellet base polymer, up to coil wrapping. The pictures above show a few steps of the extrusion production process.

Every production step is carried out in compliance with the laws in force and technically inspected as required by the regulation standards.

The regulations concerning sanitary hot and cold water provide for categorization of the different types of pipes in “application classes”.

field of application	application class	REPRESENTATIVE ICON
hot water (60 °C)	1	
hot water (70 °C)	2	

UNI EN ISO15875 - PEX pipes
 UNI EN ISO15874 - PPR pipes
 UNI EN ISO21003 - PEX/Al/PEX multilayer pipes

fig. 3.1

Along the years, Giacomini pipes have been granted the main international certifications for application in sanitary distribution systems.

In view of the continuous evolution of such matters, we recommend contacting our technical service for more details.

DVGW	SVGW	CSTB	WRAS	ATG	AENOR

PEX-B PIPES

In PE polyethylene, the polymer used for PEX pipes manufacturing, the level of cohesion between molecules is not able to guarantee sufficient performances in terms of resistance and duration in time: that is why the cross-linking process becomes key, as it adds chemical-molecular bonds to the existing ones. This increases the resistance to mechanical stress and high temperatures.

Giacomini pipes are made in PEX-with chemical cross-linking by using the so-called silane catalyzers. The cross-linking process is accelerated after extrusion by submerging the pipe in water at a controlled temperature or in steam.

The post-extrusion crosslinking has a “flushing” effect on the pipe, an operation which on the contrary is not performed on other PEX pipes. This guarantees great performances for PEX-b pipes. In fact, a lower degree of cross-linking is enough (65 % versus 70 % required for PEX-a) to achieve the requirements in terms of temperature and pressure resistance.

The standard of reference, EN ISO 15875 – Plastic piping systems for hot and cold water installations – Cross-linked polyethylene (PEX) – for production of PEX pipes, defines all physical and dimensional characteristics of the product.

It is useful to point out that the pipe characteristics do not depend exclusively on the cross-linking method, but also on many other factors, such as: base compound formulations, type of extrusion machines, accuracy of the production quality assurance procedures and other subsequent phases of finished product inspection and lab testing.

PEX-b pipes may be provided in sleeves (in PE-HD) or to be sleeved.

TECHNICAL DATA

field of application	class 1-2-4-5 (EN ISO 15875)	
density [g/cm³]	0.948	
heating pipe conductivity [W/(m K)]	0.35	
linear dilation coefficient [1/K]	at 20 °C	1.4 x 10 ⁻⁴
	at 100 °C	2.0 x 10 ⁻⁴
linear dispersion of sleeved air pipe (sleeve 25 mm) [W/(m.K)]	0.23	
linear dispersion of sleeved air pipe (sleeve 21 mm) [W/(m.K)]	0.21	

PEX-b / PEX-a

PEX-a pipes are polyethylene pipes cross-linked with the peroxide method, manufactured and inspected, as PEX-b pipes, in compliance with the EN ISO 15875 and DIN 16892 standards. The pipe undergoes an "in-line" cross-linking process and the barrier is coextruded in compliance with the DIN 4726 standard.

Cross-linking is not "3D" thus there are even fewer PEX-b pipes. As a consequence, the molecular level is less strict and PEX-a pipes offer a lower resistance with the same cross-linking percentage: that is why the minimum cross-linking degree for PEX-a pipes is 70 % versus 65 % of PEX-b pipes.

In addition, due to its lower density, resistance to chlorine or chlorinated solutions of PEX-a pipes is lower compared to PEX-b.

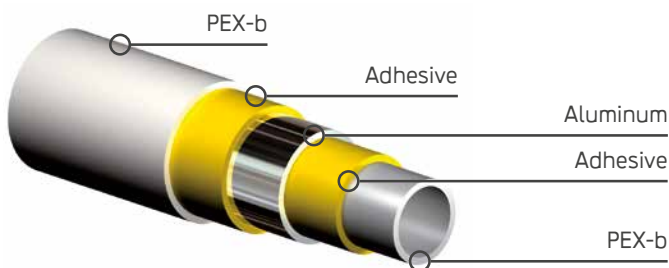
NOTE: The density of PEX-a pipes ranges from 0.925 and 0.935 g/cm³ versus 0.948 g/cm³ for PEX-b pipes.

This aspect plays an important role because the use of chlorine-based disinfectants is growing as one of the main anti-bacterial actions.

PEX-b produced by Giacomini is thus especially recommended for facing the increasing presence of chlorine in disinfection actions of drinking water, and confirmed to be the ideal choice for the realization of hot water systems.

PEX-B/AL/PEX-B MULTILAYER PIPES

R999 multilayer pipes include a PEX-b (cross-linked polyethylene) internal layer, an intermediate aluminum layer, welded longitudinally (head-head) with laser technology, and an external PEX-b white layer. Two intermediate gluing layers evenly connect the aluminum layer to the PEX-b layers.



The aluminum layer limits linear dilation of the pipe and guarantees a safe barrier against oxygen and other gases in addition to conferring exceptional product resistance to crushing. PEX-b/Al/PEX-b multilayer pipes are suitable for (hot and cold) drinking water conveying in compliance with the laws in force and for application in heating and cooling systems.

Multilayer pipes are also available as insulated pipes or may be provided sleeved (in PE-HD).

NOTE: Installations with PEX-b/Al/PEX-b pipes are not removable.

TECHNICAL DATA

range of use	class 1-2-4-5 (UNI EN ISO 21003)
linear dilation coefficient [1/K]	at 20 °C 2.4x10 ⁻⁵
pipe thermal conductivity [W/(m K)]	0.40
insulation thermal conductivity [W/(m K)]	0.040
insulation fire reaction	Class 1, in compliance with Ministerial Decree. 26/06/84
insulation fire reaction	Euroclass E, in compliance with EN 1350-1

PPR PIPES

The raw material used is polypropylene (PP), is obtained through random polymerization and is also known as PPR.

The technical characteristics of the material make it ideal for the realization of systems conveying drinking water, even when very calcareous.

Among the main benefits that PPR shares with other plastic pipes are: extended duration, thanks to its superior resistance to aggressive agents, no perforations caused by stray currents which the material does not transmit as it is a bad electric conductor, reduced pressure drops and much less surface roughness.

The PPR used by Giacomini for its system, already known by the conventional name Giacogreen, is PPR TYPE3 100 which, compared to the previous version 80, guarantees – with the same thickness values – better performances, especially in terms of long-term mechanical resistance.

TECHNICAL DATA

field of application	class 1-2-4-5 (EN ISO 15874)
density [g/cm ³]	0.905
pipe thermal conductivity [W/(m K)]	0.24
linear dilation coefficient [1/K]	at 20 °C 1.5x10 ⁻⁴

GIACOMINI PIPE STORAGE PRECAUTIONS

To guarantee use of the pipes in compliance with the best quality standards, a few simple but essential precautions are required when storing them in the various warehouses of the distribution chain:

- > store the pipe in roofed and dry areas to prevent humidity from damaging the package
- > pipe piles should not exceed 1 m of height and this must be kept into consideration also during transportation (PPR only)
- > keep the pipe packed to prevent exposure to direct sunlight
- > take special care during transportation and installation
- > prevent contact of the pipe with sharp objects that may scratch and perforate it
- > prevent formation of ice as dilations due to a change of status may damage the pipe
- > prevent contact of the pipe with open flames
- > prevent contact of the pipe with chemical solvents or paints

STANDARDS OF REFERENCE

The main standards of reference for the distribution systems discussed in the next chapter are summarized below:

Systems with T-shaped fittings and manifold systems:

- > EN ISO 15875 – Plastic pipe systems for hot and cold water installations – Cross-linked polyethylene (PEX)
- > DIN 16892 – Cross-linked high density polyethylene (PEX) pipe systems – General quality and testing requirements
- > UNI EN ISO 21003 – Multilayer pipe systems for hot and cold water installations inside buildings
- > EN 1254-3 – Copper and copper alloys – Hydraulic fittings – Fittings for plastic pipes with compression terminal
- > EN 1254-4 – Copper and copper alloys – Hydraulic fittings – Fittings combining other connection terminals with capillary or compression terminals
- > EN 12165 and DIN 50930-6 – Classification standards applied to brass (CW617N)

PEX expansion system - GX:

- > EN ISO 15875 Plastic pipe systems for hot and cold water installations – Cross-linked polyethylene (PEX)
- > DIN 16892 Plastic pipe systems – Technical requirements
- > DIN 4726 Plastic pipe systems - Technical requirements
- > EN 12165 and DIN 50930-6 - Classification standards applied to brass (CW617N)

PEX system with crimping ring:

This system, already known as Giacoquest, has been designed in compliance with the requirements below:

- > EN 12165 and DIN 50930-6 - Classification standards applied to brass (CW617N)
- > system technical characteristics, defined by standard EN ISO 15875 – Plastic pipe systems for hot and cold water installations specified by the design for a 50-year operational life
- > pipe size, defined by standard ASTM F876
- > technical characteristics for fittings and rings, defined by standard ASTM F1807

PPR welding system:

- > EN ISO 15874 - Plastic pipe systems for hot and cold water installations – Polypropylene (PP)
- > DIN 8077:2008-09 - Polypropylene (PP) pipes - PP-H, PP-B, PPR, PP-RCT - Dimensions
- > DIN 8078:2008-09 - Polypropylene (PP) pipes - PP-H, PP-B, PPR, PP-RCT - General quality requirements and testing
- > EN 12165 and DIN 50930-6 - Classification standards applied to brass (CW617N)

Classification table for pipe operation conditions

The standards of reference EN ISO 15874 (PPR pipes), EN ISO 15875 (PE-X pipes) and UNI EN ISO 21003 (multilayer pipes) include the operation conditions classification tables for this type of pipes.

As for application classes 1 and 2 (respectively “sanitary hot water at 60 °C” and “sanitary hot water at 70 °C”), the characteristics are:

field of application	T_{oper} [°C]	time at T_{oper} [years]	T_{max} [°C]	time at T_{max} [years]	T_{mal} [°C]	time at T_{mal} [h]
CLASS 1 hot water (60 °C)	60	49	80	1	95	100
CLASS 2 hot water (70 °C)	70	49	80	1	95	100

fig. 3.2

where

- > *operation temperature* (T_{oper}) is the working temperature provided for the field of application, expressed in °C
- > *maximum working temperature* (T_{max}) is the highest operation temperature value, allowed only for a short period of time
- > *malfunction temperature* (T_{mal}) is the highest possible temperature value when control systems fail (the possible period of time allowed for such a value is 100 h on a 50-year term of uninterrupted use)

All pipes are suitable for water conveying for a period of 50 years at working temperature corresponding to the range of use and an operation pressure of 10 bar. An exception is made for PPR for which, with reference to category 2, the operation pressure is 8 bar.

In addition, all pipes are suitable for water conveying for a period of 50 years at a temperature of 20 °C and a working pressure of 10 bar.

NOTES



Competence, reliability, cutting-edge materials for state-of-the art water distribution in new constructions and building renovations.



Chapter 4

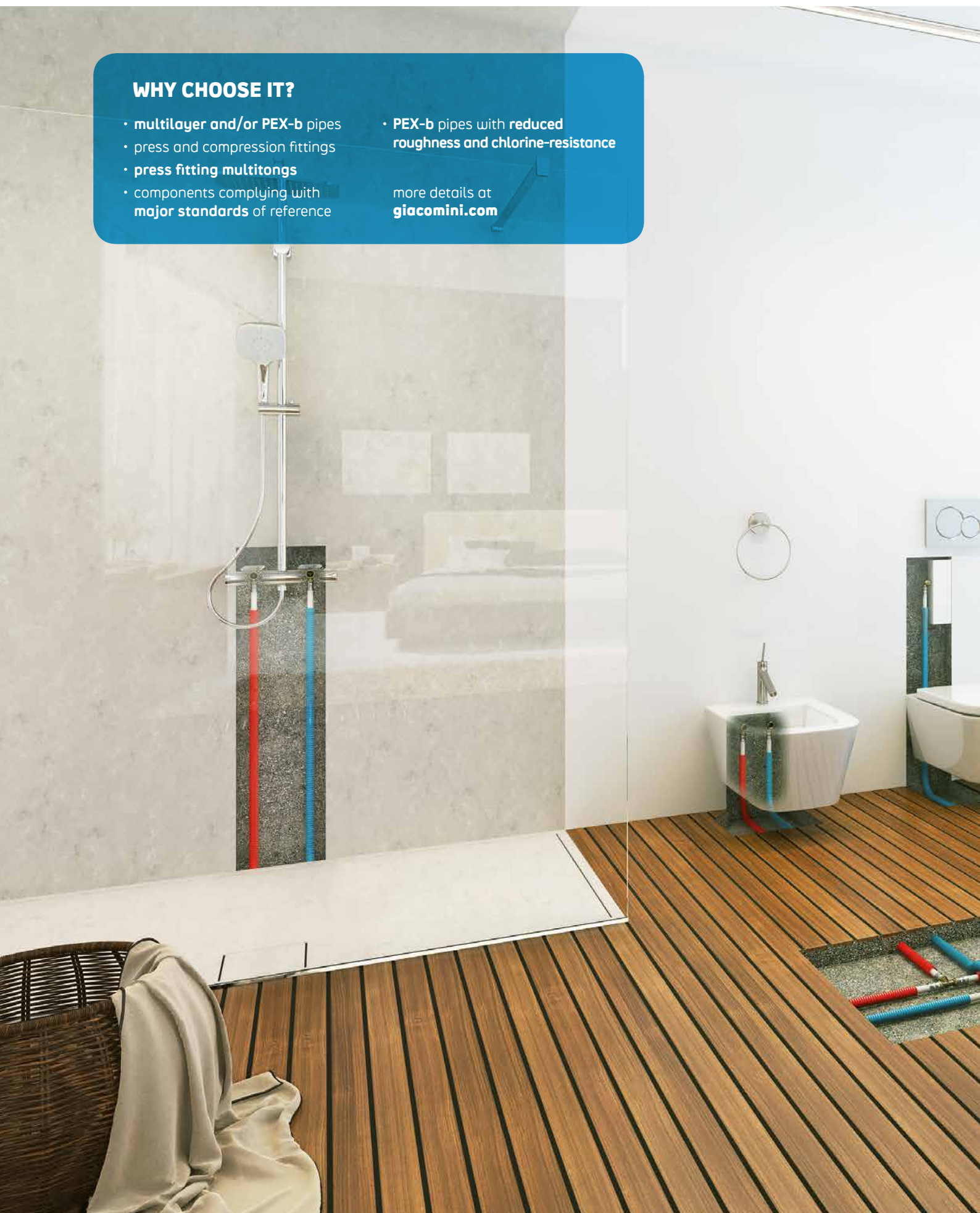
Giacomini Systems

PEX AND MULTILAYER SYSTEM, WITH T-SHAPED DERIVATIONS

WHY CHOOSE IT?

- multilayer and/or PEX-b pipes
 - press and compression fittings
 - press fitting multitongs
 - components complying with major standards of reference
- PEX-b pipes with reduced roughness and chlorine-resistance

more details at
giacomini.com



INTRODUCTION

Giacomini **press and compression fittings** with adapter are designed for use with hot and cold water distribution for sanitary and heating systems.

They feature a dual-pipe and fitting system: the first includes multilayer pipes and press or compression fittings with adapter.

The second includes PEX-b pipes and compression fittings with adapter.

The fitting range width allows to solve any on-site problem caused by space limits, technical or economic preferences by using PEX-b or multilayer pipes.

The production of every system component guarantees a totally non-toxic product, suitable for hot water distribution, as required by the European Directive 98/83/CE for drinking water quality.

SYSTEM COMPONENTS

> MULTILAYER PIPE



> PEX-b PIPE WITH SLEEVE



> RM PRESS FITTINGS



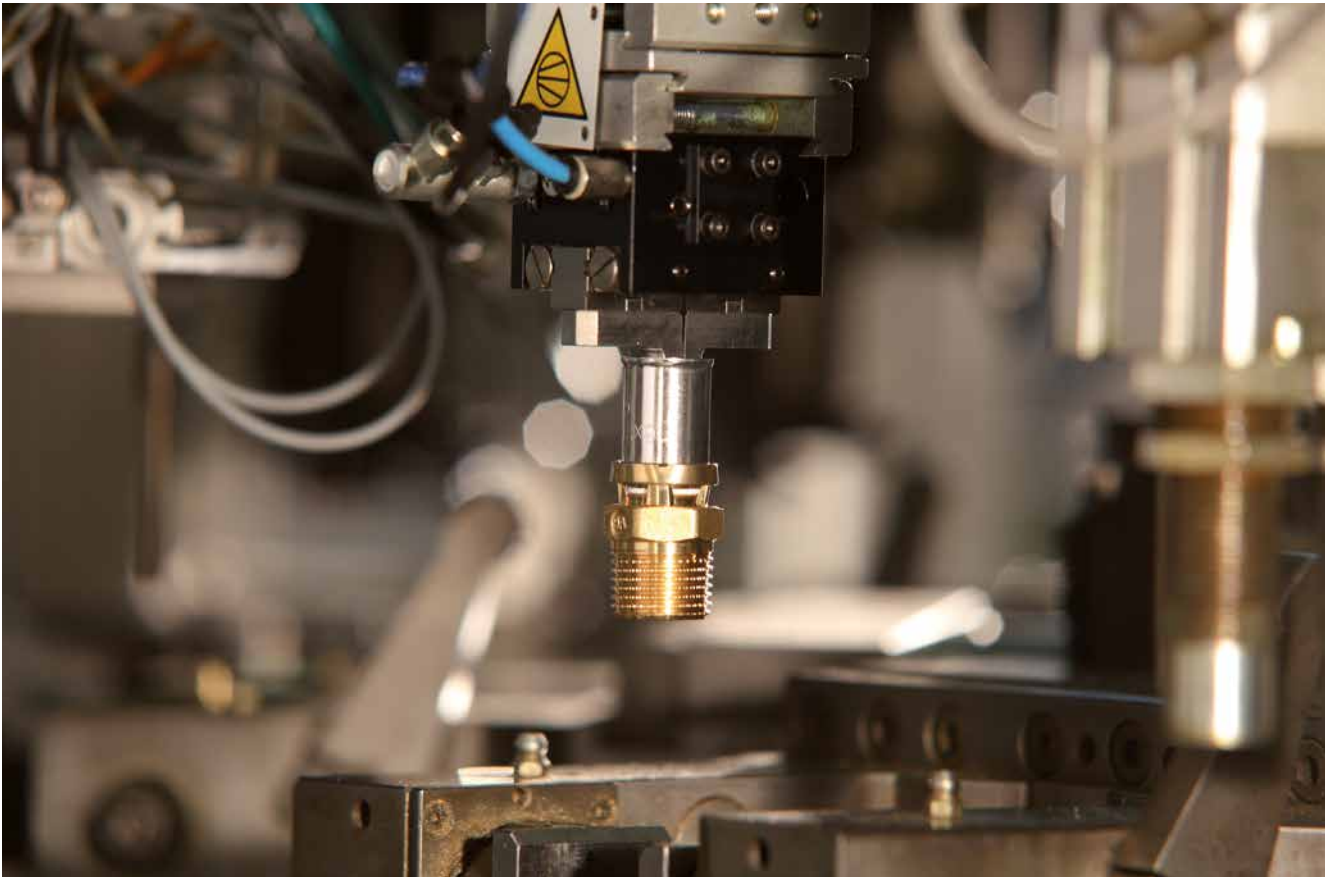
> COMPRESSION FITTINGS



> PRESS FITTING PRESS MACHINE AND TONGS



PEX AND MULTILAYER SYSTEM, WITH T-SHAPED DERIVATIONS



COMPONENT CHARACTERISTICS

Press fittings

Mechanic press fittings from the RM series represent the evolution of the previous RP series.

