PRANDELLI®

MULTILAYER PIPE IN PE-XB/AL/PE-XB AND BRASS FITTINGS

MULTYRAMA

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Edition 7: 09/2015

INTRODUCTION

The **Multyrama System** is a system of pipes and fittings produced with cutting edge technologies, which combines and fully exploits the properties of plastics and metals. It is a multi-layer pipe, comprising two layers of cross-linked polyethylene, bonded to an intermediate layer of aluminium.

The joints are made using mechanical compression fittings, both “press-fittings” and “nut and ring” fittings. The resistance features of the **Multyrama System**, as well as the wide-range of sizes available, allow installers to create various types of systems. These can range from residential water to heating, from compressed air to spa water, conveying foodstuffs or industrial fluids (based on compatibility with the fluid itself).

CONTENTS

1. GENERAL FEATURES

DESCRIPTION OF THE MULTYRAMA SYSTEM

The **Multyrama System** consists of a metal-plastic composite pipe in Pe-Xb/Al/Pe-Xb and brass mechanical joints.

Characteristics unique to the system are:

- internal pipe made from cross-linked Pe-Xb polyethylene pursuant to standard UNI EN ISO 15875

- intermediary pipe realised in aluminium, continuously welded along the longitudinal seam, and anchored to both the internal and external surfaces

- external coating in white coloured Pe-Xb

- wwMechanical joint using brass fittings.

CHARACTERISTICS OF CROSS-LINKED POLYETHYLENE	TEST METHOD	TEST TEMPERATURE	UNIT OF MEASURE	TEST VALUE
Density	ISO-DIS 1872	-	g/cm³	~ 0.95
Ultimate tensile strength	DIN 53455	+ 23 °C	kg/mm²	2.0 ÷ 2.9
		+ 100 °C	kg/mm²	1.0 ÷ 1.9
Elongation at break	DIN 53455	+ 23 °C	%	170 ÷ 250
		+ 100 °C	%	300 ÷ 500
Module of Elasticity	DIN 53457	0 °C	kg/cm²	15,000
		80 °C	kg/cm²	5,000
Impact resistance	B.S.	- 150 °C	kgm/cm²	no break
		20 °C	kgm/cm²	no break
Field of Application	-	-	°C	-100 +110
Linear expansion coefficient	-	(20 °C) (100	°C-1	1.5 x 10-4
Softening temperature	-	°C)	°C	135
Coefficient of thermal conductivity (λ)	-	-	kcal/hm°C	0.38
Volume of resistivity	BS2782-202B	-	ohm ∑ cm	> 1 x 1016
		20 °C		

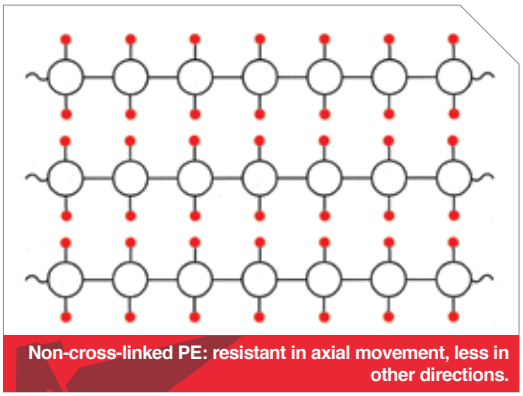
CROSS-LINKING

Polyethylene consists of linear macro-molecules which, after being “cross-linked” are joined by transversal links.

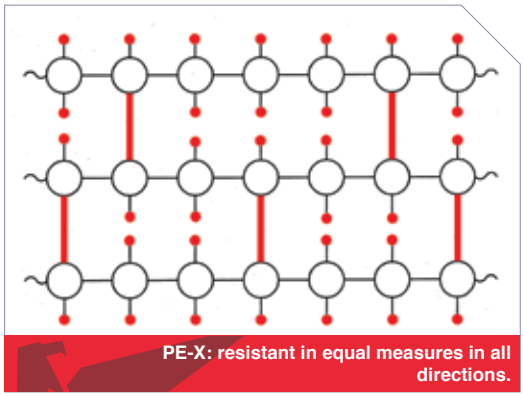
Please note that the UNI EN ISO 15875 standard requires the following minimum degree of cross-linking:

PE-Xa	Metodo a perossidi	≥ 70%
PE-Xb	Metodo a silani	≥ 65%
PE-Xc	Metodo a raggi elettronici	≥ 60%

While respecting these limits, higher values of mechanical, thermal and chemical resistance are guaranteed and the internal **Multyrama** pipe is capable of transporting pressurised cold and hot water for long periods.



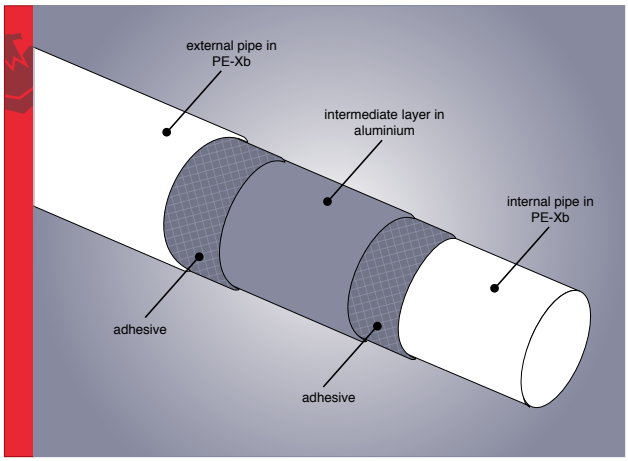
Non-cross-linked PE: resistant in axial movement, less in other directions.



PE-X: resistant in equal measures in all directions.

Carbon Hydrogen Bonds between molecules

Multyrama pipes meet the UNI 10954-1 Class 1 standard dimensional characteristics.



2. PROPERTIES

Multyrama pipe possesses multiple characteristics which render it unique in the construction of modern, technically advanced installations.

RESISTANCE TO ELECTRO-CHEMICAL CORROSION

Multyrama pipe has a very low chemical affinity with various acid/basic substances. This makes it compatible in contact with materials normally used in building, such as cement or lime without requiring dedicated protection (with the exception of the metal fittings).

When transporting or in contact with particular substances, please verify the chemical resistance by consulting the appropriate table on page 22 – Chapter 8.

Volume resistivity (at 20 °C) of cross-linked polyethylene and metals of common use in the water-heating-sanitary field

Cross-linked polyethylene	$\rho_{20} > 1 \cdot 10^{16}$	Ω cm
Steel	$\rho_{20} \cong 0.1 \div 0.25 \cdot 10^{-4}$	Ω cm
Pure iron	$\rho_{20} \cong 0.0978 \cdot 10^{-4}$	Ω cm
Industrial copper for conductors	$\rho_{20} \cong 0{,}0172541 \cdot 10^{-4}$	Ω cm

Special attention is given to the **Multyrama system** joints.

In fact, in order to avoid accidental brass/aluminium contact, an o-ring is placed at the base of the pipe adapter. In this manner, the different values of electronegativity of brass and aluminium cannot create electrochemical corrosion.

LOW THERMAL CONDUCTIVITY

Multyrama thermal conductivity and metals commonly used in the water-heating-sanitary field.

Multyrama	$\lambda = 0.38$	kcal • h^{-1} • m^{-1} • $°C^{-1}$
Steel	$\lambda = 40 \div 50$	kcal • h^{-1} • m^{-1} • $°C^{-1}$
Iron	$\lambda = 40 \div 50$	kcal • h^{-1} • m^{-1} • $°C^{-1}$
Copper	$\lambda = 260 \div 340$	kcal • h^{-1} • m^{-1} • $°C^{-1}$

Considering the nature of the materials used in **Multyrama** production, one of its primary characteristics is its low coefficient of thermal conductivity. It is evident that this factor is important for energy savings as it reduces heat dispersion during fluid transport.
Moreover, the low value of **Multyrama**'s coefficient of thermal conductivity reduces the formation of external surface condensation in the pipes and extends the time of water transformation in drops, as opposed to what happened when using metal pipes.

STRAY CURRENT RESISTANCE

Multyrama is a bad electrical conductor in that the metallic component is isolated by Pe-X and thus is insensitive to stray currents. Typical in places which a high static load (scientific and industrial research laboratories) or in close proximity to high voltage wires, this phenomena generates huge problems not only in residential buildings but for sanitation and heating networks constructed using metal pipes. Please note that the phenomena of pipeline perforation due to stray currents is emphasised when the system is earthed for electrical appliances.

