INSTAPLAST

pipelife.cz

PP-R/PP-RCT SYSTEM INSTAPLAST

System for distribution of potable, cold and hot water.
Can be used for the distribution of compressed air.

PIPELIFE
always part of your life

we are wienerberger

CONTENT

1.
PP-R/PP-RCT SYSTEM INSTAPLAST

1.1. ADVANTAGES OF THE SYSTEM

- Wide range of pipes for different applications
- Wide range of fittings in the pressure range of S2,5
- Substitution of steel pipes by plastic ones results in considerably positive ecological and economical indicators
- Minimal service life in case of correct application: 50 years
- Hygienically harmless, it is not susceptible to corrosion
- Installation is simple, clean and quick
- Easy handling due to low weight
- Low noisiness
- The system complies with the standards for classification as “Environment friendly product”

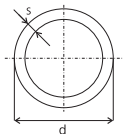
1.2. PIPES

1.2.1. PIPES FROM PP-R

PP-R S5 / S3,2 / S2,5

Pipes from the standard PP-R.
Permissible pressure load depends on the wall thickness. Former pressure range classification according to EN ISO 15874 moves from PN to the S (series) range.

$$\text{Marking } S = \frac{d - s}{2s} = \frac{SDR - 1}{2}$$



1.2.2. PIPES FROM PP-RCT

UNIBETA

UNIBETA pipes are all plastic pipes from innovative material PP-RCT. Special process of nucleation improves the crystalline structure of random copolymer PP-R. Through this process, the material gains far better pressure and temperature characteristics.

CARBO^{CRP}

CARBO^{CRP} are three-layer pipes, **wherein the outer and inner layer are made of PP-RCT. The middle layer contains compound of carbon fiber (CF)**.
Advantages of CARBO^{CRP} pipes

- Temperature resistant up to 90 °C
- Higher pressure resistance at high temperatures of up to 50 %
- Higher flow up to 20 %
- Even smaller thermal linear expansion
- No need to peel before welding

CARBO oxy^{CRP}

The highest range of pipes from PP-R/PP-RCT system INSTAPLAST. The construction of the pipe is three-layer. The outer and inner layers are made of PP-RCT. The middle layer contains a carbon compound (CF) and special additives (SA). This middle layer forms oxygen barrier - prevents entering of oxygen from the environment hrough the wall of the pipe to the heat transfer/cooling medium. This protects the sensitive parts in a closed circuit (boiler, exchanger, pump) against corrosion.

You will find this pipe and suitable use, as well as technical documents and installation instructions, in the separate PP-RCT catalog INSTAPLAST system for heating and cooling circuits.

1.2.3. OVERVIEW OF PIPES

TYPES OF PIPES AND THEIR USE

	Pipe type	Scope of application					
		Cold water	Hot water	Heating I (max. 70 °C)	Heating II (max. 90 °C)	Air	Cooling
	PP-R S5	■					
	PP-R S3,2	■	■				■
	PP-R S2,5	■	■	■		■	■
	UNIBETA	■	■	■		■	■
	CARBO^{CRP}	■	■	■	■	■	■
	CARBO oxy^{CRP} HEAT/COOL	■	■	■	■	■	■
	CARBO oxy^{CRP} HEAT	■	■	■	■	■	■
	CARBO oxy^{CRP} COOL	■				■	■

TYPES OF PIPES – BASIC CHARACTERISTICS

Pipe type	More information						
	Pressure range Dimension range	Material	Pressure resistance according to class 2 (hot water 70 °C)	Pressure resistance according to class 5 (heating water 90 °C)	Coefficient of thermal linear expansion	Lifetime	Guarantee
PP-R S5	S5 (PN10) Ø 20 - 110	PP-R	-	-	0,150 mm/(m.K)	50 years	10 years
PP-R S3,2	S3,2 (PN16) Ø 20 - 110	PP-R	6 bar	-	0,150 mm/(m.K)	50 years	10 years
PP-R S2,5	S2,5 (PN20) Ø 20 - 110	PP-R	8 bar	6 bar	0,150 mm/(m.K)	50 years	10 years
UNIBETA	S3,2 Ø 16 S4 Ø 20 - 125 S5 Ø 160 - 200	PP-RCT	8 bar	6 bar	0,150 mm/(m.K)	50 years	10 years
CARBO^{CRP}	S3,2 Ø 20 - 63 S4 Ø 75 - 125	PP-RCT/PP-RCT+CF/ PP-RCT	10 bar	8 bar	0,045 mm/(m.K)	50 years	10 years
CARBO oxy^{CRP} HEAT/COOL	S3,2 Ø 20 - 32	PP-RCT/PP-RCT+ CF+SA/PP-RCT	10 bar	8 bar	0,045 mm/(m.K)	50 years	10 years
CARBO oxy^{CRP} HEAT	S4 Ø 40 - 125	PP-RCT/PP-RCT+ CF+SA/PP-RCT	10 bar	8 bar	0,045 mm/(m.K)	50 years	10 years
CARBO oxy^{CRP} COOL	S5 Ø 40 - 125	PP-RCT/PP-RCT+ CF+SA/PP-RCT	-	-	0,045 mm/(m.K)	50 years	10 years