Its main characteristics are:

- enhanced sealing thanks to a new fitting section
- “multitongs fitting” with pressing option for the main types of TH - H - U tong sections (fig. 4.1) based on the table below:

pipe size [mm]	tongs section
16 x 2	TH - H - U
20 x 2	TH - H - U
26 x 3	TH - H
32 x 3	TH - H - U
40 x 3.5	TH - H
50 x 4	TH - H
63 x 4.5	TH

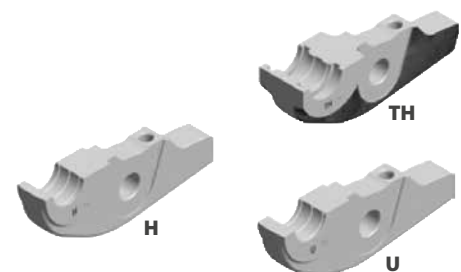


fig. 4.1 Tongs sections

Giacomini press fittings, combined with PEX-b pipes and multilayer pipes, are suitable for use in hot and cold water distribution systems for sanitary or heating installations.

In fact, the fittings are made of CW617N brass (CuZn40Pb2), complying with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4MS European initiative) so as to be used also in hot water systems. The black double sealing O-ring is made of EPDM, in compliance with EN 681-1 and suitable for drinking water distribution.

Design and manufacturing of the fittings is carried out with great care throughout the production process, bearing in mind the goal of maximum component reliability in order to make installer work easier under the highest safety conditions.

Among the main peculiarities are:

- AISI 304 stainless steel flared bush to ease insertion of the pipe (fig. 4.2 - ref. 3)
- CW617N brass bush lock ring in compliance with EN12164 with openings to visually control correct insertion of the pipe all the way through (condition necessary to guarantee firm pressing) (fig. 4.2 - ref. 2)
- the insulating separator for multilayer pipe joints (as known, the contact between the pipe aluminum and the fitting brass may generate electrochemical phenomena which can damage the brass components) (fig. 4.2 - ref. 5)
- fitting section with use of a black EPDM double O-ring (in compliance with EN 681-1) (fig. 4.2 - ref. 4) designed to guarantee pressure seal of the system, for all classes and working pressures in sanitary and heating systems.

Fittings are provided fully assembled and packed in boxes. The diameter and thickness of the pipe for which they are made are clearly marked on the bush.

The range of Rp male and female fittings comply with the EN 10226 standard (ex ISO-7).

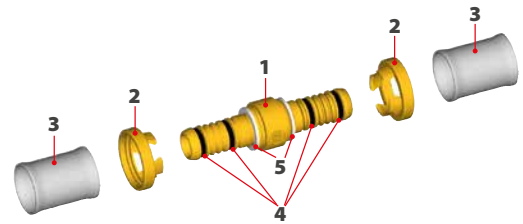
Compression fittings with adapter

Compression fittings with adapter are one of the first fitting ranges by Giacomini.

They have proven their sturdiness and reliability in various applications over time.

The range of fittings, combined to PEX-b and multilayer pipes, is suitable for use in hot and cold water distribution systems for sanitary and heating installations.

In fact, the fittings are made of CW617N brass (CuZn40Pb2), complying with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4MS European initiative) so as to be used also in sanitary installations. The black seal O-ring is made with EPDM, in compliance of EN 681-1, suitable for drinking water distribution.



- 1 Brass body
- 2 Bush lock ring
- 3 Bush
- 4 O-ring
- 5 Insulating separator

fig. 4.2 Construction characteristics



fig. 4.3

Detail of bush: the RM Series marking indicates that the fitting may be pressed with the TH - H - U section tongs

Design and manufacturing of the fittings is carried out with great care throughout the production process, bearing in mind the goal of maximum component reliability in order to make installer work easier under the highest safety conditions.

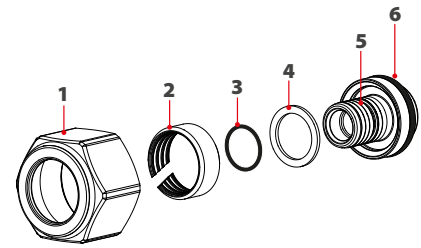
Among the main peculiarities are:

- separation ring for multilayer pipe joints (as known, the contact between the pipe aluminum and the fitting brass may generate electrochemical phenomena which can damage the brass components) (fig. 4.4 - ref. 4)
- section with use of an internal EPDM O-ring in compliance with EN 681-1 designed to guarantee pressure seal of the system, for all classes and pressures of use in sanitary and heating systems. (fig. 4.4 - ref. 3)

The Giacomini range of compression fittings with adapter includes 2 variants:

- **fittings with assembled components:** the fitting body and all the adapter components are preassembled. These fittings are made of chromed-plated brass
- **fittings with single components:** the fitting body and the adapter are not assembled and may be ordered separately. The body and nut are made of brass; the adapter nut is rough or chrome-plated brass or chrome-plated depending on the type of adapter

The threaded fitting range complies with the international standards: Gc male and female fittings comply with EN ISO 228.



- 1 Nut
- 2 Mechanical seal element
- 3 Internal O-ring
- 4 Separation ring
- 5 Hose connection adapter
- 6 External O-ring

fig. 4.4 Construction characteristics

PEX-b/Al/PEX-b multilayer pipes

Giacomini R999 multilayer pipes production is explained in chapter 3. Multilayer pipes are available as 16x2 - 18x2 - 20x2 - 26x3 - 32x3 - 40x3.5 - 50x4 - 63x4.5 mm.

PEX-b/Al/PEX-b multilayer pipes are also available as sleeved (in PE-HD) or in the R999I insulated version¹.

The insulation material layer, realized with closed-cell polyethylene foam, in addition to enhancing the installation energy efficiency, furtherly improves the already reduced noise level of the systems made with synthetic materials.

The insulation section includes a closed-cell polyethylene foam layer (CFC-free) protected by a special external lining film red or blue (for sanitary and heating systems), and light grey (for cooling systems).

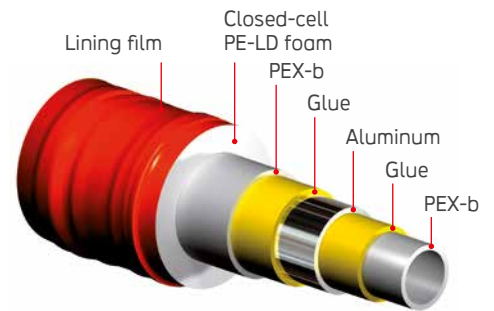


fig. 4.5 PEX-b/Al/PEX-b multilayer pipe in the insulated version

NOTES

¹ Systems made with PEX-b/Al/PEX-b pipes are not removable.

PEX-b pipes

Giacomini R993 and R994 sanitary pipes are made with PEX-b, as described in chapter 3, always in neutral color, and they include a blue (R993) or red (R994) PE-HD sleeve.

Availability: 16x2.2 - 20x2.8 mm pipes.

Systems made with a 16 mm outside diameter pipe are known as “removable”, as they can be easily and rapidly replaced, without damaging the floor or wall, with a new pipe if accidentally perforated or obstructed – the R993 and R994 series removable feature is guaranteed only when the installation curves have a minimum radius exceeding 8 times the outside diameter of the pipe.

For an in-depth analysis of all characteristics of PEX-b pipes, see chapter 3.

Tools

Power or battery-powered press tools are used to install the RM series press fittings; they may be equipped with tongs of different types, TH – H – U, based on the Table in fig. 4.1 and they enable to connect the entire range in a rapid and flexible way, minimizing possible errors.

For a correct and long-lasting operation of the press machine, one must comply with the programmed revision dates. Tongs must always be clean and greased to prevent anomalous pressing stresses that may reduce tool life.

INSTALLATION AND TESTING TECHNIQUES

To install the **PRESS FITTING SYSTEM COMBINED TO MULTILAYER PIPES**, proceed as described below:

1. Cut, burr and calibrate the pipe Cut the pipe at 90° to its axis, using the R990 cutter (we recommend rotating slightly the cutter during this operation) or the RP204 roller pipe cutter to limit ovalizations of the pipe (1.1). To avoid damaging the hydraulic seal elements during installation, burr the pipe end with the RP205 or RP209 tool (1.2) and calibrate the internal surface with RP209 (1.3). Check correspondence between the cutter/calibration tool size and the pipe size.

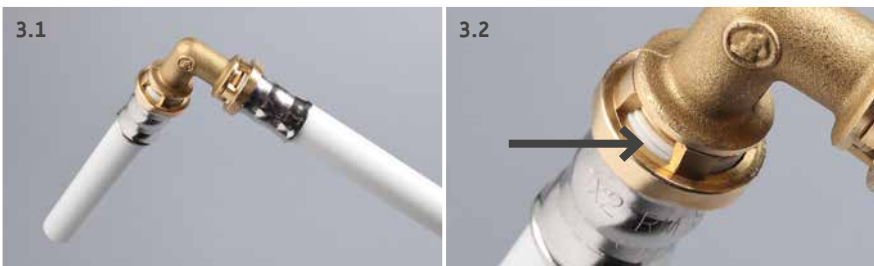


2. Lubricate and insert the pipe, install the fitting in the press machine Lubricate the internal surface of the pipe with lubricants suitable for use with the system materials and for the provided application. Insert the pipe all the way into the fitting; the bush flared terminal shape eases the insertion of the pipe. Make sure the pipe is installed correctly so that it touches the insulating separator through the bush lock ring slots (2.1). To press the fittings, use a press machine with a jaw size corresponding to the fitting and with section based on the Table in fig. 4.1:

- open the jaws and, before inserting the pipe, make sure there are no debris inside
- place the pipe into the jaw grooves, so that the shapes coincide neatly (2.2)



3. Start the press machine and check the grip Start the press tool and wait till the jaws are completely closed and lock the fitting. During this operation, pay special attention to the moving mechanisms. Once the pressing is completed, invert the operational direction of the press machine, based on its type, start it and wait till it stops. Then open the jaws to take out the pressed fitting (3.1). Check proper pressing and the correct position of the pipe by looking at the bush lock ring (3.2). The fittings feature a non-reversible fastening system. In case of incorrect pressing, the pipe must be cut and the joint must be remade with a new fitting.



To install the COMPRESSION FITTING SYSTEM WITH ADAPTER, COMBINED TO MULTILAYER AND PEX-b PIPES, proceed as described below:

1. Cut, burr and calibrate the pipe Cut the pipe at 90° to its axis, using the R990 cutter (we recommend rotating slightly the cutter during this operation) or the RP204 roller pipe cutter to limit ovalizations of the pipe (1.1). To avoid damaging the hydraulic seal elements during installation, burr the pipe end with the RP205 or RP209 tool for multilayer pipes (1.2). Only in case of multilayer pipes, calibrate the internal surface with RP209 (1.3). Make sure the cutter/calibration tool size and the pipe size are the same.



2. Lubricate and insert the pipe, then position the fitting Lubricate both the hydraulic seal elements and the internal surface of the pipe with lubricants suitable for use with the system materials and the provided application. Fit the nut (2.1) and the bicone on the pipe, then insert the adapter hose connection into the pipe till it is flush with it (2.2) (in case of multilayer pipes, make sure the hose connection is equipped with the insulation ring). Insert the adapter into the distribution system (manifold, elbow fitting with wall-mount bracket, etc.) using the external O-ring (2.3).



3. Fasten the fitting and check proper fastening Start fastening the nut (3.1) on the distribution system terminal using the proper wrench (3.2). Check proper fastening.

Notes:

- compression fittings with adapter feature a non-reversible fastening system
- when disassembling, check the shape and quality of the O-ring
- after each new assembly, perform pressure test (see chapter 5)



4. Install the pipes PEX-b and PEX-b/Al/PEX-b pipes enable to realize hydraulic systems in an easy and rapid way.

A few simple precautions are required for installation:

- connect the pipes using the proper fittings and adapters
- if required, bend the pipes, avoid exposing the components to permanent mechanical stresses
- temperature changes of the thermal transfer fluid cause a proportional extension of the pipes. To solve such thermal dilations, use “fix” supports which lock the pipe, and “sliding” supports that enable the pipe to slide, and install expansion curves in long sections of straight pipes
- in exposed installations, always protect the pipes from ultraviolet rays
- avoid exposing the pipe to ultraviolet rays for extended periods of time also when installing or storing it
- prevent, whenever possible, in-wall installation of the fittings. If this is not possible, make the fitting inspectionable or protect it from contact with construction materials, so that it is free to dilate and, in any case, always keeping track of its position in the design files

Always comply with national and local laws and standards.

5. Pressure test After installing the pipes, carry out a system pressure test so as to immediately identify possible leaks (see chapter 5).

SYSTEM COMPONENTS



PEX-b and multilayer pipes



RM fittings



Compression fittings with adapter single components



Compression fittings with adapter assembled components



Press machine and tongs



Backflow preventers



Pressure reducers



Thermostatic mixers

NOTES

PEX AND MULTILAYER SYSTEM WITH MANIFOLDS

WHY CHOOSE IT?

- possibility to **intercept single draw-off points** of the system through the manifold
 - **suitable** for the **PEX-b** pipe removable system
 - **multitongs press fittings**
 - components complying with the **main standards** of reference
- **PEX-b** pipes with **reduced roughness, chlorine-resistant**

more details at giacomini.com



INTRODUCTION

Giacomini **press fittings and compression fittings** with adapter, combined to Giacomini manifolds, are suitable for use with hot and cold water distribution in sanitary and heating systems.

They include a double system made with pipes and fittings: the first includes multilayer pipes and press or compression fittings with adapter. The second features PEX-b pipes and compression fittings with adapter.

The fitting range width allows to solve any on-site problem caused by space limits, technical or economic preferences by using PEX-b or multilayer pipes.

Production of all the system components guarantees a fully non-toxic product, suitable for sanitary water distribution, in compliance with European Directive 98/83/CE for the quality of drinking water.

SYSTEM COMPONENTS

> MULTILAYER PIPE



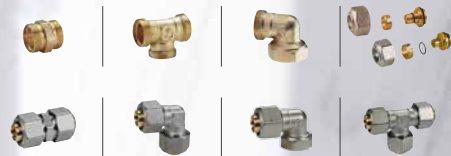
> PEX-b PIPE WITH SLEEVE



> RM PRESS FITTINGS



> COMPRESSION FITTINGS



> MANIFOLDS



> CABINETS



> PRESS MACHINE AND TONGS FOR PRESS FITTINGS



PEX AND MULTILAYER SYSTEM WITH MANIFOLDS



COMPONENT CHARACTERISTICS

Manifolds

With the R580C series (without shut-off valve) and R585C series (with shut-off valve) of modular manifolds we created a range that is very easy to install, highly reliable and extremely thought through down to the last detail.

The manifold body is molded, a feature conferring great solidity in addition to reduced roughness on all internal surfaces.

The fitting sections are designed to obtain the largest passage possible.

Reliable closing of the R585 manifold stopper is guaranteed by an EPDM gasket for front seal. The shut-off valve is made of two pieces thus the overall dimensions of the manifold does not depend on the shutter closure position; this characteristic prevents the handwheels from possibly obstructing correct closing of the containment cabinet door during ordinary operation (that is with the shut-off valves fully or partially open).



The handwheels connected to the shut-off valve with a screw are equipped with two plates: one shows the corresponding draw-off point, the other overlaps the first one and is colored (blue on one side, red on the other) to immediately show if there is hot or cold sanitary water flowing in that manifold. This enables to optimize also the quantity of products on stock.

Modular manifolds are available with 3/4" male x female connections, with 2 - 3 - 4 1/2" outputs and a 35-mm center distance to connect the draw-off points. There is also a range of press fittings and adapters to connect PEX-b and multilayer pipes.

The R580C and R585C manifolds are made with CW617N brass (CuZn40Pb2), in compliance with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4 MS European initiative) so as to be used in hot water systems.

Press fittings

The RM mechanic press fittings represent the evolution of the previous RP series.