LOW NOISE

Due to the material used and its value of acoustic isolation, noise from installations is notably reduced as is the presence of water hammer.

SANITATION

The raw materials used in **Multyrama** products are completely non-toxic and correspond to current international standards.

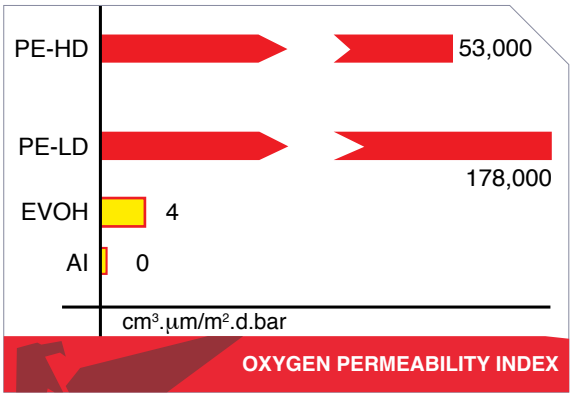
2. PROPERTIES

LOW LOAD LOSS

The surface structure of PE-X is homogenous, due to the lack of cracks, porosity and small fissures, typical of the metal surfaces traditionally used in water pipelines, therefore, **Multyrama** has a very low friction coefficient (PE-X is physically defined as a 'smooth body'). This characteristic permits very swift flows of water; consequently, there is low load loss, as shown in diagrams on pages 39-40-41.

OXYGEN PERMEABILITY

Multyrama is impermeable to oxygen as the presence of aluminium impedes any diffusion phenomena from crossing the pipe walls. Please recall that this characteristic is particularly sought after in central heating installations, and in particular in those with radiators.



Key:
PE-HD = high density polyethylene
PE-LD = low density polyethylene
EVOH = barrier material
Al = aluminium

LINEAR EXPANSION

The aluminium component notably reduces dilatation with respect to only plastic materials, in fact:

α = 0.026 mm/m-K

HIGH RELIABILITY OVER TIME

Considering the temperature and pressure values in water-heat-sanitation installations and by virtue of the characteristics of the components used, installations constructed using **Multyrama** have a significant life time, comparable to that of the masonry work.

3. APPLICATIONS

APPLICATIONS

Multyrama pipes have been designed to withstand the stress levels present in residential and industrial installations, with an ample safety ratio. In sanitation installations the pipes can function at a stable operating temperature when Toper = 60 °C, can sustain a maximum temperature Tmax = 80 °C and malfunction temperature Tmal = 95 °C.

In heating installations the maximum temperature is Tmax = 90 °C with the malfunction temperature at Tmal = 100 °C.

In these installations it is always best to use anti-freeze to avoid danger of freezing (for example second homes).

These conditions are foreseen under the specific EN-ISO 21003-1 standard relevant to multilayer pipes and shown below.

Class cl	Poper bar	Toper °C	Time at Toper °C	T_{max} °C	Time at T_{max} 1)	T_{mal} 2) °C	Time at t_{mal} h	Applications
1	10	60 20	49 2.5	80	1	95	100	Sanitary hot water
4	6	Plus 40 Plus 60	Plus 20 Plus 25	70	Plus 2.5	100	100	Under-floor heating and radiators at low temperature
5	6	20 Plus 60 Plus 80	14 Plus 25 Plus 10	90	Plus 1	100	100	Radiators at high temperature

1) The system does not work for the entire expected 50-year life-span at the operating temperature, Toper . The difference in time seen is attributable to the period where the temperature remains at 20 °C.

2) Current legislation at the time of publication of the standard (Presidential Decree No. 412 dated 26.08.1993 - see Appendix D) on energy savings that calls for an operating temperature of Toper = 48 °C (+5 °C) for the centralised distribution of sanitary hot water.

3) The operating life of 50 years takes into consideration usage at 40 °C for 20 years added to a usage at 60 °C for 25 years.

4) The operating life of 50 years takes into consideration usage at 60 °C for 25 years added to a usage at 80 °C for 10 years.

5) Class 1 can also be used for the applications in Classes 4 and 5. 5) Class 5 can also be used for applications in Class 4.

4. FITTINGS

The **Multyrama** fitting is made from brass.

The pipe-fitting seal is formed by compression and consequential crimping of the pipe on the fitting adapter. Depending on the means used to achieve the compression, two type of fittings can be identified:

- “press-fitting” type (single or multiple gripper)
- screw type

Both are mechanical joints.

Press-fittings

Compression is obtained by compressing a metal bush using a dedicated tool. Deformation of the bush, along with the shape of the fixing adapter, in turn, permit the interposed pipe to be deformed, thereby ensuring a perfect mechanical and hydraulic seal. The two O-rings, located on the adapter, on one hand contribute to improving the hydraulic seal and to cleaning the pipe’s interior surface, and on the other, ensure that the ‘supported’ portion of the alumium pipe does not come into contact with the joint body, eliminating the risk of electro-chemical corrosion and allowing pre-assembly of the metallic bush.

Screw fittings

Compression, followed by crimping of the pipe to the fitting adapter, is obtained by screwing a lock nut on the fitting body. This movement tightens a metal ferrule on the pipe. The adapter is placed at the part of the taper shank equipped with an o-ring for insertion into the fitting body and the other part calls for a ribbed section onto which the pipe is assembled. There are two O-rings in this area to improve hydraulic technique and to ensure that the interior surface of the pipe is cleaned. Meanwhile, a plastic disc is located in the "support" area which ensures there is no aluminium-brass contact.

5. GUARANTEE

Multyrama products and components are subject to strict quality control. The productive cycle calls for daily physical-chemical tests and continuous controls of dimensions and surfaces, as well as verification of the wall integrity. Consequently, **Multyrama** employed in water-heating-sanitary installations, for all other types of installations compatible with the product's technical characteristics and for installations that comply with the installation instructions provided in the this publication, we give the following **GUARANTEE**, covered by the policy stipulated with a top Insurance Company.

1. The **Prandelli** company, supplier of the **Multyrama** system, will provide compensation through insurance coverage stipulated with a top Insurance Company for all damage caused to persons or property, caused due to breakage of pipe and fittings ascribable to evident manufacturing defects, up to a maximum of EUR 500,000 for a period of 10 YEARS from the production date printed on pipes.

2. The conditions of the **GUARANTEE** are the following:
a) The pipe must be installed in compliance with the installation instructions supplied by us, subject to inspection for faults or tampering that can have occurred during the period following production or due to accidental causes.
b) The operating conditions (pressure and temperature) must be within the technical limits provided in the latest **Multyrama Guide**.
c) The product must carry the **Multyrama** brand.

3. The **GUARANTEE SHALL BECOME NULL AND VOID** in the following cases:
a) Lack of observation of the recommended installation instructions.
b) Connection of the pipe and fittings to heat sources with temperature and pressure limits, even if accidental, that are not compatible with the pipe's characteristics.

c) Use of clearly unsuitable materials (aged pipes, scratched pipes, etc.).

d) Use of one or more components that are not of our manufacture when installing the system.

4. **INSTRUCTIONS FOR REQUESTING INTERVENTION UNDER GUARANTEE**

In event of breakage of a **Multyrama** product exclusively attributable to evident manufacturing defects, it is necessary to submit a registered letter, with a copy to the area representative, containing:

- place and date of installation;
- data and identification mark of pipe;
- information regarding the working conditions (pressure and temperature);
- sample of pipe or fitting where breakage occurred;
- name and address of the installer of the system.

On receipt of this registered letter, within a reasonable period, we will send a technician to verify the causes of damage.
When the breakage falls within the conditions of GUARANTEE, we will provide the Insurance Company with the details. In turn, they will provide compensation for damages, after ascertainment of causes and entity.
Should breakage not all within the conditions of the guarantee, we will bill our expenses for our intervention.

PRANDELLI S.p.A.

6. DIMENSIONAL CHARACTERISTICS

DIMENSIONAL RANGE

The technical characteristics of the **Multyrama** pipe, together with the specific technique used for fittings, which we will examine later, makes the system suitable for all situations where a technical, cutting-edge product is desired. As the system carries has a specific dimensional range that includes the fundamental diameters for distribution in plumbing and/or heating systems in different types of installations.