1.3. FITTINGS

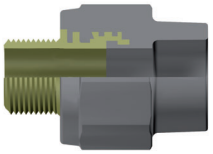
The fittings correspond to the dimension ranges of pipes. They are produced in the highest pressure range S 2.5 (PN 20) and therefore are suitable for all piping of PP-R/PP-RCT system INSTAPLAST.

Plastic fittings differ from each other depending on the application and function in the system. They may be simply divided to:

- Full plastic fittings which forms the basis of the system (T-pieces, elbows, pipe couplings, reductions, blinders, plugs etc.)
- Combined fittings for connecting threaded parts of pipes, fittings (DG transitions with metal plugs or with combined threads, bulkheads, flanged collars, etc.)
- Plastic shut-off valves - direct and, ball valves
- Additional elements (clips, crossings, dilatation loops)

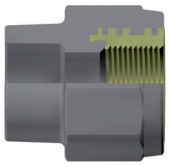
DG-coupling MZV

Coupling with external brass thread. The brass thread is full nickel plated, new technology with internal transit injected with plastic material - possible to use for distribution of cold and hot water. There are manufactured also as elbows and T-pieces MZV.



DG-coupling MZD

Coupling with internal brass nickel plated thread, possible to use for cold and hot water distribution. There are manufactured also as elbows and T-pieces MZD or wall-mounted pieces.



1.4. OPERATING CONDITIONS ACCORDING TO ISO 10508

Class of use and maximal operating pressures are printed on each pipe.

Class	Lifetime	Service life	Operating temperature [°C]	Application	PP-R		PP-RCT		
					S2,5 (PN20) SDR 6	S3,2 (PN16) SDR 7,4	S3,2 SDR 7,4	S4 SDR 9	S5 SDR 11
					Maximal operating pressure [bar]				
1	50 years	49 years	60	hot water 60 °C	10	8	10	8	6
		1 year	80						
	Tmal/service life Tmal	100 hours	95						
2	50 years	49 years	70	hot water 70 °C	8	6	10	8	6
		1 year	80						
	Tmal/service life Tmal	100 hours	95						
4	50 years	2,5 years	20	underfloor heating low temperature radiators	10	10	10	8	6
		20 years	40						
		25 years	60						
		2,5 years	70						
	Tmal/service life Tmal	100 hours	100						
5	50 years	14 years	20	high temperature radiators	6	-	8	6	-
		25 years	60						
		10 years	80						
		1 year	90						
	Tmal/service life Tmal	100 hours	100						

1.5. PIPE DIMENSIONS FOR WATER DISTRIBUTION ACC. TO STANDARD EN ISO 15874

Dimension [mm]	Wall thickness of the pipe [mm]*						
	PP-R			UNIBETA	CARBO^{CRP}	CARBO oxy^{CRP} HEAT	CARBO oxy^{CRP} COOL
	S5 (PN10)	S3,2 (PN16)	S2,5 (PN20)	S3,2/S4/S5*	S3,2/S4*	S3,2/S4	S3,2/S5
16	-	-	-	2,2	-	-	-
20	1,9	2,8	3,4	2,3	2,8	2,8	
25	2,3	3,5	4,2	2,8	3,5	3,4	
32	2,9	4,4	5,4	3,6	4,4	4,4	
40	3,7	5,5	6,7	4,5	5,5	4,5	3,7
50	4,6	6,9	8,3	5,6	6,9	5,6	4,6
63	5,8	8,6	10,5	7,1	8,6	7,1	5,8
75	6,8	10,3	12,5	8,4	8,4	8,4	6,8
90	8,2	12,3	15,0	10,1	10,1	10,1	8,2
110	10,0	15,1	18,3	12,3	12,3	12,3	10,0
125	-	-	-	14,0	14,0	14,0	11,4
160	-	-	-	14,6	-	-	-
200	-	-	-	18,2	-	-	-