The main characteristics are:

- enhanced seal thanks to a new fitting section
- "multitong fitting" with optional pressing with the main types of TH - H - U section tongs (fig. 4.6) based on the table below:

pipe size [mm]	tong section
16 x 2	TH - H - U
20 x 2	TH - H - U
26 x 3	TH - H
32 x 3	TH - H - U
40 x 3.5	TH - H
50 x 4	TH - H
63 x 4.5	TH

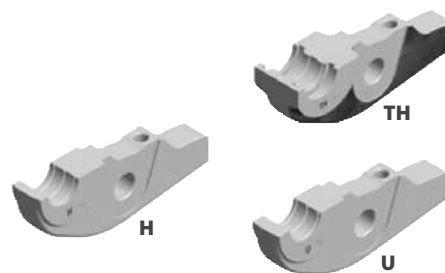


fig. 4.6 Tongs sections

Giacomini press fittings, combined to PEX-b and multilayer pipes, can be used in hot and cold water distribution systems for sanitary or heating installations.

In fact, they are made of CW617N brass (CuZn40Pb2), in compliance with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4MS European initiative) so as to be used also in hot water systems. The black double O-ring is made of EPDM, according to EN 681-1, suitable for drinking water distribution.

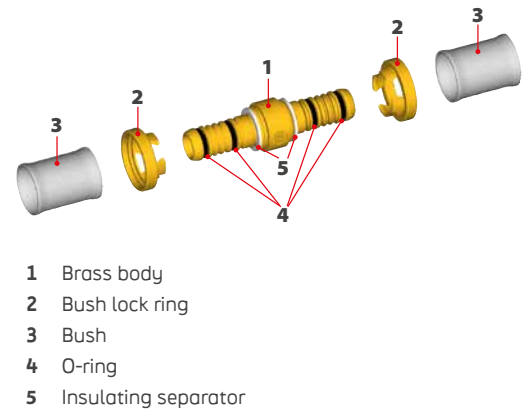
Design and manufacturing of the fittings is carried out with great care throughout the production process, bearing in mind the goal of maximum component reliability in order to facilitate the installer's work and maximize safety conditions.

Among the main unique features are:

- AISI 304 stainless steel flared bush to facilitate insertion of the pipe (fig. 4.7 - ref. 3)
- bush lock ring made of CW617N brass in compliance with the EN12164 standard, with openings to visually check the correct full insertion of the pipe (condition required to guarantee firm pressing) (fig. 4.7 - ref. 2)
- insulating separator for multilayer pipe joints (as known, the contact between the pipe aluminum and the fitting brass may generate electrochemical phenomena which can damage the brass components) (fig. 4.7 - ref. 5)
- fitting section with use of black EPDM double O-ring (in compliance with EN 681-1) (fig. 4.7 - ref. 4) designed to guarantee pressure seal of the system, for all classes and working pressures in sanitary and heating systems

Fittings are provided fully assembled and packed in boxes. The diameter and thickness of the pipe for which they are made are clearly marked on the bush.

The range of RP male and female fittings comply with the EN 10226 standard (ex ISO-7).



- 1 Brass body
- 2 Bush lock ring
- 3 Bush
- 4 O-ring
- 5 Insulating separator

fig. 4.7 Construction characteristics



fig. 4.8

Bush detail: the RM Series marking indicates that the fitting may be pressed with TH - H - U section tongs

Compression fittings with adapter

Compression fittings with adapter are one of the first fittings developed by Giacomini. In time they have proven their sturdiness and reliability through various applications.

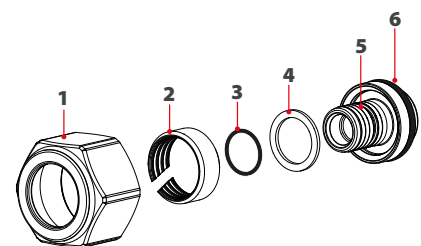
The range of fittings, combined with PEX-b and multilayer pipes, can be used in hot and cold water distribution systems for hot water or heating installations.

In fact, the fittings are made of CW617N brass (CuZn40Pb2), complying with the EN12165 standard and the UBA list (according to DIN50930-6 and established by the 4MS European initiative) so as to be used also in hot water systems. The black sealing O-ring is made of EPDM, in compliance with EN 681-1 and suitable for drinking water distribution.

Design and production of the fittings is carried out with great care for every single detail, and setting as goal maximum reliability of the system to make the installation the easiest possible. This makes the installer's work easier under the highest safety conditions.

Among the main unique features:

- separation ring for multilayer pipe joints (as known, the contact between the pipe aluminum and the fitting brass may generate electrochemical phenomena which can damage the brass components) (fig. 4.9 - ref. 4)
- fitting section of EPDM internal O-ring in compliance with EN 681-1 designed to guarantee pressure seal of the system, for all classes and working pressures in hot water and heating systems (fig. 4.9 - ref. 3)



- 1 Nut
- 2 Mechanical seal element
- 3 Internal O-ring
- 4 Separation ring
- 5 Hose connection adapter
- 6 External O-ring

fig. 4.9 Construction characteristics

The Giacomini range of compression fittings with adapter range includes 2 categories:

- **fittings with assembled components:** the fitting body and all the adapter components are preassembled. These fittings are made with chromed-plated brass
- **fittings with single components:** the fitting body and the adapter are not assembled and may be ordered separately. The body and the nut are made of brass; the adapter nut is rough or chrome-plated brass according to the type of adapter

The threaded fitting range complies with the international standards: Gc male and female fittings comply with EN ISO 228.

PEX-b/Al/PEX-b multilayer pipes

Giacomini R999 multilayer pipes are produced as described in chapter 3.

Multilayer pipes are available as 16x2 - 18x2 - 20x2 - 26x3 - 32x3 - 40x3.5 - 50x4 - 63x4.5 mm.

PEX-b/Al/PEX-b multilayer pipes can also be provided sleeved (in PE-HD) or in the R999I insulated version¹.

The insulation material layer, realized with closed-cell polyethylene foam, in addition to enhancing the installation energy efficiency, further improves the already reduced noise level of systems made with synthetic materials.

The insulation section includes a closed-cell polyethylene foam layer (CFC-free) protected by a special external lining film, red or blue (for hot water and heating systems), and light grey (for cooling systems).

PEX-b pipes

Giacomini R993 and R994 hot water pipes are made with PEX-b, as described in chapter 3, always in neutral color, and they include a blue (R993) or red (R994) PE-HD sleeve.

Availability: pipes with dimensions 16x2.2 - 20x2.8 mm.

Systems made with a 16-mm outside diameter pipe are known as “removable”, as they can be easily and rapidly replaced, without damaging the floor or wall, with a new pipe if accidentally perforated or obstructed. The removable feature of the R993 and R994 series is guaranteed only when the installation curves have a minimum radius exceeding 8 times the outside diameter of the pipe.

For an in-depth analysis of all the characteristics of PEX-b pipes, see chapter 3.

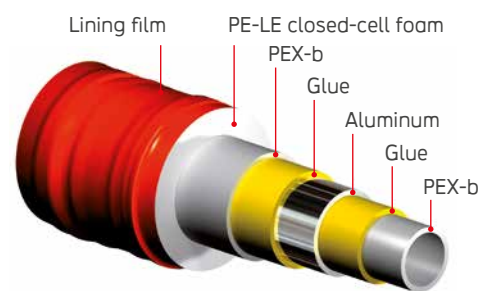


fig. 4.10 PEX-b/Al/PEX-b multilayer pipe – insulated version

NOTES

¹ Systems made with PEX-b/Al/PEX-b pipes are not removable

Tools

Power or battery-powered press machines are used to install the RM series press fittings. They may be equipped with tongs of different types, TH – H – U, based on the Table in fig. 4.6 and they enable the rapid and flexible connection of the entire range, minimizing potential errors.

For a correct and long-lasting operation of the press machine, one must comply with the programmed revision dates. Tongs must always be clean and greased to prevent anomalous pressing stresses that may reduce the mechanism life span.

INSTALLATION AND TESTING TECHNIQUES

To obtain a perfect seal of mechanical pressure fittings and compression fittings with an adapter, the pipe and the fitting must have the same nominal diameter and thickness. To prevent erroneous installations, we therefore recommend checking the component dimensions before installation.

To install the PRESS FITTING SYSTEM COMBINED WITH MULTILAYER PIPES, proceed as described below:

1. Cut, burr and calibrate the pipe Cut the pipe at 90° from its axis, using the R990 cutter (we recommend slightly rotating the cutter during this operation) or the RP204 roller pipe cutter to limit ovalizations of the pipe (1.1). To avoid damaging the hydraulic seal elements during installation, burr the pipe end with the RP205 or RP209 tool (1.2) and calibrate the internal surface with RP209 (1.3). Make sure the cutter/calibration tool and the pipe have the same size.

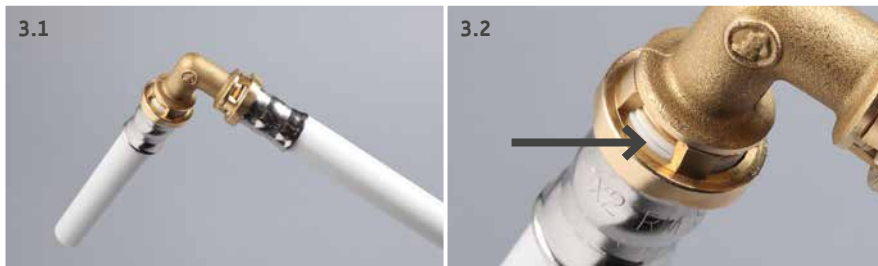


2. Lubricate and insert the pipe, place the fitting in the pressing machine Lubricate the internal surface of the pipe with lubricants suitable for use with the system materials and the provided application. Insert the pipe all the way through the fitting. Make sure the pipe is properly inserted and that it touches the insulating separator through the openings of the bush lock ring (2.1). To press the fittings, use a pressing machine with a jaw of the same size as the fitting and a section based on the Table in fig. 4.6:

- open the jaws and, before inserting the fitting, make sure there is no debris inside
- insert the fitting into the jaw grooves so that the shapes coincide perfectly (2.2)



3. Start the press machine and check the grip Start the press machine and wait till the jaws are completely closed and lock the fitting. During this operation, pay special attention to the moving mechanisms. Once the clamping is completed, invert the operational direction of the press machine based on its type, start it and wait till it stops. Then open the jaws to take out the pressed fitting (3.1). Check proper clamping and correct positioning of the pipe by looking at the bush lock ring (3.2). The fittings feature a non-reversible fastening system. In case of incorrect pressing, the pipe must be cut and the joint must be remade with a new fitting.



To install the SYSTEM HAVING COMPRESSION FITTING WITH ADAPTER, COMBINED TO MULTILAYER AND PEX-b PIPES proceed as described below:

1. Cut, burr and calibrate the pipe Cut the pipe at 90° from its axis, using the R990 cutter (we recommend slightly rotating the cutter during this operation) or the RP204 roller pipe cutter to limit ovalizations of the pipe (1.1). To avoid damaging the hydraulic seal elements during installation, burr the pipe end with the RP205 or RP209 tool (1.2) for multilayer pipes. Only with multilayer pipes, calibrate the internal surface with RP209 (1.3). Make sure the cutter/calibration tool and the pipe have the same size.



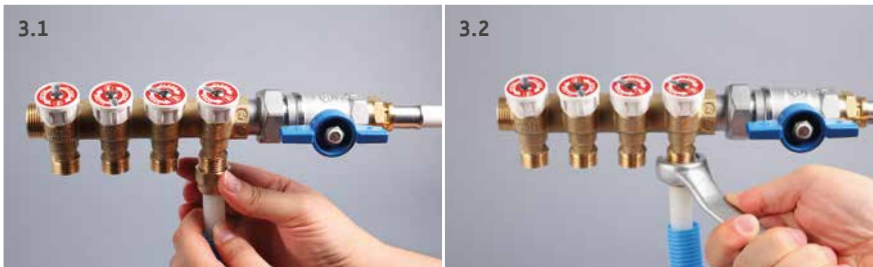
2. Lubricate and insert the pipe, introduce the fitting into the press Lubricate both the hydraulic seal elements and the internal surface of the pipe with lubricants suitable for use with the system materials and the provided application. Fit the nut (2.1) and the bicone on the pipe, then insert the adapter hose connection into the pipe till it is flush with it (2.2) (in case of multilayer pipes, make sure the hose connection is equipped with the insulation ring). Insert the adapter into the distribution system (manifold, elbow fitting with wall-mount bracket, etc.) using the external O-ring (2.3).



3. Fasten the fitting and check proper fastening Start fastening the nut (3.1) on the distribution system terminal using the special wrench (3.2). Check proper fastening.

Notes:

- compression fittings with non-reversible adapter fastening feature
- in case of disassembly, check the O-ring shape and quality
- after each disassembly, perform a pressure test (see chapter 5)



4. Install the pipe PEX-b and PEX-b/Al/PEX-b pipes to enable the easy and rapid realization of the hydraulic systems.

A few simple precautions are required for installation:

- connect the pipes using the proper fittings and adapters
- if required, bend the pipes, and avoid exposing the components to permanent mechanical stresses
- temperature changes of the thermal transfer fluid cause a proportional extension of the pipes. To solve such thermal dilations, use “fixed” supports which lock the pipe, and “sliding” supports which enable the pipe to slide, and install expansion curves in long sections of straight pipes
- in exposed installations, always protect the pipes from ultraviolet rays
- avoid exposing the pipe to ultraviolet rays for extended periods of time, also when installing or storing it
- avoid, whenever possible, in-wall installation of the fittings. If this is not possible, make the fitting inspectionable or protect it from contact with construction materials so that it is free to dilate and, in any case, always keep the trace of its position in the design files

Always comply with national and local laws and standards.

5. Pressure test After installing the pipes, carry out a pressure test of the system so as to immediately identify any fluid leaks (see chapter 5).

SYSTEM COMPONENTS



1/2" connection manifolds



Cabinets



PEX-b and multilayer pipes



RM fittings



Adapter



Backflow preventers



Pressure reducers



Thermostatic mixers

NOTES

PEX EXPANSION SYSTEMS - GX

WHY CHOOSE IT?

- wide range of O-Ring-free fittings
- long-lasting polymeric ring
- rapid installation and reduced number of components
- components complying with the main standards of reference
- PEX-b pipes with reduced roughness, chlorine-resistant

more details at giacomini.com



INTRODUCTION

The **PEX expansion system – GX – Giacomini eXpansion System** – is a distribution system for sanitary installations (also suitable for traditional or radiant heating and cooling systems) made with PEX-b pipes and brass fittings with a special seal section guaranteed by a polymeric ring.

A gradual expansion of the pipes combined to the ring allows installation of the fitting which, in a very short time, will be locked by the force generated by the elastic return of the polymeric elements.

Once the process is completed, the joint features improved mechanical characteristics compared to the single pipe and offers great reliability for the entire life cycle of the system.

Production of all the GX system components guarantees a fully non-toxic product, suitable for sanitary water distribution, in compliance with European Directive 98/83/CE for the quality of drinking water.

SYSTEM COMPONENTS

> PEX-b PIPES



> GX EXPANSION FITTINGS



> RINGS



> TOOLS



PEX EXPANSION SYSTEMS - GX



COMPONENTS CHARACTERISTICS

Rings

The special polymeric rings have been designed to both resist the expansion stress undergone during installation and to guarantee connection of the components in time. The ring design has been engineered to ease insertion of the pipes, while the upper edge is shaped to guarantee correct positioning of the ring during installation. The white color makes it the perfect solution also for exposed installation and outside boiler rooms. Availability: Pipe rings with outside diameter 16 - 20 - 25 - 32 - 40 mm.

Ring size, system name and manufacturer (Giacomini) are shown on the back of the component.



Fittings

The fittings are made of CW617N brass (CuZn40Pb2), complying with the EN12165 standard and the UBA list (according to DIN50930-6 and established by the 4MS European initiative) so as to be used also in hot water systems. One single range of fittings featuring an O-Ring-free section has been designed for all classes and pressures of use in hot water installations to guarantee the pressure seal of the system.

The threaded fitting range complies with the EN ISO 228 international standard.



PEX-b pipes

Giacomini R993 - R994 - R995 - R996 hot water pipes, as described in chapter 3, are made with PEX-b and are available in neutral color, white or red. The table below shows the outside diameters and the related thicknesses available:

outside diameter [mm]	thickness 1 [mm]	thickness 2 [mm]
16	1.8	2.2
20	1.9	2.8
25	2.3	3.5
32	2.9	4.4
40	3.7	5.5

R993 - R994 - R995 hot water pipes are provided with a blue, red or black PE-HD sleeve. R996 pipes are provided without a sleeve and must be sleeved or insulated if installed in-wall. Installations with pipes featuring a 16-mm outside diameter are known as removable pipes, as they can be easily replaced, without damaging the floor or wall, with a new pipe if accidentally perforated or obstructed. The R993, R994 and R995 removable pipe feature is guaranteed only when the installation curves have a minimum radius exceeding 8 times the outside diameter of the pipe.

For an in-depth analysis of all characteristics of PEX-b pipes, see chapter 3.

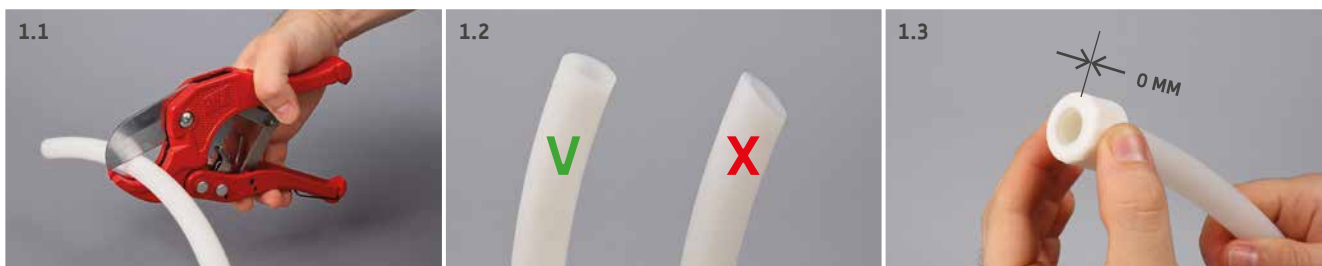
Tools

The GX system tools enable connection of the entire range in a rapid and flexible way, minimizing potential errors. In addition, they include all types of expanders (manual, battery-powered, electric) and adapters to combine the various expansion heads.