Nominal diameter (ND) mm	Total thickness mm	Internal diameter (ID) mm	Aluminium thickness (eAll) mm	Series (S) S	PACKAGING		
					ROLLS		
					Bare m	Isolated m	Bars m
14	2.0	10	0.2	34.5<S≤42.8	100	50	/
16	2.0	12	0.2	34.5<S≤42.8	100/200/500	50	100
16	2.0	12	0.4	S≤20.5	100	50	/
16	2.25	11.5	0.4	S≤20.5	100	50	/
18	2.0	14	0.25	34.5<S≤42.8	100/200	50	/
20	2.0	16	0.25	34.5<S≤42.8	100/200	50	100
20	2.0	16	0.4	20.5<S≤26	100	50	100
20	2.5	15	0.4	20.5<S≤26	100	50	100
26	3.0	20	0.5	20.5<S≤26	50	25	40
32	3.0	26	0.6	20.5<S≤26	25/50	/	40
40	3.5	33	1.0	20.5<S≤26	/	/	20
50	4.0	42	1.2	20.5<S≤26	/	/	20
63	4.5	54	1.5	20.5<S≤26	/	/	12

The entire range of dimensions satisfies the requirements of the EN-ISO 21003-1 classification as shown in Prospectus 1.

In particular, all dimensions in series 34.5<S<42.8 belong to Class 1 with Toper 60° and PD 10 bar. Those with a lower S value have, at an equivalent DN diameter, a greater alumium thickness, eAll, and, therefore, they have greater resistance or a higher safety coefficient when used under the conditions foreseen by Class 1.

We have observed that in some European countries, sanitary installations requires Class 2, according to standard UNI ISO 15875-2 for Pe-X.

7. PRODUCTION

PIPE CUTTER TOOL

The tool necessary for processing **Multyrama** components has the following elements:

We recommend the use of these shears to obtain a clean, net cut on all **Multyrama** pipes. This sets the base to achieve a secure joint.
For pipes with diameters greater than 26 mm, we recommend using a scissors tool or a standard rotating blade pipe cutter.

7. PRODUCTION

CALIBRATOR TOOL

- calibrator tool to give the pipe its original cylindrical form and to ease insertion of fitting adapters.

ELECTRIC OR BATTERY OPERATED PRESS

- Electric or battery operated crimper with pliers for assembling the fittings

MANUAL CRIPMER

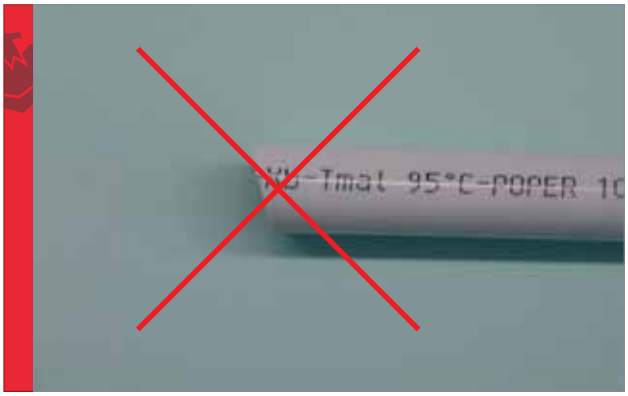
- Manual press: up to diameter 26.

CONSTUCTION OF JOINT

The phases for making joints are the following:

1. Preparation of pipe

Cut the tube perpendicularly to its axis, thereby avoiding partial connection of the fittings;



7. PRODUCTION

Moreover, the pipe-cutter's blade must be kept in perfect condition so as to avoid possible "tears" on Pe-X pipes, which could compromise the operation.

In this case, it is necessary to replace the pipe-cutter blade and repeat the operation.

CALIBRATION


A

This consists in calibrating the newly cut pipe, using the appropriate tool that must be inserted into the pipe, turning it clockwise (photo A) until the conical area is reached (photo B).


B

After calibration, and before assembling the fitting, please check that there is no residue in the pipe- such as residual burr or dirt in general.

ASSEMBLY OF FITTINGS

Once verified that there are no traces of residue on the fittings' O-rings, proceed to insert the adapter in the pipe until the appropriate inspection holes made on the metal bush, in the case of press-Fitting, have appeared. For the screw fittings the pipe must be pushed into the adapter until flush.

PREPARING THE FITTING

CRIMPING PROCEDURE

CRIMPED FITTING

SCREW FITTINGS

WARNINGS

Before crimping please check that the various components of the joint, such as the O-rings and the metal bush, are positioned correctly, that the pipe is securely fixed to the adapter, that it is flush and that the crimper pliers, in addition to being of the type and dimensions requested, are set on the one side of the body of the joint.

7. PRODUCTION

CURVATURE OF PIPES

Thanks to the technical-construction features of Multyrama products, it is very easy to manually curve pipes with diameters of 20 mm both with or without the use of dedicated curvature springs.

For those with larger dimensions, the use of a pipe bender is recommended and when the recommended values, shown on the chart, are not applicable, the use of joints is mandatory.

The following curvature radius must be respected:

PIPE DIMENSIONS mm	CURVATURE RADIUS WITHOUT PIPE BENDER	CURVATURE RADIUS WITH SPRING	CURVATURE RADIUS WITH PIPE BENDER
14 x 2	5.0 x d	2.5 x d	-
16 x 2	5.0 x d	2.5 x d	-
16 x 2.25	5.0 x d	2.0 x d	-
18 x 2	5.0 x d	2.5 x d	-
20 x 2	5.0 x d	3.0 x d	-
20 x 2.5	5.0 x d	3.0 x d	-
26 x 3	-	-	5.0 x d
32 x 3	-	-	5.0 x d
40 x 3.5	-	-	≥ 8.0 x d
50 x 4.0	-	-	≥ 8.0 x d
63 x 4.5	-	-	≥ 10.0 x d

d = pipe external diameter

Please note that in aiming to ensure the reliability over time of the pipe-joint link, the length of the pipe must always be straight and as must the section immediatly prior to the joint.

RECOVERY OF THE FITTING

Press-fittings or screw fittings allows for the recovery of the joint body when the operation has been performed incorrectly or when changes to a previous installation must be performed.

Procedure:

- If an operation on an existing installation is necessary, separate the joint to be recovered from the rest of the pipe;
- Use an industrial blower to heat the fitting bush to be removed. When the temperature of the pipe causes the Pe-X layer to soften, both the pipe and the bush can be easily separated from the joint body.
- Once separated, the joint body can be re-used for another joint after it the adapter has been carefully cleaned and the O-rings replaced.
- The bush and the connected length of pipe must be eliminated in that the previous pressing phase caused crimping such as to impede subsequent re-use.
- For screw fittings, the lock nut must be unscrewed, enabling removal of pipe along with adapter with taper shank. Beside the length of tube, it is advisable to replace the adapter and the metal ferrule.

8. CHEMICAL RESISTANCE

Hereunder is a chart showing compatibility and incompatibility of the most common reagents with high density polyethylene, according to the data provided in the ISO/TC 138 Document (Segretariat 351) no. 556 E-December 1976.

Please note that, as cross-linking increases the average molecular weight, it can be considered that the chemical resistance of PE-X is not lower, rather higher than uncross-linked PE-HD.

Please note that in conveying specific fluids, such as fuels or others, it is necessary to follow to the current legal regulations, where they exist.

CHART SHOWING RESISTANCE TO CHEMICAL AGENTS

Fluids that can be conveyed at an atmospheric pressure of up to 60 °C using HDPE pipes, which are not subject to external stress

FLUIDS	CONCENTRATION
Acetic acid	10%
Vinegar	-
Adipic acid	sat. sol.
Allylic alcohol	96%
Alum	sol.
Aluminium chloride	sat. sol.
Aluminium fluoride	sat. sol.
Aluminium sulphate	sat. sol.
Ammonia, gas	100%
Ammonia, liquified	100%
Nitrogen ammoniacal in water	dil. sol.
Ammonium chloride	sat. sol.
Ammonium fluoride	sol.
Ammonium nitrate	sat. sol.
Ammonium sulphate	sat. sol.
Ammonium sulphide	sol.
Antimony trichloride	90%
Arsenic acid	sat. sol.
Hydrogen peroxide	30%
Water	-
Silver acetate	sat. sol.
Silver cyanide	sat. sol.
Silver nitrate	sat. sol.
Barium carbonate	sat. sol.
Barium chloride	sat. sol.
Barium hydrate	sat. sol.
Barium sulphate	sat. sol.