Note: In water at temperature of 30 °C - 50 °C, there is a proliferation of bacteria, incl. type Legionella. Owing to this fact, we recommend to perform regularly a short-term overheating of hot water tanks from 60 °C up to 70 °C. Therefore exceptionally the pipes of S2,5 pressure range (PN20), UNIBETA, CARBO^{CRP} or CARBO oxy^{CRP} should be used.

1.6. MATERIAL OF THE SYSTEM

We use **PP-R** (PP-polypropylene type 3 random, gray) and **PP-RCT** material for the production of INSTAPLAST. It gets a much better **pressure and temperature properties** due to a special process of nucleation, which improves the crystalline structure of random copolymer PP-R.

System PP-R/PP-RCT system INSTAPLAST is manufactured according to the standard EN ISO 15874.

Material properties		PP-R	PP-RCT
Density [kg/m^3]		900-910	905
The melt flow index MFI 230 / 2.16 [g/10 min]		0,30	0,30
Notched impact strength (Charpy) [kJ/m^2]	**23 °C**	31	40
	-20 °C	2,2	2,0
Shear modulus [N/mm^2]		400	-
Tensile modulus [N/mm^2]		900	900
Elongation at yield [%]		12	100
Tensibility [%]		200	-
Yield strength [N/mm^2]		26	25
Absorbency [%/7 days]		0,03	-
Coefficient of thermal linear expansion [mm/(m.K)]		0,15	0,15
Coefficient of thermal conductivity W/(m.K)		0,24	0,24

1.7. CHEMICAL RESISTANCE

Pipes and fittings made of PP-R and PP-RCT are suitable for transporting all substances to it do not violate. It resists the action of radon. It is not resistant to long-term operation of a number of some concentrated petroleum products. Transported the medium may have a pH in the range of 2 to 12, i.e. water may show both acidic and basic reactions. The pipes can be used for a wide range of reaction fluids in various industries, they are not recommended for the transport of oxidizing media or for long-term use of pipelines for the transport of disinfectant solutions.

To determine the suitability for the transport of chemicals other than water, we have a separate brochure - **Chemical resistance of plastic materials.**

When transporting media other than water, it must be remembered that the service life of the pipeline here can decrease much more significantly with increasing temperature.

1.8. SYSTEM DESINFECTION

Thermal disinfection of the system
In the case of thermal disinfection to prevent legionella bacteria, we recommend disinfecting with a duration of min. 3 minutes and water at 70 °C throughout the system.
Chemical disinfection of the system
Disinfection of the system must be applied only in case of proven contamination.In the case of impact disinfection, it is permitted to load plastic pipes twice a year with a free chlorine content of 50 mg/l for a period not exceeding 12 hours.Alternatively, 150 mg/l hydrogen peroxide (H_2O_2) can be used for 24 hours. The temperature must not exceed 30 °C during the disinfection process. The use of a disinfection process, especially for chlorinated water, can have a direct impact on the life of the drinking water system.

1.9. LIFETIME

Molecular structure of plastic material, if it is exposed to permanent influence of tension, shows a slow flow of polymer chains and at the same time their orientation is changed. The first consequence of this effect is that Young's modulus for calculation differs in compliance with the assumed loading time. For a longer time of operation, it is lower than for a short-time operation – also the data result from this fact, as given in the below table of temperature dependability. These are the values taken during long-term laboratory tests which have been already verified by practical use and also are published in EN and ISO standards. Second consenquence of the orientation polymer chains is called relaxation. After the mechanical loading (pressure tension etc.), a strain is developed in the pipe walls. If the force is not effecting permanently, the strain in pipe walls will decrease after some time (is relaxed) to zero, and the pipe behaves then as if it was without any loading. Its strenth does not decrease and the pipe „does not grow old".