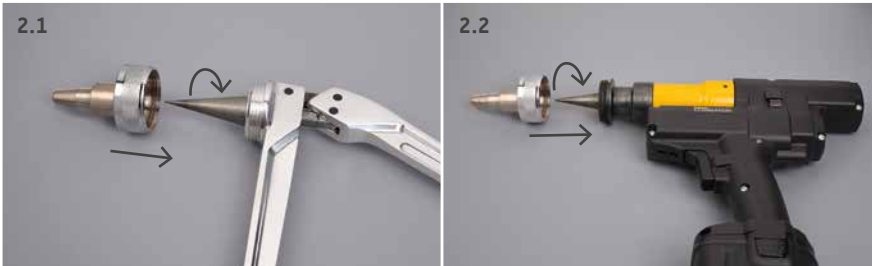
INSTALLATION AND TESTING TECHNIQUES

To install the GX system, proceed as described below:

1. Cut the pipe and insert the ring Cut the pipe at 90° from its axis, using the R990 cutter and making an effort to avoid deforming it (1.1 - 1.2). Fit the plastic ring on the pipe and make sure the pipe is flush with the upper edge of the ring (1.3).



2. Prepare the expander Prepare the expander (manual or battery-powered), by fastening the special expansion head (2.1 - 2.2), selected based on the pipe diameter.



3. Enlarge the pipe with the manual expander Insert the open expander – with the expansion head – inside the pipe, all the way through but without forcing it. Close the expander to enlarge the pipe. The expansion head will make opening shifts to expand the pipe (3.1). At the end of each enlargement of the expansion head, **manually rotate the pipe or expander by a minimum of 10° - maximum of 45°** and push it further into the pipe (3.2). Carry out these steps till the expansion head is completely inside the pipe (3.3). Perform at least two more expansions.



4. Enlarge the pipe with a battery-powered expander Insert the expander – with the expansion head – into the pipe, all the way through but without forcing it. Tighten the expander. The expansion head will make opening shifts to expand the pipe (4.1). At the end of each enlargement of the expansion head, **manually rotate the pipe or expander by min. 10° - max. 45°** and push it further into the pipe (4.2). Carry out these steps till the expansion head is completely inside the pipe (4.3). Perform at least two more expansions. For 32 x 4.4 mm and 40 x 5.5 mm pipes, perform at least six more expansions.



5. Insert the fitting Insert the GX fitting right after it has dilated (5.1). Make sure the ring is fully in contact with the fitting collar (5.2). The dilated ring and pipe will start to fasten on the fitting. After one minute, the fitting joint will be completed and you can start the next connection (5.3). After 24 hrs. at 23 °C, the connection will have the same strength as the pipe.



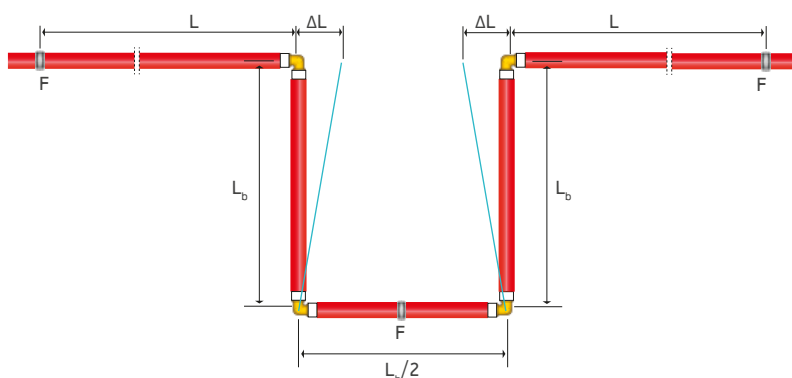
6. Install the pipes The GX system pipes enable an easy and rapid realization of hydraulic systems. To install the pipes, a few simple precautions are required:

- connect the pipes using the special fittings and adapters
- bend the pipes if necessary, do not expose the components to permanent mechanical stress
- in exposed installations, offset the pipe length variation generated by temperature changes (this is the reason why “fixed” supports locking the pipe and “sliding” supports that enable the pipe to move are required, fig. 4.11) and fit the expansion curves in long sections of straight pipes. To absorb any length variation, we recommend fitting at least one expansion curve every 10 m of pipe, as shown in the diagram below. Use expansion curves every time the pipes change direction (for pipes with a diameter equal to or exceeding 32 mm, expansion curves are mandatory)
- if possible, do not install fittings in-wall. If this is not feasible, make the fitting inspectionable or protect it from any construction material and keep a trace of its position in the project files
- in exposed installations, always protect the pipes from ultraviolet rays

Always comply with national and local laws and standards.

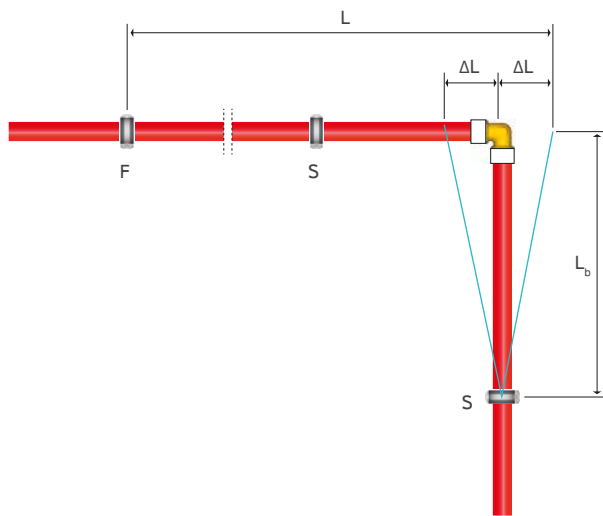


fig. 4.11 Fixed and sliding supports



- L** Distance between fixed support and expansion curve
- ΔL** Pipe length variation
- L_b** Expansion arm length
- F** Fixed support

fig. 4.12 Expansion curve



- L** Distance between fixed support and expansion curve
- ΔL** Pipe length variation
- L_b** Expansion arm length
- F** Fixed support
- S** Sliding support

fig. 4.13 Direction change

7. Pressure test The system can be pressurized after 30 minutes at temperatures $\geq 5^\circ\text{C}$ (for lower temperatures see technical datasheet). Carry out a pressure test for all GX system installations before commissioning – the max. testing pressure, which should never be exceeded, is 15 bar (1.5 MPa; 200 psi).

Example of pressure test for a system with working pressure = 6 bar

Working pressure = 6 bar
 Initial testing pressure: 0.5 bar [for 15 min]
 Testing pressure after 15 min: $6 \cdot 1.5 = 9$ bar [for 30 min]
 Testing pressure after 45 min: $6 \cdot 0.5 = 3$ bar [for 90 min]
 Pressure ≥ 3 bar ($6 \cdot 0.5$) = the system does not leak [for 90 min]

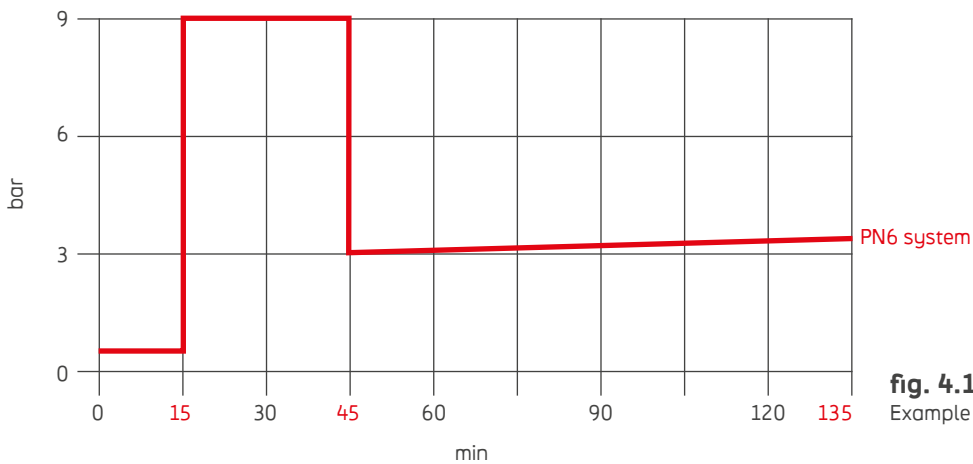


fig. 4.14 Example for Class 1, 2, 5 system

PEX SYSTEM WITH CRIMPING RING

WHY CHOOSE IT?

- **easy and rapid installations**
 - **O-ring-free** fittings
 - **light** for convenient use
 - pipes produced in the **most popular sizes** (1/2" - 3/4" - 1")
 - components complying with the **main standards** of reference
- **PEX-b** pipes with **reduced roughness, chlorine-resistant**

more details at
giacomini.com



INTRODUCTION

The **PEX system with crimping ring** is a distribution system for hot water installations, also used for traditional or radiant heating and cooling systems. It is made with PEX-b pipes with 1/2" - 3/4" - 1" imperial dimensions and brass fittings with a special section providing a seal through a black heat-treated ductile copper ring.

After pressing it into the correct position, the ring fastens the pipe and the fitting in a permanent and reliable way for the entire life cycle of the system.

Production of all PEX system components with fastening ring guarantees a fully non-toxic product, suitable for hot water distribution, as established by European Directive 98/83/CE for the quality of drinking water.

SYSTEM COMPONENTS

> PEX-b PIPES



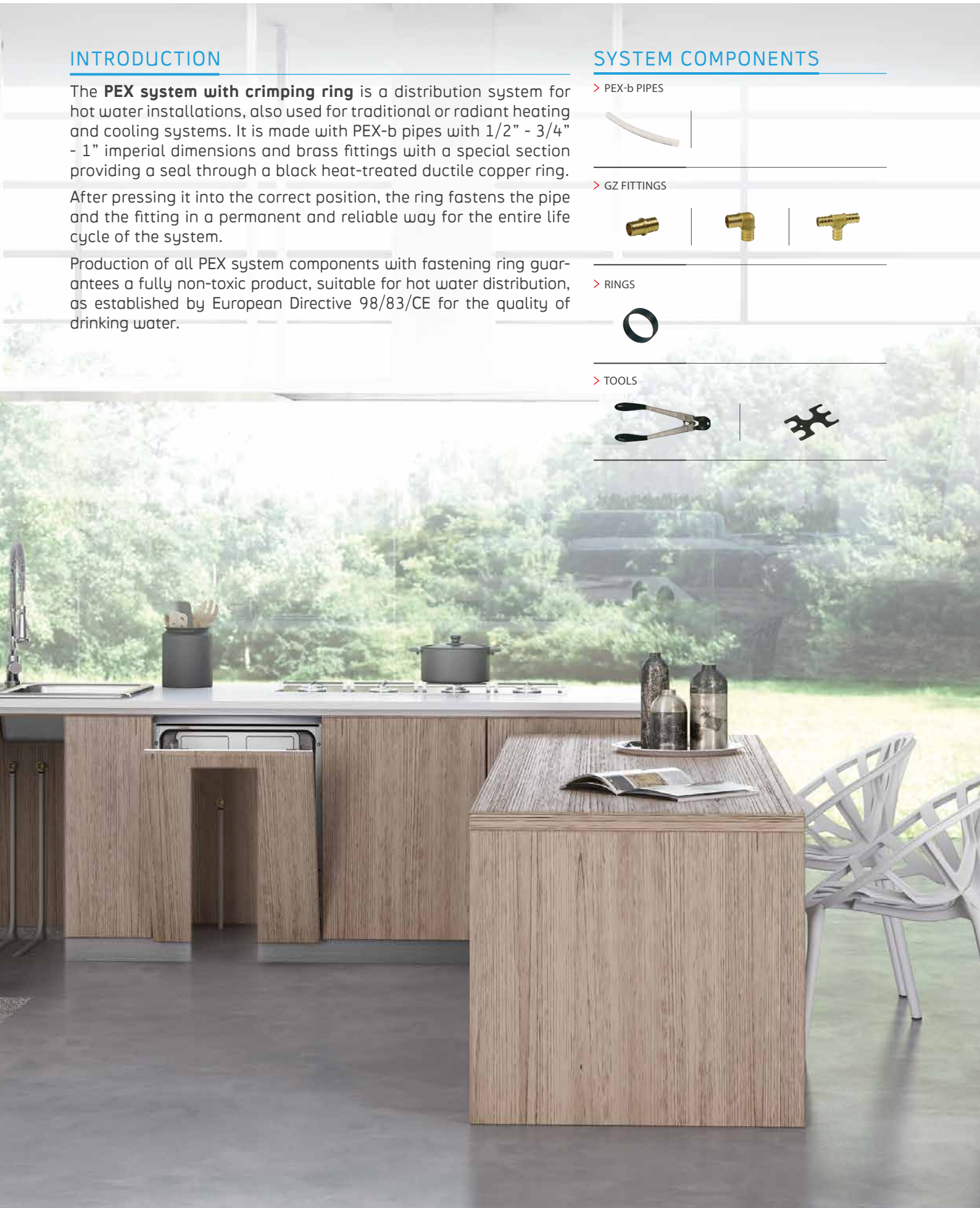
> GZ FITTINGS



> RINGS



> TOOLS



PEX SYSTEM WITH CRIMPING RING



COMPONENT CHARACTERISTICS

Copper rings

The special rings made with heat-treated ductile copper are black. The ring design has been engineered to facilitate insertion of the pipes. They also comply with the American standard ASTM F1807.

After pressing it into the correct position, the ring locks the pipe and the fitting permanently.



Fittings

The fittings are made of CW617N brass (CuZn40Pb2), in compliance with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4MS European initiative) so as to be used also in hot water systems. An O-ring-free section has been designed to guarantee the system pressure seal (for all classes and operation pressures in hot water systems).

The range of threaded fittings complies with the international standards: the male threads comply with the EN 10226 standard (formally ISO-7) while the female threads comply with EN ISO 228.



PEX-b pipes

The PEX system pipes with GZ996 fastening ring are made of PEX-b, as described in chapter 3. They are available in the 1/2" - 3/4" - 1" imperial sizes, always in neutral color, and provided in rolls or as 4-m bars. The pipes are sleeveless and must be sleeved or insulated if installed in-wall.

For more details on all characteristics of PEX-b pipes, see chapter 3.

Tools

The tools for the PEX system with fastening ring – the GZ200 manual crimping tool with GZ211 Go / No Go control matrix – enable a rapid and flexible connection of the elements of the entire range, thus minimizing potential errors.

INSTALLATION AND TESTING TECHNIQUES

To install the PEX system with fastening ring, proceed as described below:

1. Cut the pipe and fit the ring Cut the pipe at 90° from its axis, using the R990 pipe cutter and trying not to deform it (a wrong cut may affect the connection seal) (1.1). Manually fit the ring on the pipe (1.2 - 1.3).



2. Insert the fitting into the pipe, position the crimping tool and press Insert the fitting all the way into the pipe (2.1). Fit the ring at approx. 3-6 mm from the pipe end (2.2). To prevent the ring from moving, we recommend tightening it slightly with regular tongs. Position the GZ200 crimping tool so that the ring is fully covered by its jaws (2.3).



3. Check with the “Go/No Go” matrix Check the connection after completion using the GZ211 “Go/No Go” matrix (3.1). Insert the fitting into the corresponding matrix opening at 90° from the pipe axis:

- the ring must move smoothly through the “Go” opening, at any point of its diameter (with a possible exception for the deformed area on the ring caused by the jaw fastening the fitting). Do not force the ring inside the matrix (3.2)
- the ring must never go through the “No Go” matrix (3.3)

Should the connection not pass one of these two tests, cut the pipe, unfasten the fitting from the pipe piece and from the ring using the R990 pipe cutter, check the integrity of the fitting, replace the GZ61 ring and make a new connection.



4. Install the pipes The pipes of the PEX system with fastening ring enable the easy and rapid realization of the hydraulic systems.

A few simple precautions must be taken to install the pipes:

- connect the pipes using the special fittings
- do not expose the pipes to permanent mechanical stress. If necessary, install pipe curves
- if possible, do not install the pipes in-wall. If this is not feasible, make the fitting inspectionable or protect it from contact with construction materials and keep the trace of its position in the design files
- when storing and in exposed installations, always protect the pipes from ultraviolet rays

Always comply with the national and local laws and standards.

5. Pressure test After installing the pipes, pressurize the system to identify any possible fluid leaks (see chapter 5).

PPR WELDING SYSTEM

WHY CHOOSE IT?

- **very light** components
 - **sound-absorbing** and **thermally insulated**
 - pipes and fittings with **minimized surface roughness**
 - **simple and rapid installation**
- components complying with the **main standards** of reference

more details at
giacomini.com



INTRODUCTION

The **PPR welding system** (also known as Giacogreen) is made with polypropylene welding pipes and fittings. Its material technical characteristics make it the perfect solution for installations conveying drinking water, even when highly calcareous, for hot water systems.

Polypropylene (PP) is a versatile thermo-plastic polymer widely used in various industrial sectors: the variant obtained through random polymerization (also known as PPR) is used in the production of PPR welding system pipes and fittings.

Production of all the PPR welding system components guarantees a fully non-toxic product, suitable for sanitary water distribution, in compliance with European Directive 98/83/CE for the quality of drinking water.