FLUIDS	CONCENTRATION
Hydrobromic acid	50%
Hydrobromic acid	100%
Benzoic acid	sat. sol.
Beer	-
Borax	sat. sol.
Boric acid	sat. sol.
Butane gas	100%
Butanol	100%
Calcium carbonate	sat. sol.
Calcium chlorate	sat. sol.
Calcium chloride	sat. sol.
Calcium hydrate	sat. sol.
Calcium hypochlorite	sol.
Calcium nitrate	sat. sol.
Calcium sulphate	sat. sol.
Carbon dioxide, dry	100%
Carbon monoxide	100%
Hydrochloric acid	10%
Hydrochloric acid	conc.
Chloroacetic acid	sol.
Citric acid	sat. sol.
Cyclohexanol	sat. sol.
Hydrocyanic acid	10%
Dextrin	sol.
Dioxane	100%
Ethylene glycol	100%
Ferric chloride	sat. sol.

CHART SHOWING RESISTANCE TO CHEMICAL AGENTS

Fluids that can be conveyed at an atmospheric pressure of up to 60 °C using HDPE pipes, which are not subject to external stress

FLUIDS	CONCENTRATION
Ferric nitrate	sol.
Ferric sulphate	sat. sol.
Ferris chloride	sat. sol.
Ferris sulphate	sat. sol.
Hexafluosilicic acid	40%
Formaldehyde	40%
Formic acid	50%
Formic acid	98-100%
Phenol	sol.
Hydrofluoric acid	4%
Photographic acid	wash conc.
Glucose	sat. sol.
Glycerine	100%
Glycolic acid	sol.
Hydrogen	100%
Hydrogen sulphide	100%
Hydroquinone	sat. sol.
Milk	-
Lactic acid	100%
Yeast	sol.
Magnesium carbonate	sat. sol.
Magnesium chloride	sat. sol.
Magnesium hydrate	sat. sol.
Magnesium nitrate	sat. sol.
Maleic acid	sat. sol.
Mercuric chloride	sat. sol.
Mercuric cyanide	sat. sol.
Mercurous nitrate	sol.
Mercury	100%
Methanol	100%
Molasses	wash conc.
Nickel chloride	sat. sol.
Nickel nitrate	sat. sol.
Nickel sulphate	sat. sol.
Maleic acid	25%
Orthophosforic acid	50%
Oxalic acid	sat. sol.
Potassium bromate	sat. sol.
Potassium bromide	sat. sol.
Potassium carbonate	sat. sol.
Potassium chlorate	sat. sol.
Potassium chloride	sat. sol.

FLUIDS	CONCENTRATION
Potassium chromate	sat. sol.
Potassium cyanide	sol.
Potassium bichromate	sat. sol.
Potassium ferrocyanide	sat. sol.
Potassium fluoride	sat. sol.
Potassium bicarbonate	sat. sol.
Potassium bisulphate	sat. sol.
Potassium bisulphite	sat. sol.
Potassium hydrate	10%
Potassium hydrate	sol.
Potassium nitrate	sat. sol.
Potassium orthophosphate	sat. sol.
Potassium perchlorate	sat. sol.
Potassium permanganate	20%
Potassium persulphate	sat. sol.
Potassium sulphate	sat. sol.
Potassium sulphide	sol.
Propionic acid	50%
Salicylic acid	sat. sol.
Sodium benzoate	sat. sol.
Sodium bromide	sat. sol.
Sodium carbonate	sat. sol.
Sodium chlorate	sat. sol.
Sodium chloride	sat. sol.
Sodium cyanide	sat. sol.
Sodium ferrocyanide	sat. sol.
Sodium fluoride	sat. sol.
Sodium bicarbonate	sat. sol.
Sodium bisulphite	sol.
Sodium hydrate	40%
Sodium hydrate	sol.
Sodium hypochlorite	15% chlorine
Sodium nitrate	sat. sol.
Sodium nitrite	sat. sol.
Sodium orthophosphate	sat. sol.
Sodium sulphate	sat. sol.
Sodium sulphide	sat. sol.
Sulphuric acid	10%
Sulphuric acid	50%
Stannic chloride	sat. sol.
Stannous chloride	sat. sol.
Sulphurous anhydride, dry	100%

8. CHEMICAL RESISTANCE

Fluids that can be conveyed at an atmospheric pressure of up to 60 °C using HDPE pipes, which are not subject to external stress

FLUIDS	CONCENTRATION
Sulphurous acid	30%
Photographic acid	wash conc.
Tannic acid	sol.
Tartaric acid	sol.
Urea	sol.
Urine	-

FLUIDS	CONCENTRATION
Wine	-
Zinc carbonate	sat. sol.
Zinc chloride	sat. sol.
Zinc oxide	sat. sol.
Zinc sulphate	sat. sol.

Fluids which can be conveyed at an atmospheric pressure of up to 20 °C using HDPE pipes that are not subject external stress.

FLUIDS	CONCENTRATION
Acetaldehyde	100%
Glacial acetic acid	> 96%
Acetic anhydride	100%
Amyl acetate	100%
Amyl alcohol	100%
Aniline	100%
Hydrogen peroxide	90%
Benzaldehyde	100%
Aliphatic hydrocarbon petrol	-
Butyric acid	100%
Chromic acid	20%
Chromic acid	50%
Cyclohexane	100%
Decahydronaphthalene	100%
Dioctyl phthalate (DOP)	100%
Heptane	100%

FLUIDS	CONCENTRATION
Ethanol	40%
Ethyl acetate	100%
Furfuryl alcohol	100%
Hydrofluoric acid	60%
Phosphorus trichloride	100%
Nicotinic acid	dil. sol.
Oils and fats	-
Oleic acid	100%
Orthophosforic acid	95%
Oxygen	100%
Picric acid	sat. sol.
Lead acetate	sat. sol.
Potassium hypochlorite	sol.
Propionic acid	100%
Pyridine	100%
Sulphuric acid	98%
Triethanolamine	

Fluids that cannot be conveyed using HDPE

FLUIDS	CONCENTRATION
Nitro-hydrochloric acid	HCl/HNO3 =3/1
Bromine gas, dry	100%
Bromine, liquid	100%
Carbon bisulphide	100%
Carbon tetrachloride	100%
Chlorine gas, dry	100%
Chlorine, in water	sat. sol.
Chloroform	100%

FLUIDS	CONCENTRATION
Fluorine gas	100%
Maleic acid	from 50% to 100%
Ozone	100%
Sulphuric acid	fuming
Sulphuric anhydride	100%
Thionyl chloride	100%
Toluene	100%
Trichloroethylene	100%
Xilene 100%	

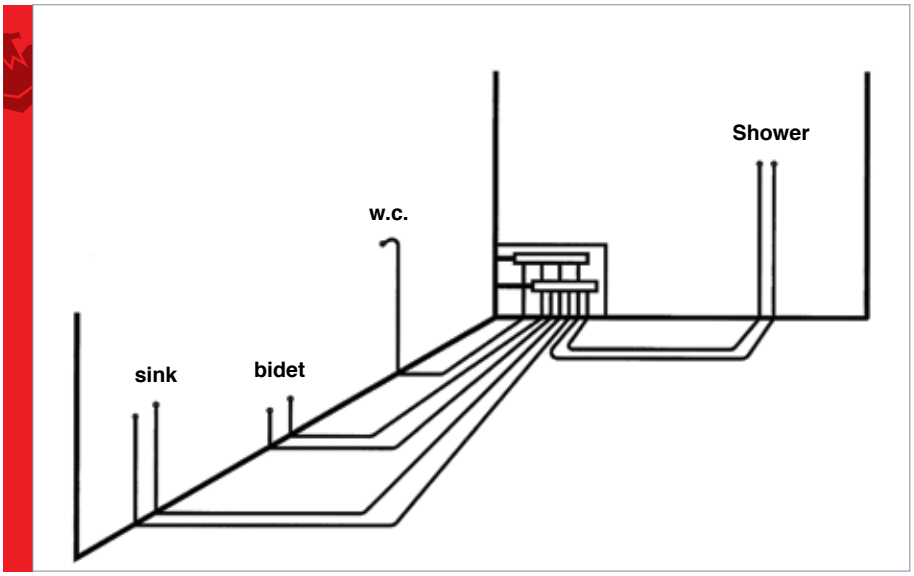
9. INSTALLATION TECHNIQUE

The **Multyrama** pipe and joint system can be installed either under plaster or externally, following the technical instructions based on the preferred type of installation.