The thickness of the pipe walls are determined so, that their strength at the end of the planned lifetime, and during the permanent operation at max. nominal pressure at 20 °C, reached the value which is necessary for the reliable function of the pressure order at maximum operation pressure, and with the determined safety coefficient (see bellow). If the pipe is not operated at max. pressure for the whole time, the lifetime is extended – see the table. The assumed lifetime of the system, when the selection of material, pressure range and the application is correct, is 50 years.

1.10. ECONOMICAL ASPECTS OF USE OF THE PLASTIC PIPES, GENERALLY

The usage of the plastic pipes provides to the user many advantages:

- High resistence against creation of incrustation (self-cleaning ability, permanent flow section).
- Flexibility of the pipes provide resistence to damage during the transport and installation.
- There is no risk of attack by microorganisms. Fungi or the corrosion caused by stray currents.
- Low weight, which allows for faster, more accurate and safer work, decreases the cost for transport and storage.

1.11. ECOLOGY – WASTE

All the materials used for packing of products of Pipelife Czech s.r.o. are classified for the „O" category – other waste. Prisms, boxex, polyethylene foils and Raschel bags may be proposed for the use as secondary recources or may be stored or disposed without any problems in incineration plants. Steel binding strips may be used as an iron scrap.

1.12. USAGE FOR THE OTHER MEDIA

For the industrial distribution media or other liquid bulk and gaseous substances it is necessary to consult the use with us as a producer. In must take into account the chemical resisance of the material, physical characteristics and other circumstances of assembly technology.

1.13. CERTIFICATION

Plastic piping systems delivered by company Pipelife Czech s.r.o. are certified by authorized person according to Act No. 22/1997 Coll. about technical requirements to products, in compliance with the last valid regulation of the Goverment of the Czech Republic. The piping for drinking water complies with the hygienic requirements, in compliance with the valid regulation of Ministry of Health of the Czech Republic. The company Pipelife Czech s.r.o. has introduced, documented and certified the Quality Management System acc. to EN ISO 9001 and the Enviromental Management System acc. to EN ISO 14001.
All valid documents are published on www.pipelife.cz or will be send upon request (please see the end of this document).
System PP-R/PP-RCT system INSTAPLAST is certified in the following countries: Czech Republic (Czech certificate is valid for all countries of European Union), Russia and Ukraine.

1.14. TABLE OF INTERDEPENDENCY OF TEMPERATURE, PRESSURE AND DURABILITY FOR INDIVIDUAL TYPES OF PIPES

Temperature [°C]	Lifetime [years]	PP-R			PP-RCT	
		S5 (PN10)	S3,2 (PN16)	S2,5 (PN20)	UNIBETA • CARBO^{CRP}	
					S4	S3,2
10	1	17,5	27,8	35,1	24,0	30,2
	5	16,5	26,2	33,0	23,2	29,3
	10	16,1	25,6	32,2	22,9	28,9
	25	15,6	24,7	31,1	22,5	28,4
	50	15,2	24,1	30,3	22,2	28,0
20	1	15,0	23,7	29,9	20,9	26,3
	5	14,1	22,3	28,1	20,2	25,4
	10	13,7	21,7	27,4	19,9	25,1
	25	13,2	21,0	26,4	19,6	24,6
	50	12,9	20,4	25,7	19,3	24,3
30	1	12,7	20,2	25,4	18,1	22,7
	5	11,9	18,9	23,8	17,4	22,0
	10	11,6	18,4	23,2	17,2	21,7
	25	11,2	17,7	22,3	16,9	21,2
	50	10,9	17,2	21,7	16,6	20,9
40	1	10,8	17,1	21,6	15,5	19,6
	5	10,1	16,0	20,2	15,0	18,9
	10	9,8	15,5	19,6	14,7	18,6
	25	9,4	15,0	18,8	14,4	18,2
	50	9,2	14,5	18,3	14,2	17,9
50	1	9,1	14,5	18,2	13,3	16,7
	5	8,5	13,5	17,0	12,8	16,1
	10	8,2	13,1	16,5	12,6	15,8
	25	7,9	12,6	15,9	12,3	15,5
	50	7,7	12,2	15,4	12,1	15,2
60	1	7,7	12,2	15,4	11,2	14,2
	5	7,1	11,3	14,3	10,8	13,6
	10	6,9	11,0	13,9	10,6	13,4
	25	6,6	10,5	13,3	10,4	13,1
	50	6,4	10,2	12,9	10,2	12,8
70	1	6,5	10,3	12,9	9,4	11,9
	5	6,0	9,5	12,0	9,1	11,4
	10	5,8	9,2	11,6	8,9	11,2
	25	5,0	8,0	10,0	8,7	10,9
	50	4,2	6,7	8,5	8,5	10,7
80	1	5,4	8,6	10,8	7,9	9,9
	5	4,8	7,6	9,6	7,5	9,5
	10	4,0	6,4	8,1	7,4	9,3
	25	3,2	5,1	6,5	7,2	9,1
95	1	3,8	6,1	7,6	5,9	7,4
	5	2,6	4,1	5,2	5,6	7,1