SYSTEM COMPONENTS

> PPR PIPES



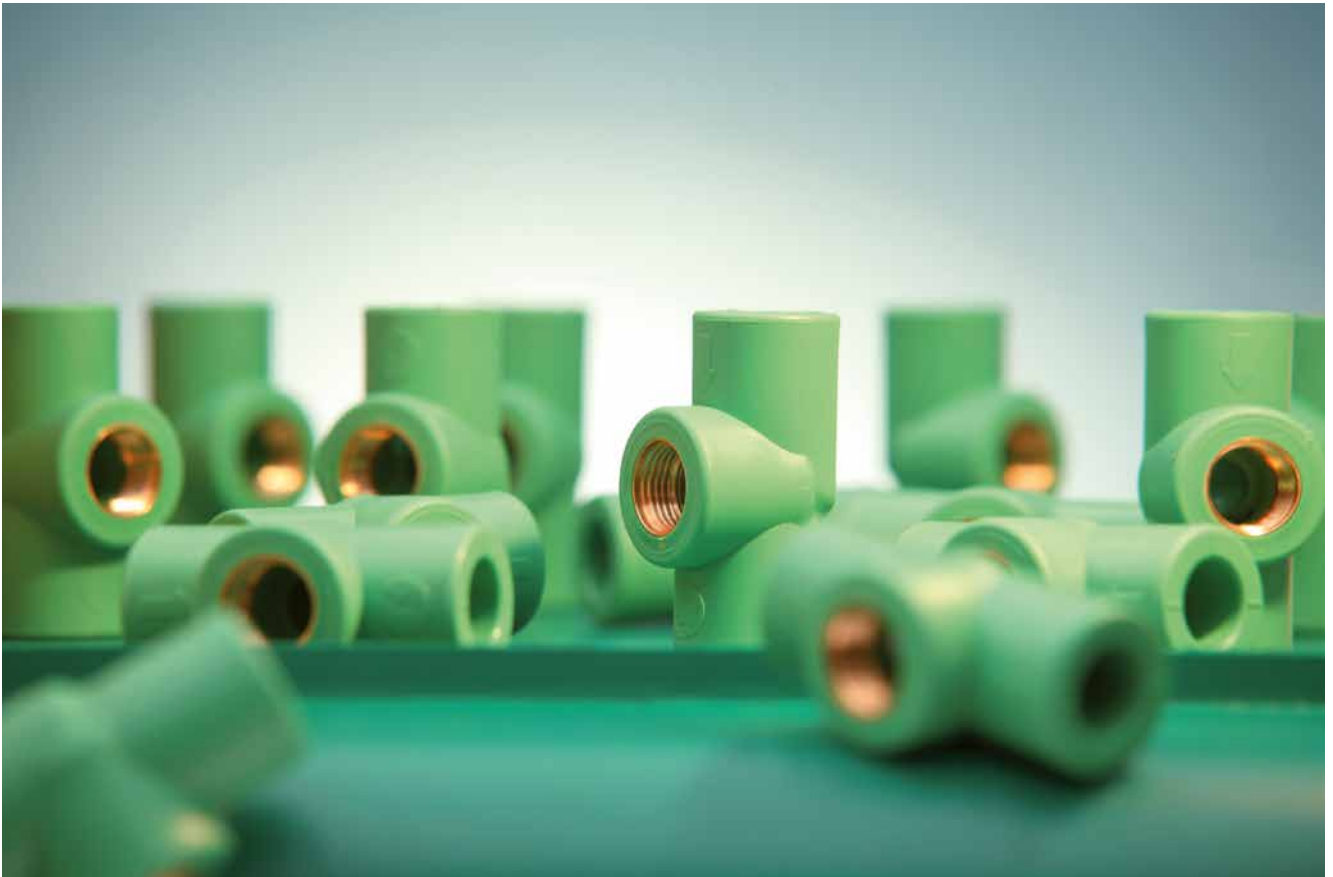
> PPR FITTINGS



> TOOLS



PPR WELDING SYSTEM



COMPONENT CHARACTERISTICS

Fittings and pipes

The PPR system pipes and fittings are made of PPR, as described in chapter 3.

Availability: pipes with 20 - 25 - 32 - 40 - 50 - 63 - 75 - 90 - 110 mm outside diameter.

The production of the PPR system polypropylene fittings is based on the injection molding technique.

The fittings used to connect the pipes or the sanitary devices are equipped with CW617N (CuZn40Pb2) brass inserts, in compliance with the EN12165 standard and the UBA list (according to DIN50930-6 and provided for by the 4MS European initiative) so as to be used also in hot water systems.

The threaded fitting range complies with the EN ISO 228 international standard.

Tools

The PPR welding system tools enable a rapid and flexible connection of the entire range, thus minimizing potential errors. They include two types of tools: the welding machine and the welder for electric sleeves (for welding in limited spaces and in positions that cannot be reached with the welding machine).



INSTALLATION AND TESTING TECHNIQUES

To weld the PPR system components with the H200 welding machine, proceed as described below:

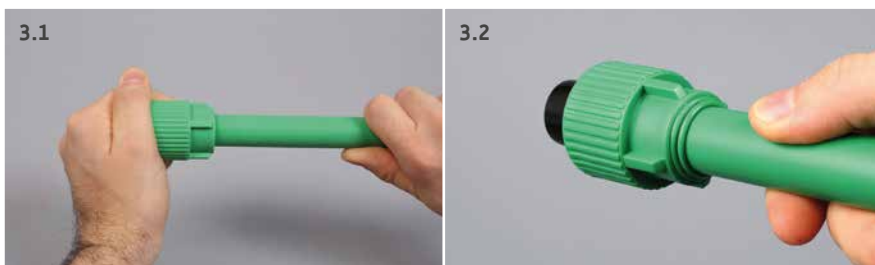
1. Cut the pipe, clean the pipe and fitting and set up the H200 welding machine Cut the pipe at 90° from its axis, using the H201 pipe cutter and making an effort to not deform it (1.1). Thoroughly clean the pipe and fitting surfaces to be welded to prevent extraneous particles (sand, dust, etc.) from affecting the welding and the quality of the connection (1.2). Fit the H200 welding machine with the bushes corresponding to the diameter of the pipe to be welded (1.3). Connect the welding machine to the electric power network and wait for the metal bushes to reach the correct welding temperature (255-270 °C): a green light will start blinking when the machine is ready.



2. Mark the pipe, insert the pipe and the fitting Mark the connection depth on the pipe with a pencil (2.1) while inserting the pipe and fitting on the bushes (2.2). When the fitting touches the male bush and the pipe inside the female bush reaches the marked limit, wait for the heating time indicated in the table for the corresponding diameters. Avoid turning both the pipe and fitting.

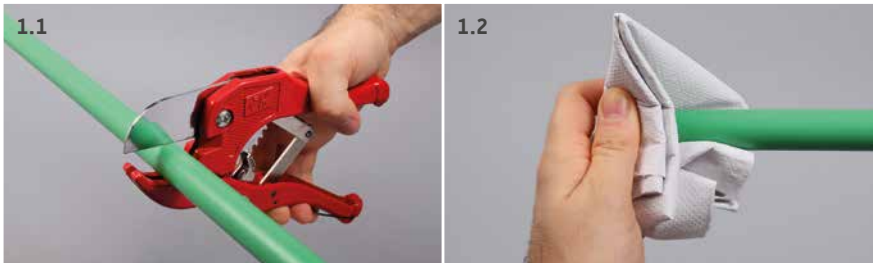


3. Remove the pipe and the fitting, then check the edge When the heating time is up, remove the pipe and the fitting and execute the coupling right away (3.1). Wait for the required time and do not make any changes. Alignment must be corrected right after coupling. Then check that the outermost weld bead is present all along the edge of the pipe (3.2). The pipe and fitting can undergo additional machining steps only after the cooling time is up.



For welding with electric sleeve and the H205 electric welding machine, proceed as described below:

1. Cut the pipe, clean the pipe and the fitting Cut the pipe at 90° to its axis using the H201 pipe cutter, trying to not deform it (1.1). Thoroughly clean the pipe surfaces to be welded to prevent extraneous particles (sand, dust, etc.) from affecting the quality of the connection (1.2).



2. Insert the pipes in the sleeve, turn on the H205 electro-welder and carry out the electric connection Insert the ends of the two pipes in the sleeve: the exact insertion depth is obtained by pushing the pipes all the way through (2.1). Move the electro-welder activation switch to "I" – the "ON" light will turn on. Carry out the electric connection with the welding sleeve – the "SLEEVE CONNECTED" light will turn ON (2.2).



3. Welding Push the "START WELDING" button – the "WELDING IN PROGRESS" light will turn ON. When the "WELDING COMPLETED" light turns ON (3.1) move the general switch to "0". The time required for welding is set automatically by the electro-welder. The welding completion is also indicated on the sleeve when the two yellow pins extend from their seat (3.2). When welding and cooling, we recommend applying mechanical stresses (flexing, twisting, pulling) to the connection for at least 20 minutes. After performing the final welding, wait at least one hour before pressurizing.



4. Install the pipe The PPR system pipes enable an extremely easy and rapid realization of the hydraulic systems. A few simple precautions are required for the installation:

- handle the pipe carefully and protect the system elements from possible accidents
- machine the pipe only with the special tools (pipe cutter, welding machine, electro-welder, etc.)
- follow welding instructions (heating and cooling time, etc.)

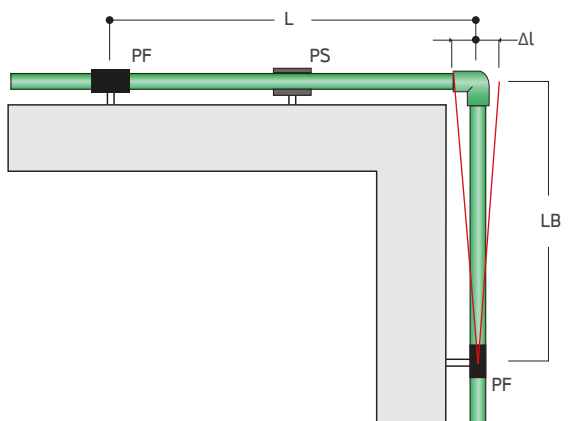
- perform, if needed, after assembly (max. 10°)
- let the product cool down according to the time indicated by the instructions before applying any mechanical stress
- keep the welding machine bushes clean
- install the pipes away from heat sources (boilers, heaters, open flames, etc.)
- clamp according to instructions
- do not discharge the dilations near connections containing metal inserts

When the pipes are used in outdoor exposed systems, follow these simple rules:

- pipes must be able to discharge radial and axial dilations generated by temperature changes
- always protect the pipes from ultraviolet rays which may affect their chemical-physical characteristics
- use fixed points, dilation outputs and sliding points to compensate
- use pipe fitting accessories to obtain a surface status suitable for correct operation without damaging the pipes (prevent scratches, perforations, etc.)
- plan and install the system in compliance with the indications given in the technical datasheet

Always comply with national and local laws and standards.

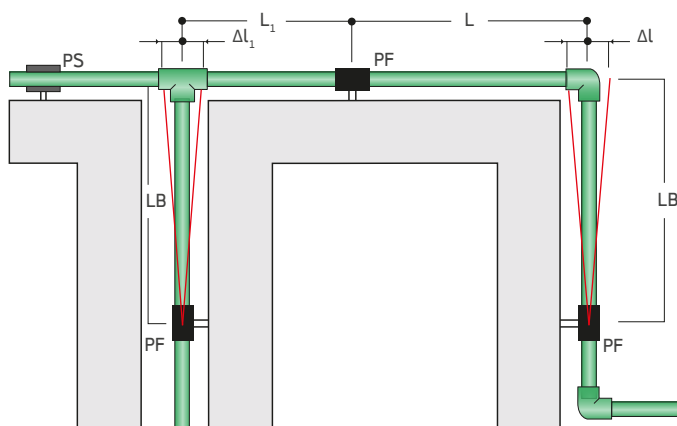
DIAGRAM A Simple direction change



- PF** Fixed point
- PS** Sliding bracket
- LB** Flexing arm length
- L** Pipe length
- ΔL** Dilation

fig. 4.15

DIAGRAM B Simple direction change and Tee branching



- PF** Fixed point
- PS** Sliding bracket
- LB** Flexing arm length
- L, L₁** Pipe length
- ΔL, ΔL₁** Dilation

fig. 4.16

DIAGRAM C U-SHAPED compensation when dilation cannot be offset with single shifts

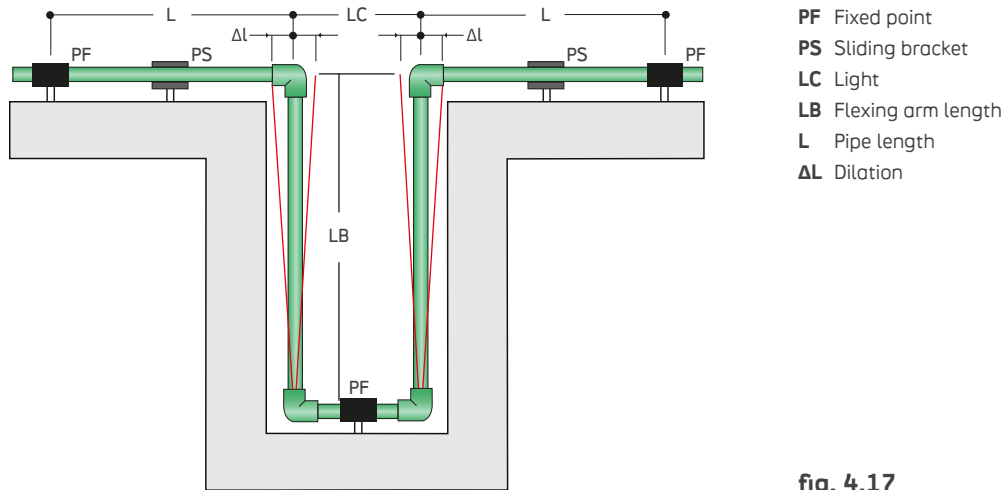


fig. 4.17

5. Pressure test After installing the pipes, perform a pressure test to promptly identify any fluid leaks (see chapter 5).

SYSTEM COMPONENTS



PPR pipes



PPR fittings



Welding machine



Electro-welder



Backflow preventers



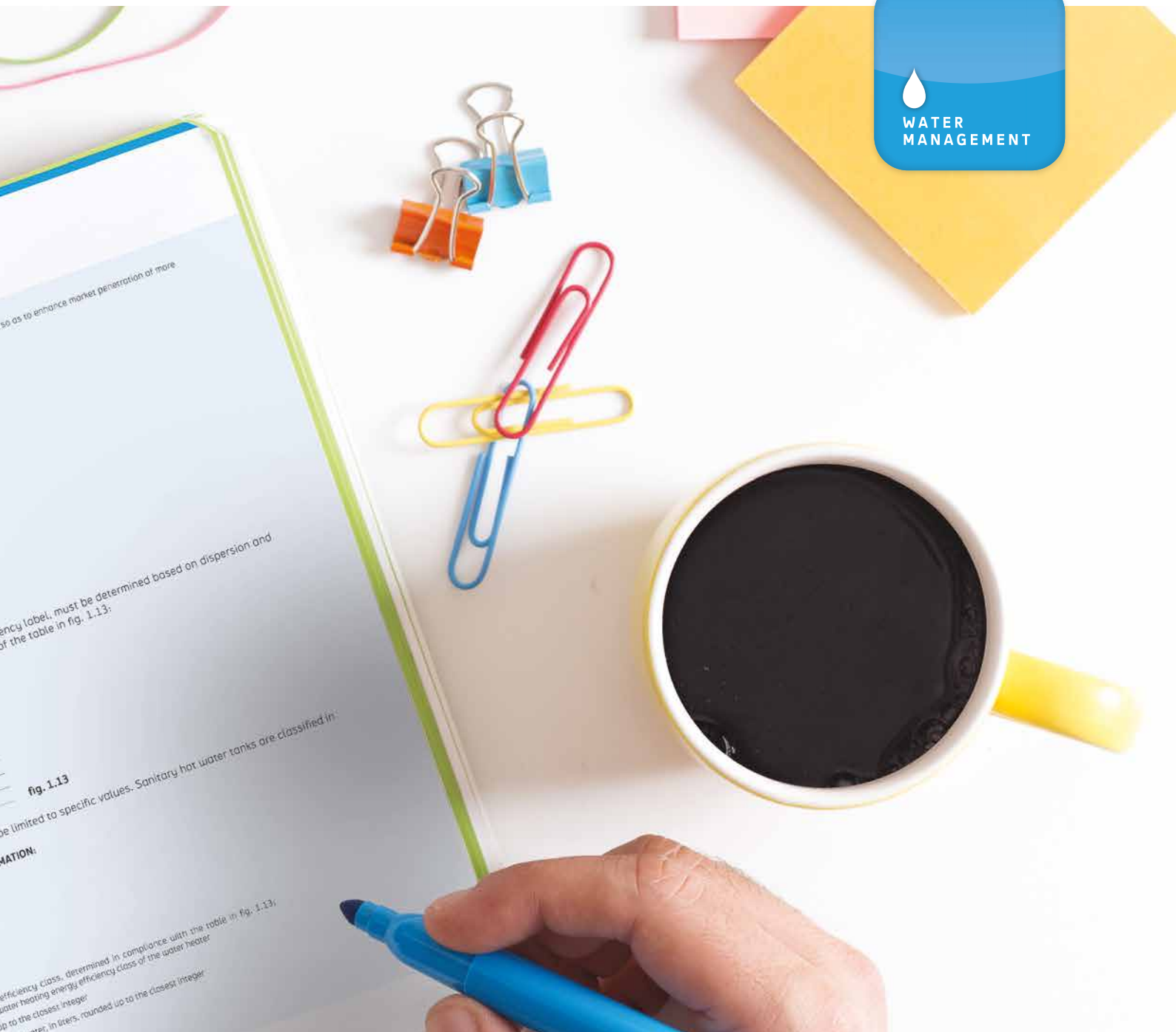
Pressure reducers



Thermostatic mixers



European requirements and recommendations for system planning, installation, modification and maintenance.



Chapter 5

In-depth analysis of technical aspects and standards

IN-DEPTH ANALYSIS OF TECHNICAL ASPECTS AND STANDARDS

EN 806 EUROPEAN DIRECTIVE SPECIFICATIONS FOR DRINKING WATER CONVEYING INDOOR SYSTEMS

The European standard EN 806 includes the requirements and recommendations for design, installation, modification, testing, maintenance and operation of new and existing systems for the distribution of drinking water inside buildings.

Drinking water must be fit for drinking and comply with relevant regulations based on the European Union Directives. Water may also be used to wash, cook and for hygiene purposes (up to 95 °C temperatures to take into account possible malfunctions).

Key points from European Regulation for pipes, accessories and equipment for the supply of drinking water can be split into 5 main chapters:

- > **Part 1:** General Information
- > **Part 2:** Design
- > **Part 3:** Pipe sizing – Simplified method
- > **Part 4:** Installation
- > **Part 5:** Operation and maintenance

The various parts of EN 806 are dedicated to engineers, architects, supervisors, contractors, installers, water distributors, consumers: they are also used to perform regulatory inspections on the systems.