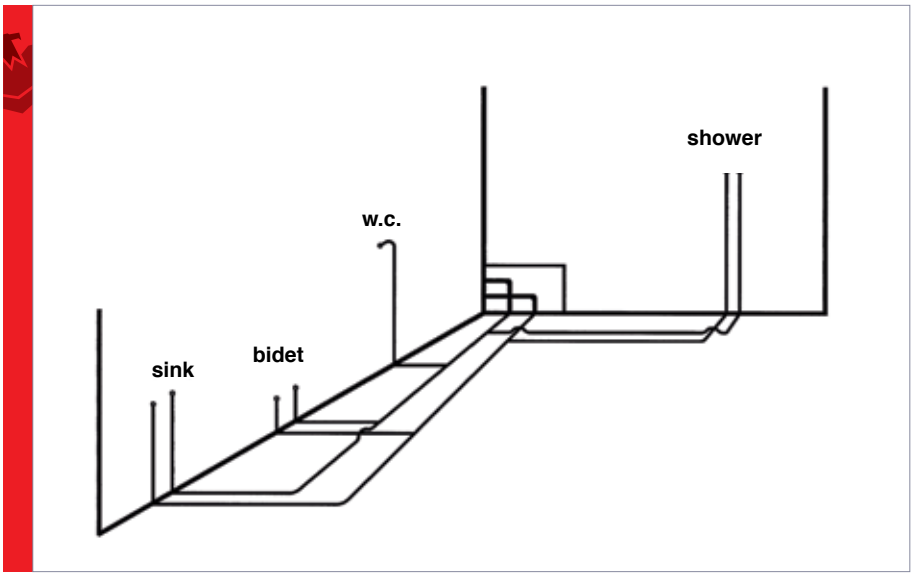
As a general rule, however, it is necessary to adopt the best-practice standards for laying as regulated by the law for energy savings in central heating installations (Law 10 dated 9th January, 1991 and relevant Presidential Decree 26/08/93 No. 412)

When installed externally, it is of fundamental importance to protect the pipe from UV rays as these could damage the external coating of the **Multyrama** Pe-X pipe.

1. Installation using manifolds



2. Installation using fittings (with T-joints and possibly 90° elbows).



THERMAL EXPANSION

All materials, including those which constitute Multyrama pipe, if subjected to temperature changes, expand or contract in proportion to their coefficient of thermal expansion. It follows that, if the pipe is installed without an expander, it is subject to a change in length

$\Delta L = \alpha \cdot L \cdot \Delta T$ where:

ΔL = pipe length variation in mm

α = coefficient of linear expansion in mm/m*K equal to 0.026

L = length of pipe free from constraints in mm

ΔT = difference between installation temperature and the working temperature in K (maximum or minimum)

Once determining that the expansion is required, apply the techniques necessary to avoid that this phenomenon does not cause the piping problems. For this, is it necessary to fit the installation with fixed points and slip points.
These are the names given to the constraints which render the pipe integral to the structure of the buildings, by totally or only partially impeding movement consequential to thermal expansion.

FIXED POINTS, SLIP POINTS AND EXPANSION ARM

Fixed points

Their function is to obstruct the movement of the pipes and for this reason a rigid connection between installation on the one hand and the building work on the other hand must be made.

This is performed using stiff collars made from a pressed element, usually metal, covered in rubber on the pipe portion and a component for fixing to the wall on the opposite side.

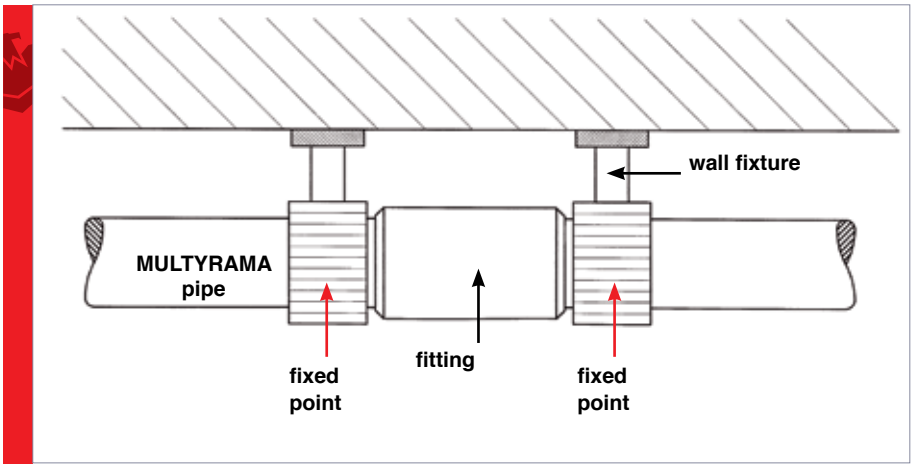
Obviously, the rubber part (or in similar material) acts as a protective shield against damage of the pipe's surface and to abate vibrations.

The fixed points are positioned, usually, in correspondence with the installation's changes in direction (arms, elbows, etc.) to impede the expansion that occurs in those specific points.

However, it is a good idea to always position the fixed point close to a pipe connection, made with any type of joint.

Therefore, it is easy to understand that the presence of fixed points limits the length of unrestrained pipe to dilate, L, consequently reducing the relative ΔL value.

Example of fixed point



9. INSTALLATION TECHNIQUES

Slip points

Slip points permit axial motion (in both ways) in the pipe. Because of this, they must be placed far from connections with fittings, on a free area of the pipe's surface. The collar that functions as the slip point must in no way have parts that could damage the pipe's exterior surface.

The slip points also act as a support and guarantee (if positioned in sufficient numbers) maintenance of the installation's straightness in the presence of thermal stress.

Generally, positioning intervals are:

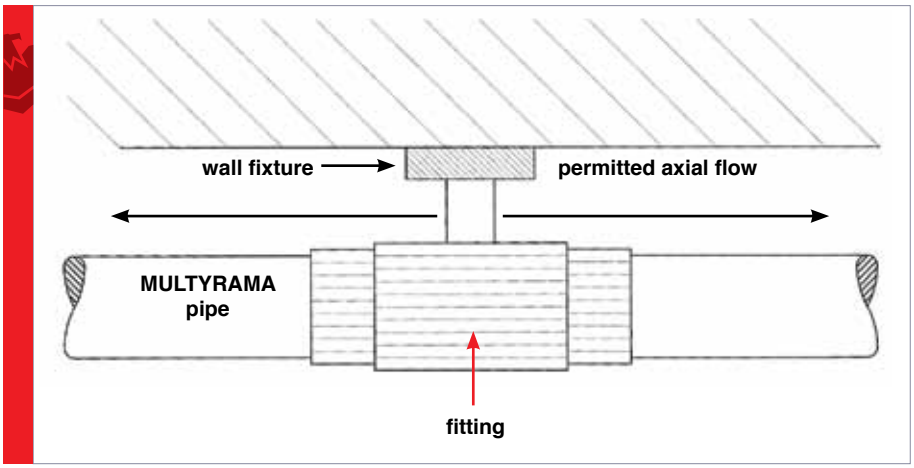
d. 16 and 20 = L 100 cm

d. 26 = L 150 cm

d. 32/40/50 = L 200 cm

d 63 = L 250 cm

Example of slip point



Expansion arm

In some cases, expansion is compensated for through either directional changes (expansion arm) or through curves (omega). In these cases, it is important to take into account the pipe's characteristics and the correct positioning of the fixed points using the following formula:

$LS = F \cdot \sqrt{D \cdot \Delta L}$ where:

LS = length of expansion arm in mm

F = material constant (for Multyrama 30)

D = pipe diameter in mm

ΔL = pipe length variation in mm

CALCULATION OF EXPANSION

Use the following formula to calculate the expansion for MULTYRAMA pipe:

$\Delta L = \alpha \cdot L \cdot \Delta T$ where:

ΔL = pipe expansion in mm

α = coefficient of linear expansion of material mm/m°C:

MULTYRAMA = 0.026 mm/m°C

L = length of pipe free to expand in m

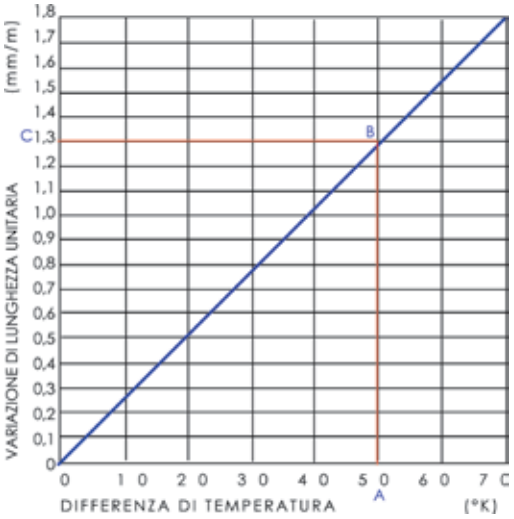
ΔT = difference between the maximum operating temperature and ambient temperature at time of installation °C

EXAMPLE:

One must calculate the ΔL expansion of a length of MULTYRAMA pipe ø 20X2.5 at 8 m length.