cold water hot water hot & cold water

Values in the table for PP-R, UNIBETA and CARBO^{CRP} pipes are determined using the safety coefficient SF = 1.5.

The table clearly shows that higher operating temperatures and operating pressures affect the mechanical properties of the pipeline and thus affect the length of its service life.

2. STORAGE AND HANDLING, GUARANTEE CONDITIONS

2.1. STORAGE AND HANDLING

The elements of PP-R/PP-RCT system INSTAPLAST are stored in accordance with ČSN 64 0090, from which some important parts are referred to further below together with the detailed conditions of company Pipelife Czech s.r.o.

- The elements of PP-R/PP-RCT system INSTAPLAST must not be stored outdoor.
- They must not be exposed to permanent direct solar radiation and climatic influences.
- They must be placed under a canopy in a dry and dust-free enviroment.
- They must not be stored together with organic solvents, products containing solvents and other chemicals for which the neutrality to the stored material is not assured (petrol, oil, sulphur etc.).
- They should not be exposed to emission of heat, the distance from heat source must be min. 1 meter.
- Temperature in stores must not exceed the value + 40 °C. Piping for drinking water must not be contaminated during storage.
- **Special care must be taken during manipulation at temperature below 0 °C.**
- The elements of PP-R/PP-RCT system INSTAPLAST must be stored separately, acc. to the type of plastic material, pressure range, shape and dimension.
- They must not be permanently unilateraly stressed, bent and leaned against sharp edges during storage and handling.
- The pipes produced in straight bars must be stored in horizontal position, min. 0.1 m above floors and in layers maximum up to 0.6 m.
- Maximal distance of supports for piping dimensions 16 – 32 mm is 0.25 m, for dimensions 40 – 100 mm it is 0.5 m.
- Supports on which the piping is laid must be so designed that it cannot damage the piping (flat supports). Minimal width of supports beams is 0.05 m.
- The pipes produced in the rolls must be stored in horizontal position, min. 0.1 m above the floor, max. 3 rolls in a pile.
- During the manipulation of elements PP-R/PP-RCT system INSTAPLAST, the packing should not be damaged.
- Individual elements should not be slide over floor or rubbed against sharp edges during handling. Strong shocks should be avoided during the manipulation with them.

2.2. GUARANTEE CONDITIONS OF THE SYSTEM

During the assembly, the combinations with elements which are not suitable for the PP-R/PP-RCT system INSTAPLAST is unacceptable. For the assembly of formed pieces with metal injection, it is not allowed to use hemp, but PFTE tape of sealing mastic Siseal or sealing PTFE thread Loctite.
Storage of the material must comply with storage conditions as given above in this chapter.

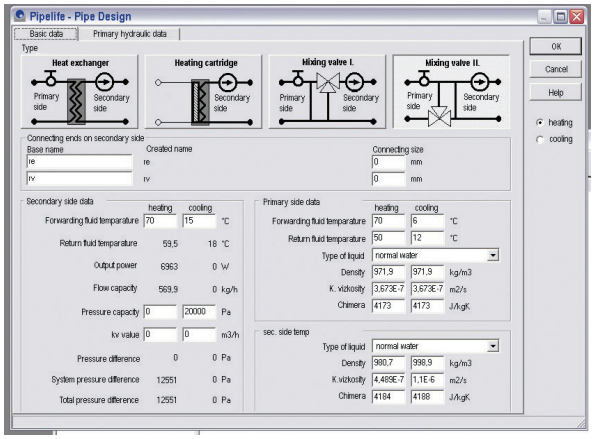
Projecting, assembly and operation must be in compliance with this manual for PP-R/PP-RCT system INSTAPLAST. Assembly of plastic piping may be performedonly by a worker who provable possess a valid certificate of welder D – U7, as the minimum, or certificate of welder for plastic materias Z – U/7, Z – U/V and C – U/V.