The national standardization organizations of EU countries must acknowledge the EN 806 European Standard and confer it the status of national standard, either by publishing an identical text or by announcing its adoption. Any preexisting national standard in contrast with the European standard must be withdrawn.

Planning of drinking water systems must therefore comply with the EN 806-2 European standard along with any more stringent national completion standard; among these are, e.g.:

- Italy, *UNI 9182: 2014 – Hot and cold water supply and distribution systems - Planning, installation and testing*
- Germany, *DIN 1988-300: 2012-05 Technische Regeln für Trinkwasser-Installationen - Teil 300: Ermittlung der Rohrdurchmesser; Technische Regel des DVGW*
- France, *NF DTU 60.11 P1-1: 2013*

NOTE: products for use in water conveying systems must comply with regulations and provisions, if any, for the national tests ensuring suitability of contact with drinking water.

The competent government representatives of the Member States and European Commission agreed upon the principle of a **shared European Acceptance Scheme (EAS)**, providing tests and approval

systems which will be the same on a European level. If and when the EAS is adopted, the product European Regulations will be amended by adding a Z/EAS appendix within the M136 directive which will include formal references to tests and product certification/marketing requirements of EAS products. The current national regulations will continue to apply until the EAS becomes effective.

EN 806 - Part 1: General Information

With the EN 806 standard, the legislative body defines the main goals for realization of the systems, such as: prevent deterioration of water quality in the system; comply with the physical, chemical and microbiological quality standards at draw-off points; achieve the required water flow and pressure of devices, if any, at draw-off points and connection points; prevent damage to goods, including all components for the entire usable life expected and health hazards; minimize noise emissions level; prevent contamination of public water supply, excessive consumption, loss and misuse; functional maintenance.

In addition, the EN806 standard specifies and defines the competences of professional operators involved in drinking water distribution.

Design: the project must be planned by competent professionals of proven experience, qualification, who know the rules and safety requirements.

Installer: the construction, modification and maintenance works must be carried out by competent installers with the qualifications required by national or local regulations.

Water distributor: this entity must provide the data required for the system design and construction, such as supply pressure, flows and analyses of the water quality at the draw-off point.

User: the building owner/tenant is responsible for safe operation and maintenance of the drinking water system.

EN 806 - Part 2: Design

This part of the standard provides the main indications for engineering the drinking water system in terms of **technical performance**: prevent excessive speed, low flow rates and stagnation areas; prevent air trapping during supply and the formation of air bubbles during operation; minimize or eliminate **environmental impact** (prevent water waste, excessive consumption, misuse and contamination; do not cause health hazards nor disturbances to people and pets, nor damage buildings or the goods contained therein; minimize noise generation; prevent crusting, corrosion and deterioration; ensure **usability and maintenance**, i.e. prevent the local environment from affecting water quality; prevent cross-connections; facilitate access to the devices and the maintenance interventions therein).

It is essential for the planner to design the system in a way that minimizes water consumption and energy demands.

All materials, components and devices used to build drinking water systems must comply with the appropriate CEN product standards or with the European Technical Approval (ETA) guidelines whenever applicable. When existing, national rules and local regulations must be complied with.

Pressure and temperature

All system components must resist the test pressure established by national and local laws and regulations, equal to at least 1.5 times the maximum allowed working pressure. The system pressure must not exceed the working pressure of the components.

When required, supply pressure must be adjusted using pressure reducing valves.

Chapter 3 describes service conditions for plastic pipe systems (application class 1 for supply of hot water at 60 °C, application class 2 for supply of hot water at 70 °C – see Table in fig. 3.2). These systems must also be able to distribute cold water for 50 years, at 20 °C and at a Design Pressure of 10 bar.

The system operation temperature (read 30 s after opening a draw-off point) should not exceed 25 °C for cold water and should not be lower than 60 °C for hot centralized water systems.

The hot water system temperature, up to the system terminal points, should be able to be increased up to 70 °C for disinfection purposes; in case of failure, the system components and connected devices should be able to resist up to 95 °C.

Choosing the materials

The materials used for hot and cold drinking water systems should be selected based on different factors, such as: resistance to internal and external corrosion; compatibility between the various materials and their effect on water quality; internal water pressure; internal and external temperature; permeation; vibration, stress, settling phenomena; mechanical factors such as aging, fatigue, durability, etc.

Lead pipes and fittings should not be used because they are health hazards.

All connections used for drinking water must comply with the standards of reference. All connection methods must comply with the manufacturer's instructions or local regulations.

Pipe connections must feature permanent watertightness when exposed to alternate stresses during operation.

All connection methods are acceptable for copper and **copper alloy pipes and fittings**, i.e.: threaded joints, compression fittings, press fittings, quick-lock fittings, flanges and disassemblable tail pieces; threaded joints must have threads complying with EN 10226-1 and national standards and regulations.

All connection methods are acceptable for **PEX pipes and metal fittings**, i.e.: threaded joints, compression fittings, press fittings, quick-lock fittings, flanges and disassemblable tail pieces.

All connection methods accepted for PEX pipes apply also to **PEX/Al/PEX multilayer pipes** (not mentioned by EN 806-2, but mentioned by EN 806-4).

Pipes - Positioning, shut-off function

For the cases admitted by national or local standards and regulations, pipes may be concealed in walls, solid floors or beneath the first floor of a building only if they can be easily removed and replaced, using sheaths or cases, sleeves or special ducts.

The pipes cannot be installed in ducts or compartments still used for their original purpose, as fume ducts, ventilation ducts, elevator shafts, sewers.

Cold water pipes cannot be fitted along hot water or heating pipes, nor cross heated areas. If this cannot be avoided, hot and cold pipes must be completely insulated.

Supply and distribution pipes must be interceptable and drainable.

In multi-family buildings, the supply pipes on each floor and the pipes of single apartments must be interceptable separately.

Only stop valves not excessively obstructing the flow should be installed (for example, ball valves).

For easier maintenance, install a service valve at the inlet of the various devices (toilet bowls, accumulation tanks, water heaters, washing machines).

Differentiation and identification

All faucets should be identified: nowadays red is always used for hot water and blue for cold water. Hot water faucets must be installed on the left, cold water faucets on the right.

When multiple systems are installed in the same building, with both drinking and non-drinking water, all system components must be properly and permanently identified. Draw-off points for non-drinking water must be identified as "Non-drinking water" or with a 'Do not drink' sign shown on the right.



Hot water systems

Hot water systems must comply with national or local regulations to prevent the proliferation of legionella bacteria.

In addition, these systems must be constructed so as to reduce scalding risks at outlets, by installing thermostatic mixing valves with temperature limit switches. All components must be insulated to guarantee minimize energy and water consumption.

Protection against crossing flows of hot and cold water must comply with EN 1717.

Water meters

Installation of water meters inside and outside buildings must comply with EN 805 water service distributor guidelines.

Water meters must comply with Directive 75/33/CEE (b) for cold water and with Directive 79/830/CEE for hot water.

These devices must be installed horizontally or vertically in a way that facilitates access and maintenance.

Noise

In compliance with national or local regulations, hot water systems must be designed so as to generate the minimum noise possible. To install pipes, use fasteners or brackets that prevent direct contact with the structure and absorb vibrations.

Use expansion loops or suitable alternatives for long straight pipe sections to ease pipe movement.

Protecting the system from external temperatures for pipes, fittings and devices

All components of the drinking water distribution system must be protected from freezing and the influence of weather conditions by draining, insulating with linings resistant to atmospheric agents or through a local heating system combined with an anti-freeze thermostat. National or local provisions indicate minimum thickness of the thermal insulation materials to be used.

Cold water pipes must be properly protected from heat gain and condensation: the insulation requirements are the same as those applied to thermal dispersion.

Pressurization and pressure reducing valves

Pressurization systems can be installed in cases where the pressure required at all draw-off points cannot be provided under normal operation conditions (e.g., auxiliary pressurization pumps).

To curb energy consumption, use of such systems must be reduced to an absolute minimum, and the need must be demonstrated through a differentiated calculation.

Pressure reducers can be required to create systems with multiple pressure zones or when the static pressure at draw-off points exceeds 500 kPa or 5 bar. Pressure reducing valves should not be sized based on nominal pipe dimensions, but on the required flow rate.

They are generally installed inside the cold water pipe downstream of the water meter unit; for regulation and maintenance purposes, they must include a pressure plug and shut-off valves. To prevent backflow phenomena, a pipe section 5 times as long as the inside diameter must be installed as an outflow section on the valve's delivery side.

All regulation devices must protect the hot and cold water systems from bursting. In addition, they must be easy to access and properly identified to prevent erroneous regulations and improper replacements. Maintenance requirements must be clearly shown for the operator.

EN 806 - Part 3: Pipe sizing - Simplified method

Part 3 of standard EN 806 describes a calculation method for pipe sizing in drinking water systems, used both for hot and cold water.

This method, known as "simplified", complies with the European minimum standard and it is characterized by a series of limitations:

- > it applies only to "normalized" systems, that is systems with devices whose single-unit flow rates do not exceed those shown in Table 5.1, not destined for uninterrupted use of water (more than 15 minutes), with traditional simultaneous use, that is when the typical demand does not exceed the one shown by the simultaneity curve (see fig. 5.2)
- > it does not apply to buildings with dimensions much greater than average buildings
- > it does not take into consideration how pressure is distributed within the installation, the geodetic height, the device's losses of pressure, the minimum flow of each draw-off point
- > it determines the pipe diameters from the Tables based on the number of draw-off points and hot water devices connected
- > it does not size the hot water recirculations
- > it does not include pipe sizing for fire prevention systems

In brief, the simplified method can be applied to most residential buildings. The designer may however adopt a calculation method that is approved on a national level.

The simplified method does not apply to non-standardized systems (the so-called "special" systems) and to systems destined to buildings with dimensions much greater than the average: in such cases, sizing must be carried out by calculation methods specified and approved on a national level.

Definition of pressure load unit, draw-off flow rate and minimum flow

The Table below shows the draw-off flow rates Q_A , the minimum flow rates at draw-off points Q_{min} and the “pressure load units” for draw-off points.

draw-off point	Q_A	Q_{min}	pressure load unit
	[l/s]	[l/s]	UC
wash basin, bidet, flush tank	0.1	0.1	1
kitchen sink, domestic washing machine, dishwasher, hand shower	0.2	0.15	2
urinal	0.3	0.15	3
domestic bath tub	0.4	0.3	4
garden/garage faucets	0.5	0.4	5
DN20 non-domestic kitchen sink, non-domestic bath tub	0.8	0.8	8
DN20 drain	1.5	1	15

- 1 load unit (LU) is equal to the draw-off flow rate Q_A of 0.1 l/s
- the values in the Table are used only for pipe sizing purposes and do not correspond to the values contained in the product rules

fig. 5.1

Fig. 5.2 shows, based on the European standard EN 806, the project flow rate for normalized systems based on the total flow rate LU. Starting from the total LU value (the sum of the LUs of all devices), the simultaneity curve can be intercepted (one must choose the curve marked by the highest single LU value among the considered devices) and, proceeding horizontally, the project flow rate is identified.

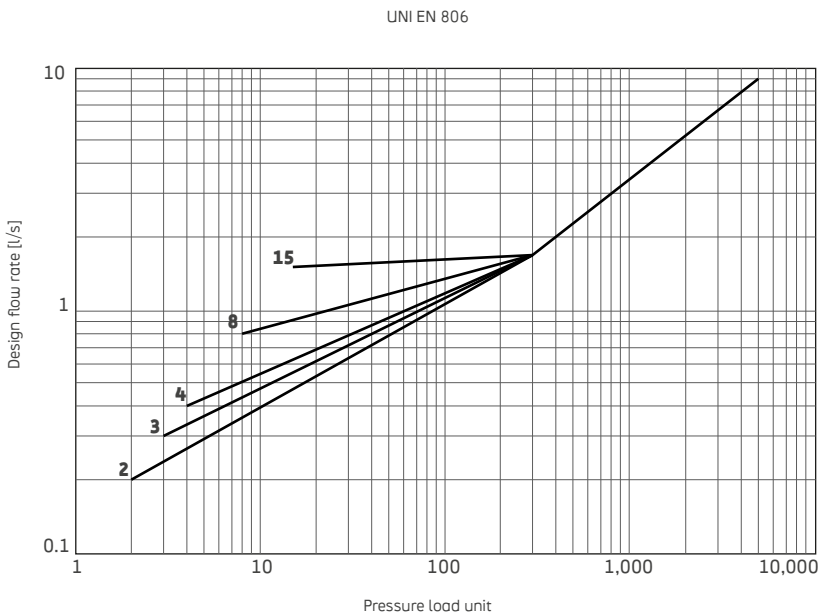


fig. 5.2

Pressure conditions and maximum flow speeds

Pressure conditions at draw-off points are:

- max. static pressure 500 kPa or 5 bar (1000 kPa or 10 bar for garden/garage faucets)
- min. dynamic pressure 100 kPa or 1 bar

The maximum flow speed admitted by the simplified calculation method is:

- 2.0 m/s for manifold pipes, foundation pillars, floor service pipes
- 4.0 m/s for pipes connected to draw-off points

NOTE: to prevent noise and water hammers, the national regulations can set lower speeds.

Load units to determine pipe diameters - Tables

There are 8 “Load units to determine pipe diameters” Tables based on the type of material selected by the designer: galvanized steel for hot plunging; copper; stainless steel; PEX; PB; PP; PVC-C; PEX/Al/PE-HD or PE-MD/Al/PE-HD. For materials not included here, use the Table with the most similar material and the riser with the same or most similar diameter.

These Tables indicate the pipe size.

The values provided consider a project flow rate Q_D , i.e. the usable flow rate for the purpose of hydraulic component sizing, which considers the most plausible maximum number of draw-off points active at the same time, based on the simultaneity criterion.

Here below are the Tables referred to pipes manufactured by Giacomini **PEX-b** (fig. 5.3), **random polypropylene PPR** (fig. 5.4) and **PEX/Al/PEX multilayer** (fig. 5.5) used in Giacomini systems, described in chapter 4, where d_{ext} is the pipe external diameter, d_{int} is the internal diameter and THK is the thickness.

PEX-b

max. load [LU]	1	2	3	4	5	8	16	35	100	350	700
highest value [LU]					4	5	8				
$d_{ext} \times s$ [mm]	12 x 1.7		16 x 2.2			20 x 2.8	25 x 3.5	32 x 4.4	40 x 5.5	50 x 6.9	63 x 8.6
d_{int} [mm]	8.4		11.6			14.4	18.0	23.2	29	36.2	45.6
pipe max. length [m]	13	4	9	5	4						

fig. 5.3

PPR

max. load [LU]	1	2	3	3	4	6	13	30	70	200	540	970
highest value [LU]			2			4	5	8				
$d_{ext} \times s$ [mm]	16 x 2.7			20 x 3.4			25 x 4.2	32 x 5.4	40 x 6.7	50 x 8.4	63 x 10.5	75 x 12.5
d_{int} [mm]	10.6			13.2			16.6	21.2	26.6	33.2	42	50
pipe max. length [m]	20	12	8	15	9	7						

fig. 5.4

PEX/AL/PE-HD - PE-MD/AL/PE-HD

max. load [LU]	3	4	5	6	10	20	55	180	540	1300
highest value [LU]			4	5	5	8				
d _{est} x s [mm]	16 x 2.25 / 16 x 2.0			18 x 2	20 x 2.5	26 x 3	32 x 3	40 x 3.5	50 x 4	63 x 4.5
d _{int} [mm]	11.5 / 12.0			14	15	20	26	33	42	54
pipe max. length [m]	9	5	4							

fig. 5.5

Application of the simplified pipe sizing method – Practical example

For pipe sizing, follow this approach: starting from the farthest draw-off point, determine the load units of each system section and then sum them up. By defining the max. load of each section as described above, the pipe diameter can be identified from the corresponding Table “Load units to determine pipe diameters”, based on the material selected.

The probability of simultaneity has already been taken into account based on the aforesaid Tables.

As a practical example we will consider a building with a basement and 4 apartment floors above ground (fig. 5.6).

Each apartment features the following draw-off points, characterized by the corresponding load units LU:

- 1 domestic kitchen sink 2 LU
- 1 domestic bath tub 4 LU
- 1 wash basin 1 LU
- 1 WC flush tank 1 LU

The pipe material selected by the planner is PEX/AL/PEX multilayer.

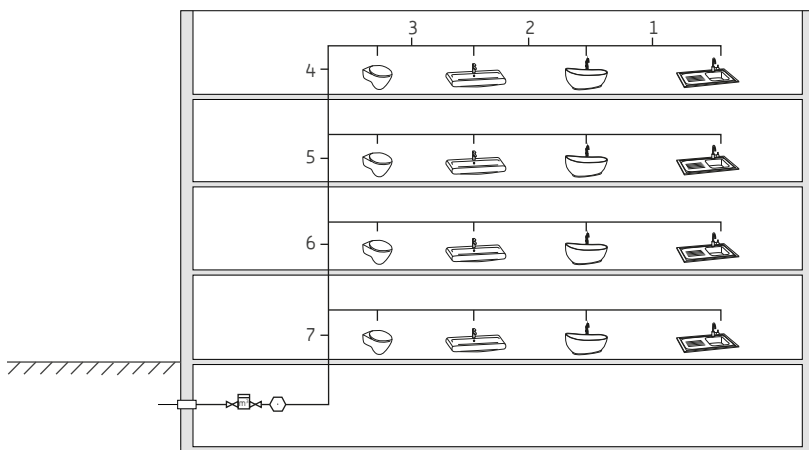


fig. 5.6

Starting from the end of the 4th floor pipes, add the load units for each section of the system. Based on the total load of each section, one can determine the pipe diameters using the PEX/Al/PEX multilayer pipe Table.

pipes	draw-off points connected and corresponding Load units	UC total	diameter [mm.] (based on Table in fig. 5.5)
section 1	1 domestic kitchen sink (2)	2	16x2
section 2	1 domestic kitchen sink (2) 1 domestic bath tub (4)	6	18x2
section 3	1 domestic kitchen sink (2) 1 domestic bath tub (4) 1 wash basin (1)	7	20x2
section 4	1 domestic kitchen sink (2) 1 domestic bath tub (4) 1 wash basin (1) 1 WC flush tank (1) = total for each apartment (8)	8	20x2
section 5	2 apartments	16	26x3
section 6	3 apartments	24	32x3
section 7	4 apartments	32	32x3

fig. 5.7

Acknowledgement of EN 806-3 by the European Member States

France - NF EN 806-3 and NF DTU 60.11 P1-1

The NF EN 806-3 standard represents the transposition of the EN 806-3 European standard into the French framework. The NF DTU 60.11 P1-1 document of August 2013 defines the rules established for the French market, characterized by more detailed specifications compared to the European standard.