T amb = 20 °C (ambient temperature);
Tmax = 70 °C (max. operating temperature);
L = 8 m;
whereby:
$\Delta L = \alpha \cdot L \cdot \Delta T = 0.026 \cdot 8 \cdot (70-20) = 10.4$ mm

To graphically calculate expansions of MULTYRAMA, the following diagram can be used:



Once the size of the expansion has been determined, if the installation has been mounted externally, it is necessary to use fixed points, slip points and, possibly, expansion arms to impede damage to pipe following changes in length.

9. INSTALLATION TECHNIQUES

COMPENSATION USING EXPANSION ARMS

This installation technique confers to the lay out a geometry which allows for the absorption of expansion.

To this end, in correspondence with directional changes (elbows, T's), expansions arms where the pipe can expand during the presence of thermal stress.

The calculation of these expansion arms is performed using the following formula:

$LS = F \cdot \sqrt{\mathbf{D \cdot \Delta L}}$ where:

LS = length of expansion arm in mm

F = material constant (for multilayer = 30)

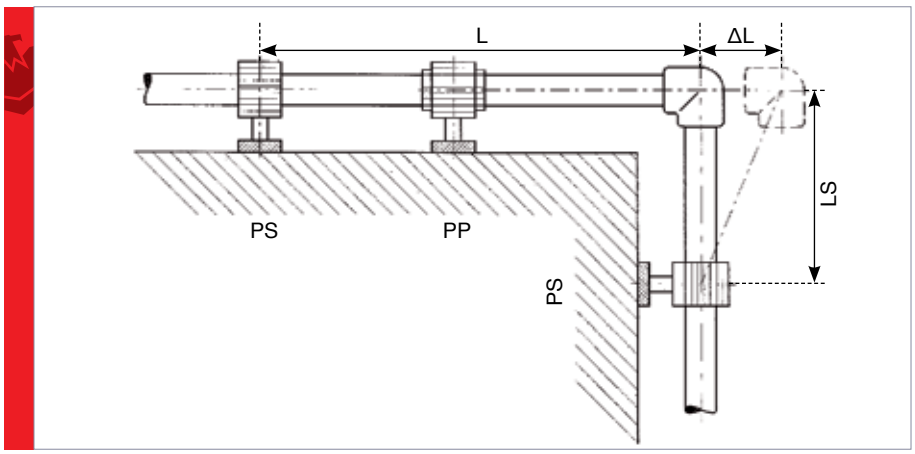
D = external pipe diameter in mm

ΔL = pipe length variation in mm

EXAMPLE:

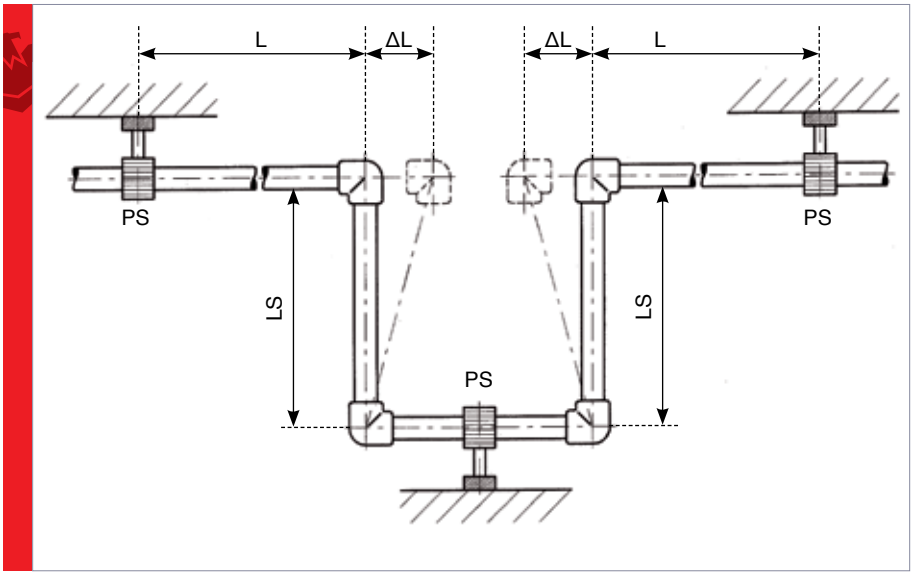
D = 20 mm
L = 8 m
ΔT = 50 °C
From the above example the following is obtained:
ΔL = 10.4 mm where
$LS = F \cdot \sqrt{D \cdot \Delta L} = 30 \cdot \sqrt{(20 \cdot 10.4)} = 433$ mm

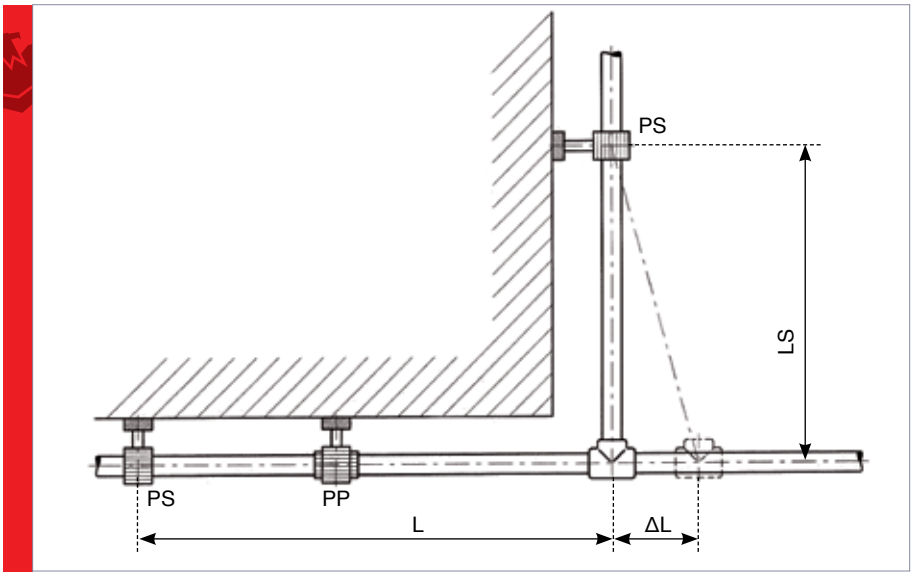
Example of expansion arm



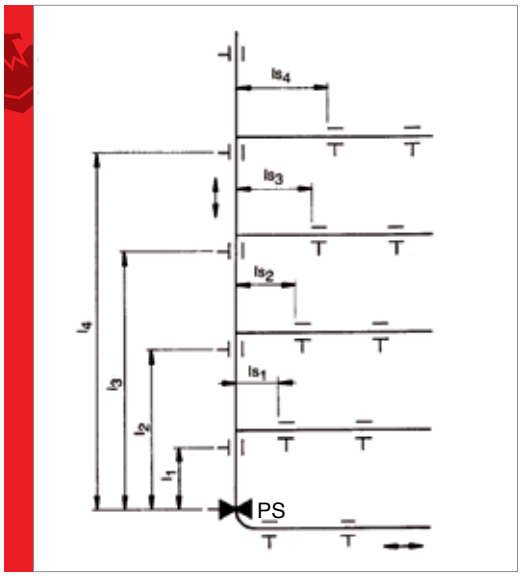
GRAPHICAL EXAMPLES

Below are a few examples of correct external **Multyrama** system installations using various techniques to take into account thermal expansion of material.