3.
DESIGN AND DIMENSIONING PLASTIC PIPES

Of course there will be specifications of required system components and design documentation. Our calculation program is also available a tour contractual designers. In case of your interest inform the sales managers of our company or direcly contact our staff via email:

projekcni.podpora@pipelife.com.

You can use the services of designers who work with SW PROTECH Nový Bor for calculation and design of drinking nd hot water. The database of this SW contains In-house products of Pipelife Czech, incl. PP-R/PP-RCT system INSTAPLAST.



4.
FIRE WATER PIPELINE

Polypropylene piping may be used for distribution of flooded fire-protective mains, if the following conditions are met:

- The piping should be laid lose in areas which are not exposed to higher temperature than 70 °C during fire.
- In other cases (in areas, in which the fire-fighting equipment is available) the piping must be placed in an installation shaft or channel with double fire resistence than is required usually for the installation shafts.
- When it is installed through a fire barrier, the transition through the structure must be additionaly sealed by a material with the lowest flamability. The sealing structure must have fire-protective resistance as high as is the fire-protective resistance of the structure through which the distribution system passes. However, the resistance is not required there higher than 60 minutes. If the passing piping has the inside cross section up to 8.000 mm^2 , then no further measures are required.

5. PRESSURE LOSSES

5.1. PRESSURE LOSS CALCULATION

Pressure losses in the pipeline Δp_{RF} [kPa] are determined by the following formula:

$$\Delta p_{RF} = \sum_{j=1}^{n} [l_j \cdot R_j + \Delta p_{Fj}]$$

- l length of the pipe section [m]
- R longitudinal pressure losses due to friction [kPa/m]
- Δp_{Fj} pressure loss due to local resistance in the respective section [kPa]
- n number of pipe sections

Longitudinal pressure losses due to friction R [kPa/m] were determined by the formula:

$$R = \frac{\lambda}{d_i} \cdot \frac{v^2}{2000} \cdot \rho$$

- d_i inner diameter of pipe [m]
- λ friction coefficient [-]
- v water velocity in the pipe [m/s]
- ρ water density [kg/m³] depending on the water temperature T [°C].
  - ρ = 999,3 [kg/m³] at T = 10 °C
  - ρ = 987,9 [kg/m³] at T = 50 °C
  - ρ = 971,8 [kg/m³] at T = 80 °C

The pressure loss due to local resistance (fittings and fixtures) Δp_F [kPa] is determined by:

$$\Delta p_F = \frac{v^2}{2000} \cdot \rho \cdot \sum_{i=1}^{m} \xi_1$$

- v water velocity in the duct [m/s]
- ρ water density [kg/m³] depending on the water temperature T [°C]
  - ρ = 999,3 [kg/m³] at T = 10 °C
  - ρ = 987,9 [kg/m³] at T = 50 °C
  - ρ = 971,8 [kg/m³] at T = 80 °C
- ξ resistance coefficient

Individual resistance coefficients are determined by the test. It is therefore a purely empirical values which may fluctuate significantly. The values in the table are "proven in practice" to be the best basis for calculation the pressure loss in the piping system.

To calculate the total piping head loss, it is necessary to count with great care all the individual parts. From our experience it is recommended recording various independent components into the table.

5.2. PRESSURE LOSS IN FITTING (CONNECTING FITTING)

Resistance coefficient (depending on geometry)

Pipe coupling	ξ = 0,2
Reduction	ξ = 0,55
Elbow 90°	ξ = 1,5
T-piece	ξ = 1,1
T-piece branch	ξ = 1,5
Reducing T-piece	ξ = 1,1
Reducing T-piece branch	ξ = 4,3
Metal - plastic coupling	ξ = 0,4
Metal - plastic reducing coupling	ξ = 8,3