This document offers two sizing methods, a general and a simplified one, for hot and cold water distribution pipes for installations inside residential or office buildings.

The static pressure must be lower than 4 bar at the faucet. If required, pressure reducers must be installed. For multi-family buildings, the system must be planned for a minimum pressure of 1 bar at the inlet of each dwelling.

For the general method, the speed required to calculate the diameters is 2 m/s for basement, loose stone foundation or boiler room pipes, and 1.5 m/s for the risers.

The values set are min. flow rate at the faucet outlet for hot, cold and mixed water (in l/s) and the minimum internal diameters (in mm) for the supply pipes of single devices.

A coefficient is assigned to each single device and the sum of the coefficients makes it possible to determine the minimum pipe diameter through a diagram.

The simplified method can be used only for installations complying with the limited flow rate criteria (based on a specific Table of the general method) and destined to uninterrupted water use (exceeding 15 minutes).

In short, the method points out EN 806-3 provisions, with two main differences: pipe dimensions are those used in France and the NF EN 806-3 Tables have been amended so as to allow a speed of 2 m/s instead of 4 m/s for pipes connected to the draw-off points.

Below are the load unit Tables to identify the pipe diameters, where d_{ext} is the pipe external diameter, d_{int} is the internal diameter and THK is the thickness:

PEX and PB pipes

max. load [LU]	1	3	4	6	13	25	55	180	500
highest value [LU]	-	-	3	3	4	5	8	-	-
d_{ext} x THK [mm]	12 x 1.1	16 x 1.5			20 x 1.9	25 x 2.3	32 x 3	40 x 3.7	50 x 4.6
d_{int} [mm]	9.8	13.0			16.2	20.4	26	32.6	40.8
pipe max. length [m]	20	15	9	7	-	-	-	-	-

fig. 5.8

multilayer pipe

max. load [LU]	3	4	5	6	10	20	55	180	540
highest value [LU]	2	2	2	3	4	5	8	-	-
d_{ext} x THK [mm]	16 x 2.25 / 16 x 2.0			18 x 2	20 x 2.5	26 x 3	32 x 3	40 x 3.5	50 x 4
d_{int} [mm]	11.5 / 12.0			14	15	20	26	33	42
pipe max. length [m]	9	5	4	-	-	-	-	-	-

fig. 5.9

Germany - DIN EN 806-3 and DIN 1988-300

The DIN 1988-300 standard of 2012 is the national standard used for pipe sizing of drinking water networks, which actually replaces the EN 806-3 European Standard, considered insufficient by Germany.

It provides two calculation methods, different for hot and cold water pipe sizing: the simplified method and the detailed method.

The simplified method, based on the EN 806-3 European minimum standard, applies only to basic installations (buildings with a maximum of 6 house units, where the pressure is quite high and hygiene is guaranteed). The detailed method must be applied to all other cases.

For the detailed method, the pipe sizing calculation aims at obtaining a minimum pressure at collection point with the most unfavorable position of the installation, when peak flow is reached. For such purpose, the first step is to determine maximum pressure loss allowed between the most unfavored outlet and the flow meter (or connection to the network), taking into consideration the draw-off point itself and the components included in this section (such as curves, T-shaped joints, that is all elements causing localized losses of pressure).

Then, this value should be divided by the pipe length between these two points to obtain a value for the maximum pressure loss allowed per linear meter of pipe. Finally, choose a pipe diameter where the pressure loss does not exceed the value previously calculated upon peak flow.

It is a very specific method requiring multiple data: generally, a specialized software used as support is extremely helpful.

With this last version of DIN 1988-300, the pipe diameter can be reduced by one or multiple sizes.

A hot or cold sanitary water pipe with an excessive diameter provides longer availability times and greater consumption compared to pipes of smaller diameters. This affects not only users' comfort, but also the cost of the system and the efficiency of distribution of hot water distribution.

In other words, we recommend using the smallest pipe diameters possible which can satisfy every need (min. flow rate, max. speed allowed).

Italy - UNI EN 806-3 and UNI 9182

As for Italy, from a standard standpoint, the calculation criteria for pipe sizing in hydro-sanitary networks are specified by UNI 9182:2014. Specifically, its text describes two possible sizing methods: the simplified method and the detailed method.

The simplified method refers to use of the method contained in the UNI EN 806-3 European standard.

The detailed method to calculate pipe diameters, as for the simplified method, starts by indicating the load unit LU for each collection point and calculating the sum of the load units LU, section by section, proceeding from the most unfavored draw-off point up to the supply point.

Based on the type of draw-off point, one must use the Tables referred to residential draw-off points or public and collective building draw-off points.

UNI 9182. Table of UCs for residential houses

draw-off point	LU cold water	LU hot water	LU total SCW + SHW
wash basin, bidet	0.75	0.75	1.00
bath tub, shower, kitchen sink	1.50	1.50	2.00
washing machine, dishwasher	2.00	-	2.00
flush tank	3.00	-	3.00

fig. 5.10

For calculation purposes, the maximum speed admitted is:

- 2.0 m/ for primary distribution, risers, floor distribution pipes
- 4.0 m/s for the abduction line to the single draw-off point

Therefore, the losses of pressure must be calculated from the supply point to the most unfavored user device, also based on water temperatures.

The sum of:

- dynamic pressure of the most unfavored user
- height difference between the most unfavored user and the supply point
- calculated losses of pressure

must be equal to or smaller than the minimum pressure value available at the supply point.

Calculate the pressure values determined in the terminal sections under minimum flow conditions, that is the flow rate corresponding only to the above-mentioned sections.

Make sure that under the conditions defined above, the speed in these sections does not exceed the provided values; should this happen, increase the diameters to restore regular values.

There are differences in the results obtained with the simplified method and the detailed method. The project flow rates calculated through the detailed method of the UNI 9182:2014 standard are definitely higher: such values are excessively conservative and lead to oversizing.

Referring to the cited example (simplified method, EN 806-3 standard, see page 105), the Table below shows the minimum internal diameters of multilayer pipes, calculated by the detailed method compared to multilayer pipes previously selected.

pipes	min. Inside diameter [mm]	multilayer pipes [mm]	
		detailed method	simplified method
part 1	7.98	16x2.0	16x2.0
part 2	13.82	18x2.0	18x2.0
part 3	13.82	18x2.0	20x2.0
part 4	14.93	20x2.0	20x2.0
part 5	20.35	32x3.0	26x3.0
part 6	24.60	32x3.0	32x3.0
part 7	27.65	40x3.5	32x3.0

fig. 5.11

EN 806 - Part 4: Installation

This part of the standard specifies the requirements and provides recommendations for the installation of drinking water systems.

Commissioning: pipe requirements and recommendations

The standard indicates application methods for system commissioning, to guarantee the system compliance with long-term safety, efficiency and environmental protection requirements:

- > all system components must be protected, handled and stored in compliance with the manufacturer's instructions to prevent damages and contaminations
- > upon pipe installation, all unconnected ends must be sealed with caps, plugs or blind flanges (for this purpose, stop valves in closed position are not considered as "sealing")

- > pipes must be bent with special tools, making an effort to prevent wrinkling, corrugations or narrowing
- > in case of long straight sections, the pipes must be free to expand and contract through dilation compensators, expansion joints or changes of direction
- > pipes must be installed so as to prevent the formation of air bubbles. Draining points must be provided in the lowest points of the system. To prevent freezing damages, pipes must be drained, insulated or heated locally
- > in case of overlapping installation of hot and cold water pipes, the hot water pipe must be placed on top of the other
- > in-wall pipes must be properly sleeved and/or insulated. In compliance with the national regulations, access to specific connections must be guaranteed for maintenance and inspection
- > plastic pipes inside sleeves must be installed with a bending radius of at least 8 times the external pipe diameter; we recommend fitting a sleeve at the floor or wall outlet
- > pipes crossing walls or floors must be sleeved, without affecting the integrity of the structural elements and fire prevention barriers
- > in general, systems must minimize noise levels. For such purpose, pipes must be installed away from joints, beams, floor planks and other pipes: if this is unfeasible, insulation panels must be installed between the pipe and the structure
- > pipe supports or brackets must guarantee permanent fitting to the structure and should not be installed to fit other components. For plastic pipes, special plastic or metal collars are required, leaving some space for axial movement within the clips which are not anchoring points. The distance between supports must comply with manufacturer's instructions or with national regulations or, if these fail, with appendix B and C of the standard
- > pipes unions must be made according to manufacturer's instructions and related standards, and preventive internal cleaning must be carried out on pipes and fittings. All connections must be permanently sealed and covered with insulation only after the pressure test is done (except when access is required by national regulations). The standard also refers to tables with connection methods to be used based on the types of materials for pipes and joints, as already specified by part 2, and the table for multilayer pipes (identical to the PEX pipes Table) is added
- > plastic pipes must not be connected directly to boilers and instantaneous water heaters as their safety devices allow for overtemperatures higher than 95 °C (< 10 s) and overpressures higher than the max. design pressure (MDP) (< 10 %)
- > valves and faucets must be installed in compliance with EN 806-2 - Planning, in compliance with EN 1717 and national regulations, so as to prevent water stagnation and with access guaranteed for maintenance and service interventions

- > pipes and delivery valves must show the performed service, with exceptions made for single-family houses
- > the use of different metals in drinking water systems must comply with the provisions of the relevant standards. Differences of electrochemical potential may generate galvanic corrosion under specific circumstances. For example, copper, as a noble metal, may corrode galvanized steel: in this case, galvanized steel products (hot-dip galvanizing) must be installed upstream of copper elements, in other words water must flow from the galvanized steel towards copper and direct contact between the galvanized steel and copper components must be avoided, e.g. by placing brass or bronze fittings in between. Copper, copper alloys and stainless steel can be used together without significant galvanic corrosions as their electrochemical potential differs only for a minimum part. In such case, use of copper alloy valves in water distribution systems is not considered critical, as they feature a relatively limited surface
- > when installing water distribution systems, one must trace a map of the pipe layouts and the position of the various components. Upon completion, this report will represent a long-lasting document of the system “as is on site” and must be delivered to the building owner

Commissioning

Filling and hydraulic test

Drinking water systems must be filled only with drinking water free of particles larger than 150 µm: to guarantee the above requirement, mechanic filters complying with EN 13443-1 must be included.

For hydraulic testing, all parameters must be recorded and saved, including the complete procedure diagram. The gauges and recording device must be installed in the lowest point of the system, they must have a size interval between 0 and 1.6 MPa and accuracy up to 0.02 MPa bar.

The test pressure is equal to the MDP increased by 10 % ($TP = 1.1 \times MDP$), while maximum pressure climbing speed is calculated based on the nominal pressure.

NOTE FOR PLASTIC PIPES:

- the specific properties of the plastic material make large pressurized plastic pipes expand for a limited time: this may affect the hydraulic test. For such reason, the hydraulic test of large plastic pipes differs from that of metal pipes
- based on the same specific properties of the material, temperature variations in the system may cause pressure variations for elastic (multilayer, PVC, etc.) and viscoelastic (PEX, PP, etc.) pipes. Thus, for balancing temperatures exceeding 25 °C, the test pressure must be calculated by applying a reduction factor f_T based on the material used, provided by the system manufacturer ($TP = 1.1 \times f_T \times MDP$). For the entire test duration, water must be maintained at a constant temperature for as long as possible

There are three hydraulic test procedures, based on the pipe material and diameter:

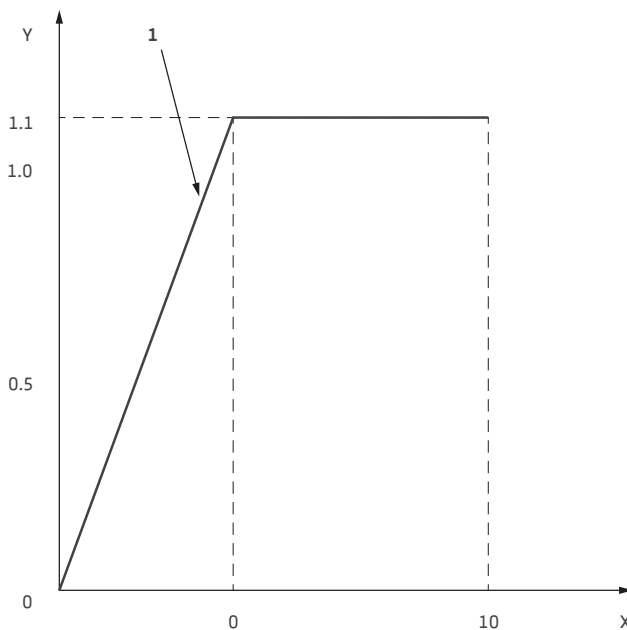
type of material	hydraulic testing procedure
metal materials	A
multilayer materials	A
PEX and PP materials, with ND or ED ≤ 63	A
PEX and PP materials, with ND or ED > 63	B o C
combined system, with ND or ED ≤ 63	A
combined system, with ND or ED > 63	B o C

fig. 5.12

where ND is the nominal diameter and ED is the external diameter.

HYDRAULIC TEST PROCEDURE A

Fill the system with water, based on fig. 5.13, respecting the maximum climbing speed for the water pressure and removing air up to reaching the test pressure, then seal all air vents and discharge valves.



1 Pumping
 X Time, in minutes
 Y Test pressure/MDP

fig. 5.13

Wait 10 minutes; the pressure must remain constant for this time interval ($\Delta p = 0$).

In case of pressure loss, the system must be kept under test pressure until leaks are identified.

HYDRAULIC TEST PROCEDURE B

Fill the system with water, as per test procedure A. Apply test pressure through pumping, according to fig. 5.14, for 30 minutes.

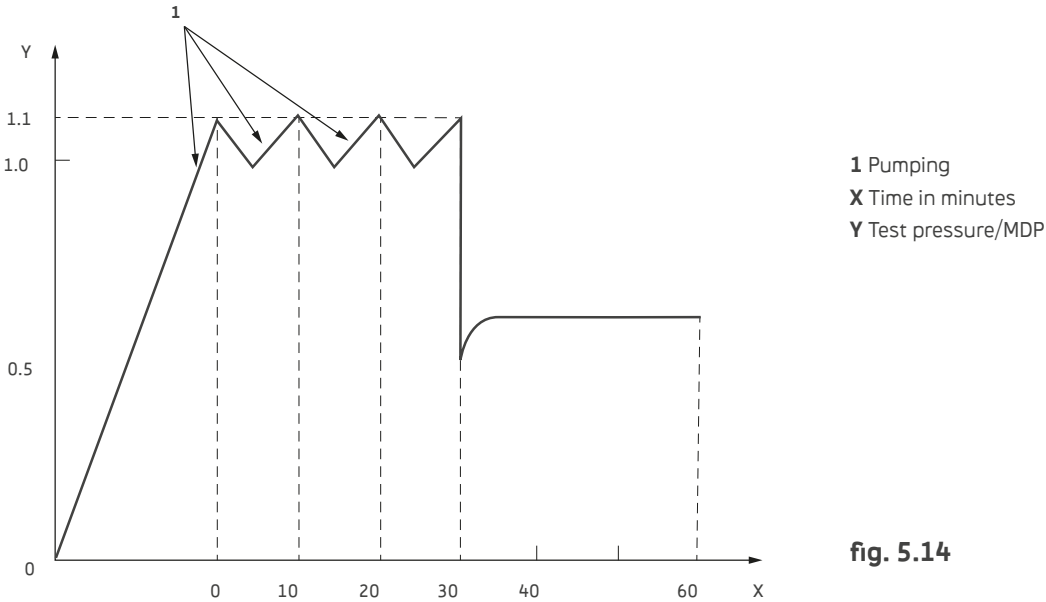


fig. 5.14

Inspect the system to identify any evident leaks. Decrease the system pressure by purging the water at 0.5 times the MDP, then wait 30 minutes. The pressure must remain constant during this period ($\Delta p = 0$). Check visually for any leaks.

TEST PROCEDURE C

Fill the system with water, as per test procedure A.

Apply test pressure by pumping, according to fig. 5.15, for 30 minutes. Inspect the system to identify any evident leaks and record the pressure.