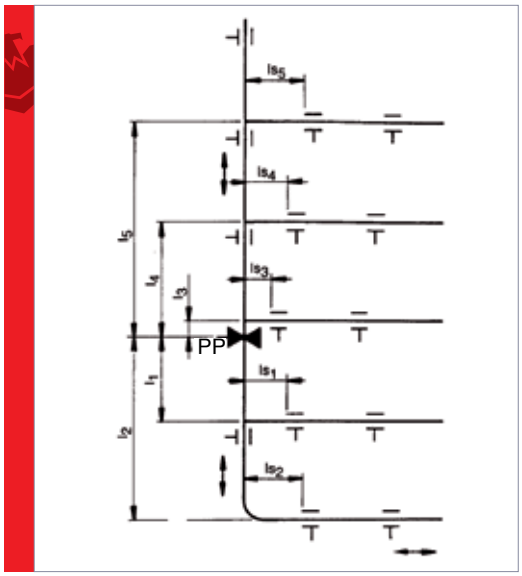




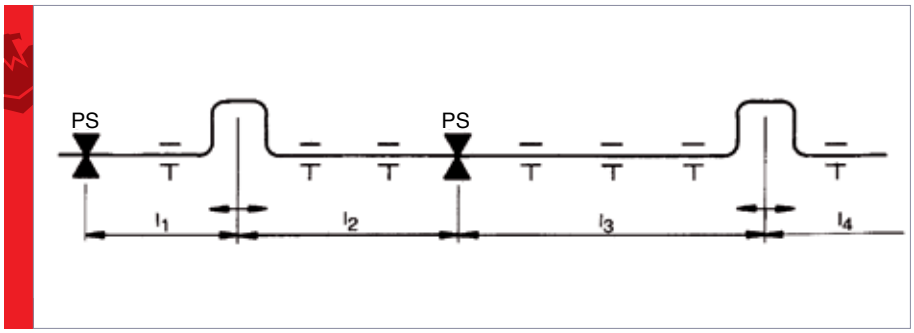
9. INSTALLATION TECHNIQUES



Fixed point at the base of column



Fixed point in the middle area of the column



Absorption of length with compensation ring in a straight conduit

10. THERMAL INSULATION

Italian Law 10/91, relevant to energy savings and the Presidential decree 412/93 dictates that pipes used in the construction of heating systems be covered suitably by insulating material. Obviously, in the case of heating system installations and/or hot water sanitary plumbing systems, insulation acts to avoid dispersion. For air conditioning systems, besides avoiding temperature increases in the fluid conveyed, it impedes the formation of condensation on the pipe's surface due to humidity in the air. At an equal insulation thickness, energy savings are consequently greater as the insulating power is greater and the heat exchange surface is smaller. Legislative Decree 412/93 establishes the minimum thickness values for the insulation as a function of its thermal conductivity and the diameter of the pipe to be insulated. Moreover, the Decree states that the thicknesses given in the following table must be applied:

CASE A - as is, for systems in unheated locations (e.g. garages, cellars, etc.)

CASE B - multiplied by a reductive factor of 0.5 for systems located inside building's perimeter walls.

CASE C - multiplied for reductive factor of 0.3 for systems located in structures not facing the exterior nor near unheated rooms.

Thermal conductivity of insulation w/m-K	External diameter of pipes					
	< 20	from 20 to 39	from 40 to 59	from 60 to 79	from 80 to 99	> 100
0.030	13	19	26	33	37	40
0.032	14	21	29	36	40	44
0.034	15	23	31	39	44	48
0.036	17	25	34	43	47	52
0.038	18	28	37	46	51	56
0.040	20	30	40	50	55	60
0.042	22	32	43	54	59	64
0.044	24	35	46	58	63	69
0.046	26	38	50	62	68	74
0.048	28	41	54	66	72	79
0.050	30	44	58	71	77	84

The pipes supplied by Prandelli with insulation use closed-cell Expanded Polyethylene at thicknesses of 6 and 10 mm with an external Polyethylene film as a barrier against humidity.

11. WARNINGS

INTRODUCTION

The use of Multyrama for of water-heating-sanitary installations offers numerous advantages already mentioned in this guide. For full benefit from these advantages, it is indispensable to fully understand each aspect relating to the product used. Below is a series of important suggestions, indispensible for the correct use of **Multyrama** pipes.

OPERATING CONDITIONS

Use of **Multyrama** in within the working conditions creates no problems whatsoever to the material. To the contrary, exceeding the operation condition limits can prejudice the product's resistance.
For this reason, it is mandatory to take all precautions to avoid this, safeguarding not only the system's integrity but also that of the user.

ULTRA VIOLET RAYS

Multyrama must never be installed or stored in an area exposed to ultra violet rays. Exposure to rays causes the aging of the material with consequent loss of the chemical-physical characteristics it initially has.

CONTACT WITH SHARP OBJECTS

It is necessary to ensure that the pipe's surface does not come into contact with sharp edges which could damage it by causing cuts and scratches. This precaution must also be taken into consideration during installation work as well as during storage. Because of this, use of pipes showing signs of accidental scratches or cuts must be avoided.

FITTINGS WITH FEMALE THREAD

When using transition fittings with female thread, avoid applying high tightening torque when mating with male fittings.

Moreover, we recommend not using an excessive quantity of hemp between the parts to be assembled, nor using alternative materials to hemp such as Teflon or similar.

It must also be considered that the male part has a sufficient length to enable coupling; generally, it is auspicious that at least one thread remains outside the coupling.

When the installation requires coupling a fitting or pipe with an iron fitting, we recommend the use of **Multyrama** hardware with male thread to create the link is advisable.

INSTALLATIONS AT AMBIENT TEMPERATURE ≤ 0 °C

Consider that if the fluid conveyed is water, the change of form occurs at the temperature is as follows:

T < 0 °C

liquid (water) ----------> solid (ice)

accompanied by an increase in volume which leads to a greater stress on the pipe. Such stress can reach values which are incompatible with the PE-X characteristics.

For this reason it is necessary to avoid creation of the aforementioned phenomenon, by calling for:

1) for central heating installations:

- emptying if inactive
- addition of anti-freeze (for example in air conditioning systems)
- suitable insulation

2) for sanitary systems:

In this case, hygiene requirements exclude all possibility of lowering the ice level by way of added additives and must, as a consequence, prevalently operate on the degree of insulation of the pipes and, for the more exposed tracks, create recycling rings.

NOTE: Very often the pipe's insulation is erroneously interpreted as being a solution of certain reliability over a period of time, suitable to ward off the danger of reaching the freezing point.

It is also opportune to take into account that insulation represents a barrier whose aim is essentially to delay the creation of such a phenomenon and certainly not to exclude it entirely.

CURVATURE IN NEAR JOINT

Pipe bending must be avoided once the system has been assembled, puts the joint under lever, stressing the pipe until it is cut.

Curving of the pipe should always precede assembly and the pipe section immediately prior to the joint must be aligned with the axis of the joint.

12. TESTING OF SYSTEM

PROCEDURE

Testing of installation (according to ENV12108:2001 standard) is fundamental in securing a good outcome of the work carried out. In fact, this is done to ascertain that, for whatever cause, the system installed has no leaks.
The operations to perform are the following:

- Visual inspection of pipes and fittings
In this way, the installation of the pipes and connecters can be checked for proper installation and that there are no parts that have been accidentally damaged by sharp points.

- Hydraulic seal test
This is carried out on installations when they are still directly accessible by filling the same with water at room temperature and carefully releasing the air present.

1. Once filled and with the system closed, put it under pressure for a 30 minute seal test (if a decrease in pressure is registered due to settling of pipes, reset pressure at 10 minute intervals).

2. Read the pressure value by using the equipment with 0.1 bar precision, after 30 minutes read the pressure value after a further 30 minutes: if the variation is less than 0.6 bar the installation does not have any leaks. Continue the test for 2 hours more.

12. TESTING OF SYSTEM

3. Read the pressure value after 2 hours, if the pressure falls more than 0.2 bar, there is a leak in the system, otherwise the test is positive.

For some parts of the system, the interventions indicated in point 3 can be omitted.

TEST PRESSURE = MAXIMUM WORKING PRESSURE x 1.5

An appropriate use of Multyrama pipes and fittings, together with a careful test, will avoid any problems including those in sections or systems for conveying hot water.

NOTE When the test has been completed, the pressure is released. At times it is suitable to empty the system completely, especially if it is constructed in areas subject to reaching temperatures that reach or fall below 0 °C.
The objective of this warning is to avoid unexpected damage due to formation of ice in installations that are presumed to be tested already and free of any inconveniences.

PRESSURE DROP DIAGRAMS

To use the graph, it is necessary to fix at least two sizes, of which one is the dimension of the pipe and the second is usually the weight or the speed.