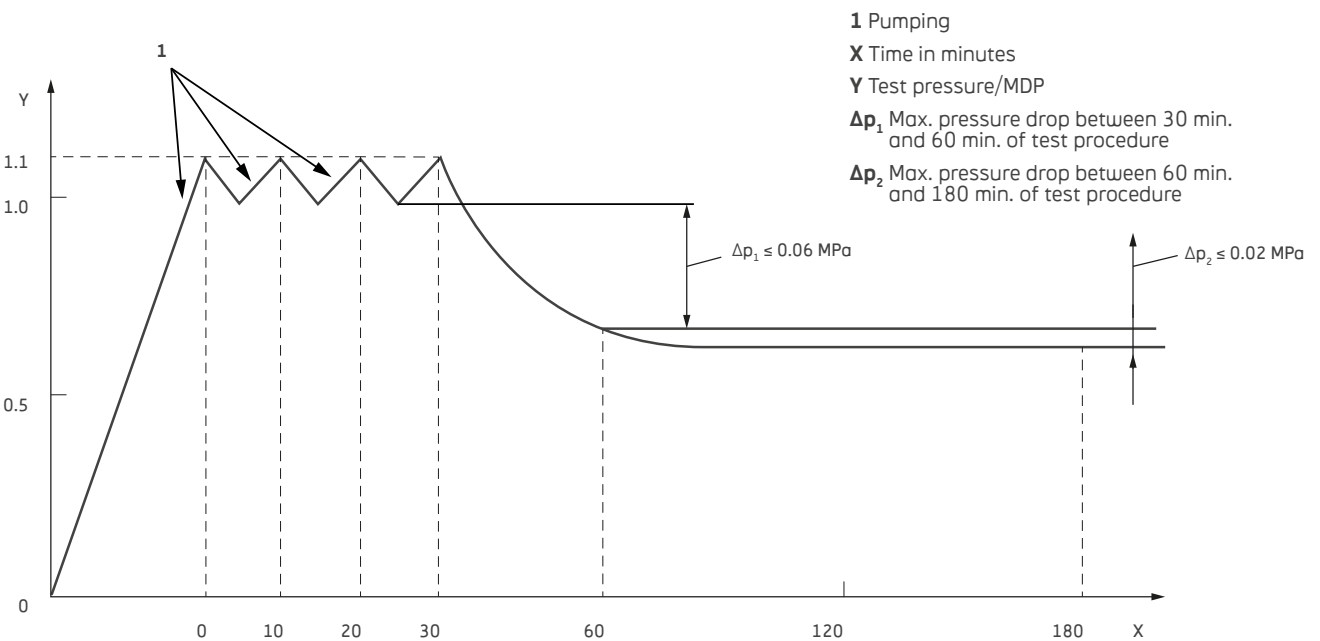


fig. 5.15

Wait for another 30 minutes and record the pressure. If the pressure loss is lower than 0.06 MPa, the system can be considered free of evident leaks.

Proceed with the test without pumping and wait for other 120 minutes.

If the pressure drops by more than 0.02 MPa or 0.2 bar, there is a leak inside the system. Maintain pressure and identify the leak.

Fluxing

The drinking water system must be fluxed right after pressure testing and right before commissioning. If the system is not used right after commissioning, it must be fluxed at regular intervals (up to every 7 days).

This requires drinking water free of particles larger than 150 µm (by using mechanical filters in compliance with EN 13443-1 to protect sensitive components and devices) or a water-air mixture.

The entire procedure must be reported completely (with hot and cold water pipes fluxed separately) and delivered to the building owner.

The system must be fluxed by section, based on its dimensions and layout, starting from the lowest floor and proceeding gradually up. All service valves installed in the section to be fluxed must be completely open. Aerators, flow filters, flow controllers, shower nozzles installed with pre-set valves must be removed to increase the flow.

On each floor, starting from the farthest point from the riser, open the draw-off points completely and perform water exchange for at least 20 times, with a minimum speed of 2 m/s.

The filters installed upstream of the valves or system, that cannot be replaced after fluxing, must be counter-flushed or renewed.

For single-family houses, small extensions or modifications on any property, the fluxing procedure is enough to use the drinking water system. If required by the competent authorities, the system must also be disinfected.

Disinfection

Disinfection of drinking water systems required by competent authorities must be performed by specialized personnel with proper qualifications and in compliance with national or local regulations.

Make sure no water is collected during the entire procedure. The system must be broken down into sections based on its dimensions.

After disinfection, the system must be promptly drained and thoroughly fluxed with drinking water, in compliance with the disinfectant manufacturer's instructions/recommendations (the external chemical agent must be absent or below the level established by national laws).

Then, samples must be collected for the bacteriological analyses.

The type of disinfectants to be used depends on multiple factors. All chemical substances used for disinfection of drinking water systems must comply with the related requirements, as established by the European and national standards. The disinfectant application and use must be carried out in compliance with the pertinent EU Directives and all local or national laws.

If the water used for disinfection must be drained in a drainage or sewerage system, the competent organization must be notified and its approval given before proceeding with the drainage. Neutralizing agents are available on request.

The entire procedure and the test results must be reported in detail and delivered to the building owner.

EN 806 - Part 5: Operation and maintenance

The systems must be operated and undergo maintenance to prevent any negative influence on the quality of the drinking water, its distribution to the users and the equipment of water distributors.

For proper operation and maintenance, information related to the system (product technical information and manufacturer's instructions, commissioning report, and periodical maintenance records) must be promptly available.

Responsibility for system operation, inspection and maintenance is subject to local and national requirements.

Operation

The system must be operated according to the conditions of the original project.

The systems and devices must be tested so as to ensure their operation reliability.

If not specified otherwise by the related operational instructions, comply with the general conditions below:

- > stop valves and service valves must be always fully opened or closed and activated on a regular basis to ensure their operation
- > all spare parts, preferably from the original manufacturer, must be promptly available and suitable for the purpose
- > connection of the devices may affect the quality of water and must be carried out by qualified personnel
- > connection of devices (e.g. washing machine and dishwasher) must be properly protected against reflux in compliance with EN 1717
- > flexible pipes (such as gardening hoses) must be connected only to dedicated draw-off points, specifically designed for such purpose and provided with anti-reflux protection

- > system parts used more rarely and containing water (e.g. pipes connected to guest rooms, garages or basement connections) must be fluxed on a regular basis
- > check water temperature inside pipes, cold water tanks, hot water accumulation tanks and faucet discharge to ensure it complies with the limits of part 2 of the standard
- > by applying the local and national regulations, pay special attention to operation and maintenance of safety and protection devices in addition to the position of the stop valves

Operation interruptions and supply resumption

Systems not activated within 7 days after completion, or left out of service for more than 7 days, must be disconnected at the supply stop valve and drained; as an alternative, flux the water on a regular basis.

Connection pipes not commissioned right after completion, or which must be temporarily disconnected or not used for a year, must be disconnected from the water supply network.

Systems that have been temporarily disconnected and drained must be thoroughly fluxed based on a special procedure before restoring operation.

In case of extended absence, to prevent potential damages caused by water and water leaks, the standard requires insulating the system at the supply stop valve in residential units or on the inlet pipe of the apartment.

In general, following an operation interruption, the stagnating water flows out by simply opening completely the single draw-off point fittings for a short time (approx. 5 minutes).

Damages and failures

Damages and failures of the system may pollute the water or affect its qualities (smell, taste, color): the system must be connected at the service stop valve and the water distribution company should be promptly notified.

In case of stagnation, with non-complying water temperatures, there is a higher risk of bacterial proliferation bacteria (*Legionella*). Corrective measures must be taken.

Maintenance

Systems must be inspected on a regular basis to check safety and performance. Adequate procedures must be adopted to maintain system performance on the level specified by EN 806-2, EN 1717 and by the single product standards.

Procedures and frequency of ordinary maintenance must comply with the manufacturer's instructions. If applicable, national requirements must also be complied with.

Here below are inspection and maintenance information for the system components:

system component and unit	reference document	inspection	ordinary maintenance
water heating device	EN 12897	every 2 months	once a year
hot water meter	MID ⁽¹⁾	once a year	every 5 years
cold water meter	MID ⁽¹⁾	once a year	every 6 years
filter (< 80 µm)	EN 13443-2	every 6 months	every 6 years
filter, without counter-flow fluxing (from 80 µm to 150 µm)	EN 13443-1	every 6 months	every 6 months
hydraulic safety group	EN 1487	every 6 months	once a year
pressure limit / pressure reducer valves	EN 1567	once a year	once a year
vacuum breaker with controllable reduced pressure (BA)	EN 12729	every 6 months	once a year
vacuum breaker with uncontrollable multiple pressure zones (BA)	EN 14367	every 6 months	once a year
pipes	EN 806-2 and EN 806-4	once a year	once a year
controllable anti-pollution check valve (EA)	EN 13959	once a year	once a year
safety valve	EN 1489	every 6 months	every 6 months

⁽¹⁾ Directive 2004/22/CE of the European Parliament and Council of 31 March 2004 on measuring instruments (MID)

fig. 5.16

EN 1717 – PROTECTION AGAINST POLLUTION OF DRINKING WATER IN HYDRAULIC SYSTEMS AND GENERAL REQUIREMENTS FOR DEVICES THAT PREVENT REFLUX POLLUTION

The standard refers to the protection of drinking water against reflux pollution in buildings. The drinking water conveyed by the water main may suffer hazardous pollutions mainly caused by the return of contaminated fluid from the systems connected directly to the main network. This European standard should be attributed the status of national standard either by publishing an identical text or by notice of adoption. As a consequence, contrasting national standards should be withdrawn. For example, UNI EN 1717: November 2002 is the Italian official version of the EN 1717 European standard.

Drinking water pollution: fluid category

The water installations, described by EN 806, based on their design or construction, must not pollute a public or private drinking water conveying system through the introduction of residual materials, harmful water or any other undesired substance.

Fluids that are or may get in contact with drinking water are classified in 5 categories, identified by an increasing number linked to riskiness.

- > **Category 1** Drinking water provided directly by a drinking water distribution system
- > **Category 2** Fluid not presenting any risk for human health. Fluid acknowledged as suitable for drinking, including water collected from a drinking water distribution system whose taste, smell and color may be altered and whose temperature may be varied (for heating or cooling purposes)
- > **Category 3** Fluid representing a certain degree of risk for human health due to the presence of one or more harmful substances
- > **Category 4** Fluid representing a risk for human health due to the presence of one or more toxic or highly toxic substances, or one or more radioactive, mutagenic or carcinogenic substances
- > **Category 5** Fluid representing a risk for human health due to the presence of microbiological or viral elements

The EN 1717 standard provides guidelines to identify fluid category:

drinking water	category
drinking water	1
high pressure water	1
stagnating water ¹	2
frozen water	2
sanitary hot water	2
depurated water ²	2
water with additives or in contact with liquid or solid elements not part of category 1	category
softened water not for drinking	3/4 ³
water + anti-corrosives not for drinking	3/4 ³
water + anti-freeze	3/4 ³
water + algicide	3/4 ³
water + liquid food products (fruit juice, coffee, soft drinks, soups)	2
water + solid food	2
water + wines and spirits	2
water + washing products	3/4 ³
water + surface-active products	3/4 ³
water + disinfectants not for drinking	3/4 ³
water + detergents	3/4 ³
water + refrigerants	3/4 ³
water from other uses	category
water for food cooking	2
water used to wash fruit and vegetables (catering system)	3/5 ⁴
dish and cooking utensil rinsing water	3
additive-free water of centralized heating systems	3
flush tank water	3
sterilized water	2
demineralized water	2

fig. 5.17

^[1] Some elements may have a higher level of bacterial proliferation risk (see legionella bacteria chapter 1)

^[2] Depurated water inside buildings (equipment excluded)

^[3] The limit between category 2 and category 3 is basically LD 50 = 200 mg/kg of body weight with reference to Directive EU 93/21/CEE of 27 April 1993

^[4] Category 4 for draw-off and washing water. Category 3 for rinsing water.

Protection units

Protection units must be built so as to safely prevent in counter-pressure and/or counter-siphoning reflux of contaminated fluids in a drinking water system. Reflux phenomena occur when, at a given point of the installation, there is a differential pressure causing the inversion of the regular flow direction. This may happen for two reasons:

- > pressure increase (counter-pressure) inside the derived circuit caused, e.g., by incoming water pumped from a well
- > the public network pressure is lower than the pressure inside the derived circuit (inverted siphoning or counter-siphoning). This may be caused by a broken aqueduct pipe or by large quantities collected by other draw-off points

To prevent contact between drinking water and other fluids, “single-wall” or “double-wall” separators are required.

The single-wall separator is made by a fixed and sealed single partition or framework: it may enter into contact with drinking water on one side and with another fluid on the other side.

A double-wall separator includes at least two fixed and sealed partitions or frameworks creating a neutral intermediate zone between the drinking water on one side and the other fluid on the other.

The intermediate zone can be designed in two different ways:

- containing a gaseous fluid or a porous inert material (open-cells)
- containing a fluid from category 1, 2, 3

Reflux prevention rules

Fluids in category 2 or 3 can be separated from drinking water by means of a single barrier. However, fluids in category 4 or 5, must be separated from drinking water by a double barrier using a safety element (liquid or gas) in the intermediate zone (combined to a sound or visual alarm system).

Consumer direct protection rules

When the fluid from which drinking water must be protected is included in category 4 or 5, a double barrier is required.

All devices connected to a drinking water network including a water draining device must feature an air breaker before the discharge connection in the related draining system. If not included, the fluid inside the device should be considered as part of category 5.

The protection unit must be represented by a hexagonal symbol with the protection family letter and the protection type letter of that family symbol.



The protection families are:

A	air vacuum
B	controllable disconnection
C	non-controllable disconnection
D	venting into the atmosphere
E	anti-pollution check valves
G	controllable mechanic disconnection
H	outlet disconnection
L	air inlet pressurized valve opening under negative depression

Their characteristics are specified in appendix A of the standard.

Except for special fields of application, anti-reflux devices must be able to operate without modifications or adjustments:

- at any pressure, up to 1 MPa (10 bar) included
- for any pressure change, up to 1 MPa (10 bar)
- when activated, with uninterrupted operation at a limit temperature of 65 °C, and for 1 hr at 90 °C

The product specifications must include a duration test for the expected life cycle.

The internal and external parts must be accessible for inspection, testing, replacement or maintenance.

Additional actuation devices (electric, pneumatic, etc.) should not affect the anti-reflux protection negatively.

Matrix of protection units appropriate for fluid categories

The standard indicates the suitability of each protection unit based on fluid category.

protection unit	1	2	3	4	5
BA vacuum breaker with controllable reduced pressure area	•	•	•	•	-
CA vacuum breaker with non-controllable multiple pressure areas	•	•	•	-	-

fig. 5.18



R626 - Dual-check backflow preventer BA type



R624 - Non-controllable backflow preventer with different pressure zones CA type

GIACOMINI HOT WATER DISTRIBUTION SYSTEMS IN YOUR HOUSE

PEX EXPANSION SYSTEM - GX

An aerial cutaway view of a two-story house with a red-tiled roof. The interior is shown in a semi-transparent style, revealing the layout of rooms including a living area, kitchen, and bathroom. A network of red and blue pipes is visible, laid out in a grid pattern across the floor surfaces. A white line with a circular endpoint points from the text label to the pipe network in the living area. The house is surrounded by a green lawn, a paved path with a person riding a bicycle, and some outdoor furniture. The overall scene is brightly lit, suggesting a sunny day.

PEX AND MULTILAYER SYSTEMS WITH T-SHAPED DERIVATIONS

An aerial cutaway view of a two-story house with a red-tiled roof, similar to the one above. The interior layout is the same, but the pipe network is more complex, featuring T-shaped junctions where multiple pipes meet. The pipes are shown in red and blue, indicating different types of water distribution. A white line with a circular endpoint points from the text label to a T-shaped junction in the living area. The house is surrounded by a green lawn, a paved path with a person riding a bicycle, and some outdoor furniture. The overall scene is brightly lit, suggesting a sunny day.



**PPR WELDING
SYSTEM**

**PEX SYSTEM WITH
CRIMPING RINGS**

**PEX AND MULTILAYER SYSTEM
WITH MANIFOLDS**

Giacomini sanitary distribution systems

Product codes

PEX AND MULTILAYER SYSTEM WITH T-SHAPED DERIVATIONS

see page 56

Pipe



R999



R999I red



R999I blue



R994



R993

RM press fittings



RM102



RM103



RM107



RM109



RM122



RM127



RM129



RM139



RM144



RM150



RM151



RM153



RM154



RM179SP



RM179



RM179E



RM18



RM19



RM173



RMV103

Assembled compression fittings



R187M



R187F



R560AM



R561AM



R562AM



R563AM



R564AM



R565AM



R566AM



R568AM



R569AM



R572AM

Compression fitting single components



R180R



R180FR



R560R



R561R



R562R



R563R



R564R



R568R



R569R



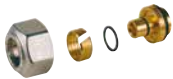
R570R



R571R



R572R



R179AM



R179



R179E

Tools



RP200-1



RP202



RP203

PEX AND MULTILAYER SYSTEM WITH MANIFOLDS

see page 66

Pipes



R999



R991 red



R9991 blue



R994



R993

RM press fittings



RM102



RM103



RM107



RM109



RM122



RM127



RM129



RM139



RM144



RM150



RM151



RM153



RM154



RM179SP



RM179



RM179E



RM18



RM19



RM173



RMV103

Assembled compression fittings



R187M



R187F



R560AM



R561AM



R562AM



R563AM



R564AM



R565AM



R566AM



R568AM



R569AM



R572AM

Compression fitting single components



R180R



R180FR



R560R



R561R



R562R



R563R



R564R



R568R



R569R



R570R



R571R



R572R



R179AM



R179



R179E

Manifolds



R580C



R585C

Tools



RP200-1



RP202



RP203

NOTE: refer to price list catalogue and giacomini.com for the complete codes

Pipes



R996



R996T



R994



R993



R995

Fittings



GX102



GX103



GX107



GX109



GX122



GX127



GX129



GX139



GX150



GX151



GX153



GX154



GX165



GX179



GX651

Polymeric rings



GX61

Tools



GX200



GX200M



GX202



GX203



R990

PEX SYSTEM WITH CRIMPING RING

see page 84

Pipe



GZ996

Fittings



GZ102



GZ103



GZ107



GZ109



GZ122



GZ127



GZ129



GZ139



GZ150



GZ151



GZ573



GZ153



GZ154



GZ165



GZ179



GZ651

Rings



GZ61

Tools



GZ200



GZ200C



GZ211

NOTE: refer to price list catalogue and giacomini.com for the complete codes

Pipe



H100

Fittings



H102



H103



H107



H109



H115



H120



H121



H122



H124



H127



H129



H130



H139



H144



H150



H151



H153



H154



H163



H165



H166



H173



H173A



H173B

Tools



H200



H205

Giacomini S.p.A. is a company with an ICIM certified Integrated Quality Management System for Environment, Health & Safety



ISO	ISO	OHSAS
9001	14001	18001

UNI EN ISO 9001: 2008
Quality Management Systems

UNI EN ISO 14001: 2004
Environmental Management Systems

OHSAS 18001: 2007
Occupational Health & Safety
Management Systems