Water temperature at 20 ° C

Pipe: ø 16 x 2,25

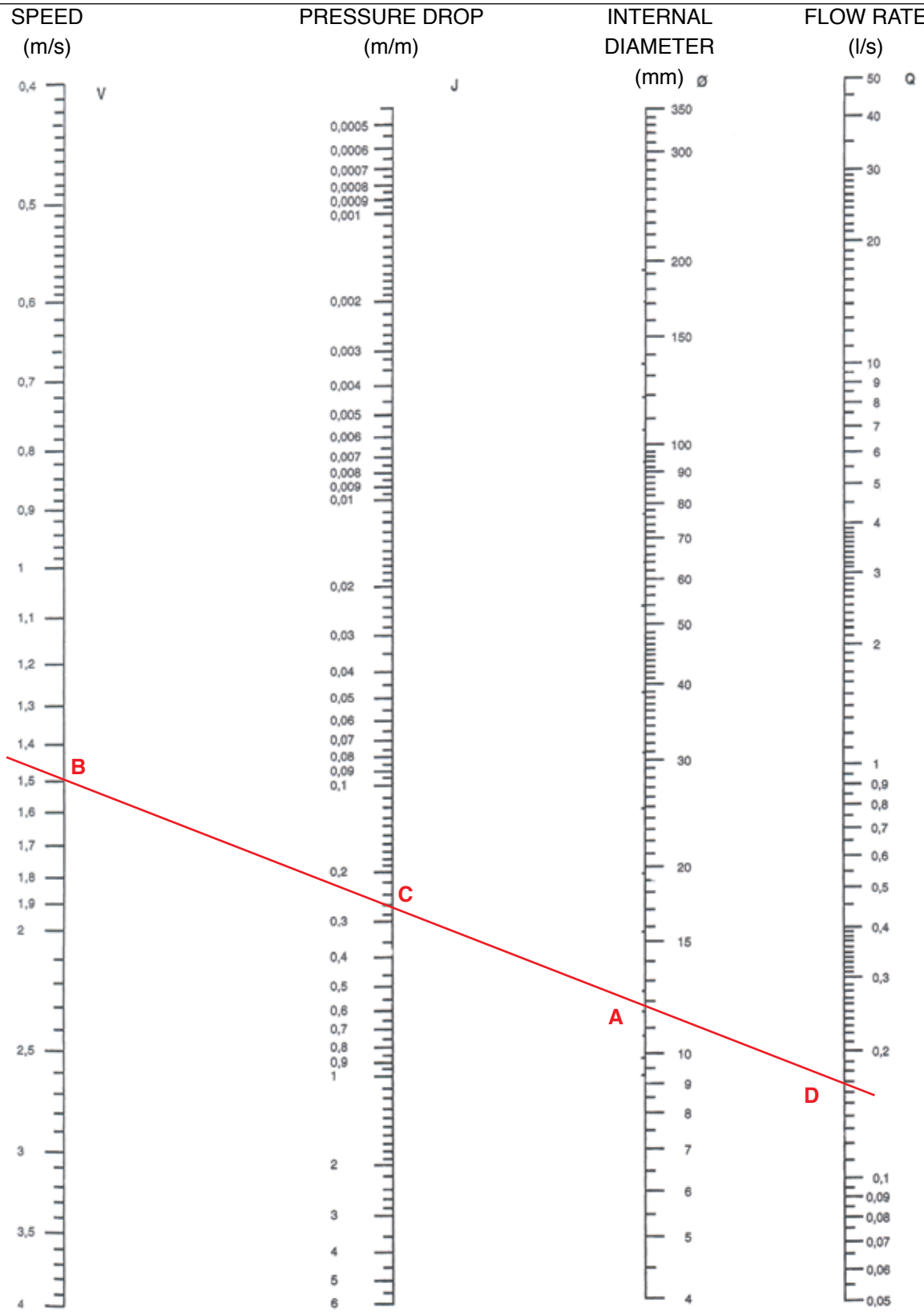
ø int. = mm 11.5 (point A)

Speed 1.5 m/s (point B)

Connecting with a line points A and B, points C and D are identified which respectively indicate a loss of pressure J = 0.26 m/m and a flow rate Q = 0.17 l/s.

13. PRESSURE DROPS

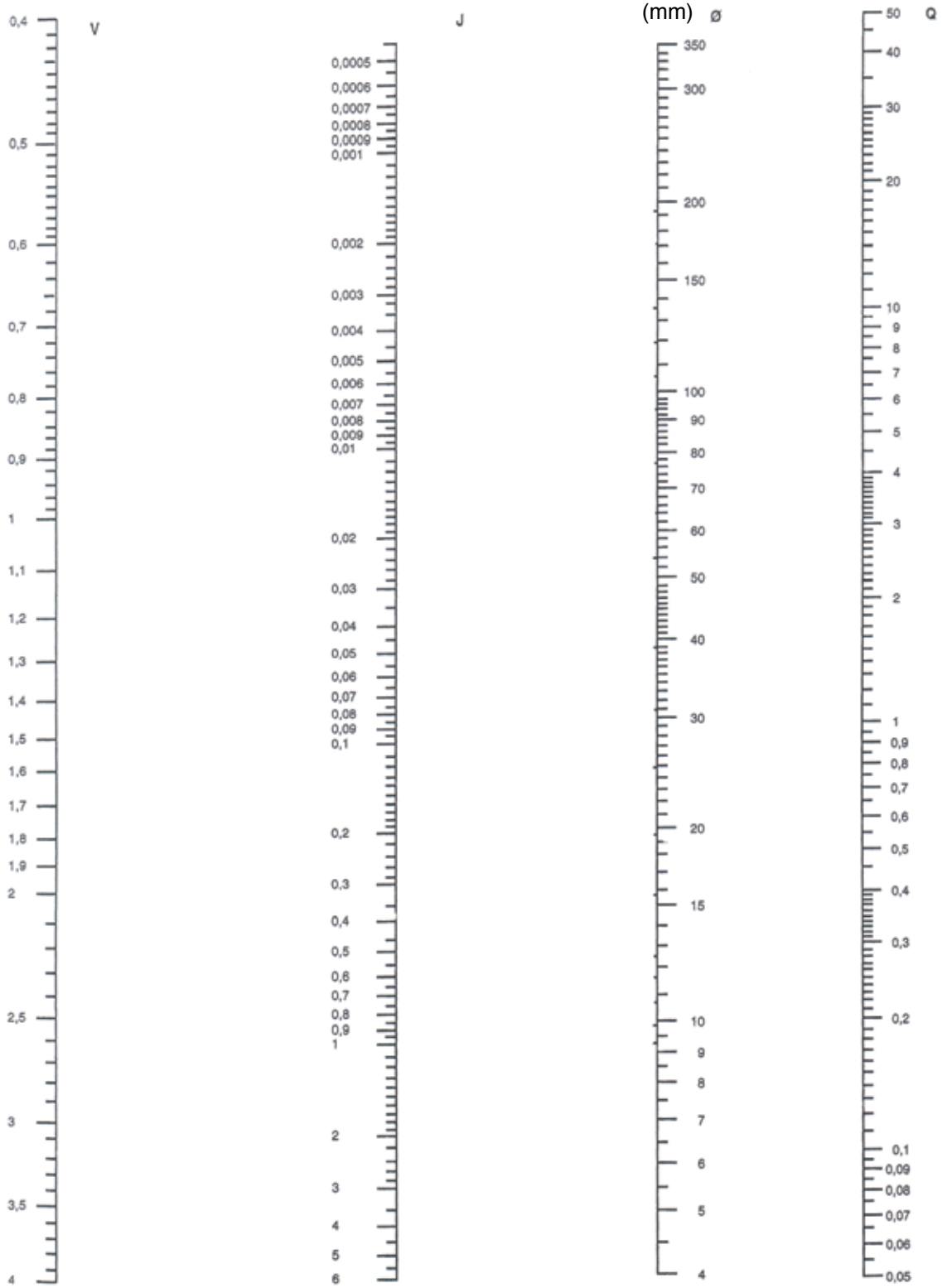
WATER TEMPERATURE 20 °C



13. PRESSURE DROPS

WATER TEMPERATURE 60 °C

SPEED (m/s) | PRESSURE DROP (m/m) | INTERNAL DIAMETER (mm) | FLOW RATE (l/s)



NOTES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