5.3. TABLES OF PRESSURE LOSSES

PP-R S5 (PN10) PIPES

water temperature = 10 °C

	20 × 1,9 mm		25 × 2,3 mm		32 × 2,9 mm		40 × 3,7 mm		50 × 4,6 mm		63 × 5,8 mm		75 × 6,8 mm		90 × 8,2 mm		110 × 10 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,006	0,1																
0,02	0,020	0,1	0,006	0,1														
0,03	0,041	0,2	0,012	0,1	0,003	0,1												
0,04	0,067	0,2	0,019	0,1	0,006	0,1												
0,05	0,099	0,3	0,029	0,2	0,008	0,1	0,003	0,1										
0,06	0,137	0,3	0,039	0,2	0,011	0,1	0,004	0,1										
0,07	0,180	0,4	0,052	0,2	0,015	0,1	0,005	0,1	0,002	0,1								
0,08	0,227	0,4	0,065	0,3	0,019	0,2	0,006	0,1	0,002	0,1								
0,09	0,280	0,5	0,080	0,3	0,023	0,2	0,008	0,1	0,003	0,1								
0,10	0,337	0,5	0,097	0,3	0,028	0,2	0,009	0,1	0,003	0,1								
0,12	0,465	0,6	0,133	0,4	0,038	0,2	0,013	0,1	0,004	0,1	0,001	0,1						
0,14	0,611	0,8	0,175	0,4	0,050	0,3	0,017	0,2	0,006	0,1	0,002	0,1						
0,16	0,774	0,9	0,222	0,5	0,063	0,3	0,022	0,2	0,007	0,1	0,002	0,1	0,001	0,1				
0,18	0,954	1,0	0,273	0,6	0,078	0,3	0,027	0,2	0,009	0,1	0,003	0,1	0,001	0,1				
0,20	1,150	1,1	0,329	0,6	0,094	0,4	0,032	0,2	0,011	0,2	0,004	0,1	0,002	0,1				
0,30	2,370	1,6	0,674	1,0	0,192	0,6	0,065	0,4	0,022	0,2	0,007	0,1	0,003	0,1	0,001	0,1		
0,40	3,971	2,1	1,124	1,3	0,319	0,8	0,108	0,5	0,037	0,3	0,012	0,2	0,005	0,1	0,002	0,1	0,001	0,1
0,50	5,939	2,7	1,675	1,6	0,474	0,9	0,160	0,6	0,055	0,4	0,018	0,2	0,008	0,2	0,003	0,1	0,001	0,1
0,60	8,266	3,2	2,322	1,9	0,655	1,1	0,221	0,7	0,076	0,5	0,025	0,3	0,011	0,2	0,005	0,1	0,002	0,1
0,70			3,064	2,2	0,863	1,3	0,291	0,8	0,099	0,5	0,033	0,3	0,014	0,2	0,006	0,2	0,002	0,1
0,80			3,900	2,5	1,095	1,5	0,369	1,0	0,126	0,6	0,042	0,4	0,018	0,3	0,008	0,2	0,003	0,1
0,90			4,826	2,9	1,352	1,7	0,455	1,1	0,155	0,7	0,051	0,4	0,022	0,3	0,009	0,2	0,004	0,1
1,00			5,844	3,2	1,634	1,9	0,549	1,2	0,187	0,8	0,062	0,5	0,027	0,3	0,011	0,2	0,004	0,2
1,20					2,269	2,3	0,760	1,4	0,258	0,9	0,085	0,6	0,037	0,4	0,015	0,3	0,006	0,2
1,40					2,998	2,6	1,001	1,7	0,340	1,1	0,112	0,7	0,049	0,5	0,020	0,3	0,008	0,2
1,60					3,819	3,0	1,273	1,9	0,431	1,2	0,142	0,8	0,062	0,5	0,026	0,4	0,010	0,3
1,80					4,732	3,4	1,574	2,2	0,532	1,4	0,175	0,9	0,076	0,6	0,031	0,4	0,012	0,3
2,00							1,903	2,4	0,642	1,5	0,211	1,0	0,092	0,7	0,038	0,5	0,014	0,3
2,20							2,262	2,6	0,762	1,7	0,250	1,1	0,108	0,7	0,045	0,5	0,017	0,3
2,40							2,649	2,9	0,891	1,8	0,292	1,2	0,126	0,8	0,052	0,6	0,020	0,4
2,60							3,064	3,1	1,029	2,0	0,337	1,3	0,146	0,9	0,060	0,6	0,023	0,4
2,80							3,507	3,4	1,176	2,1	0,385	1,3	0,166	1,0	0,069	0,7	0,026	0,4
3,00									1,332	2,3	0,436	1,4	0,188	1,0	0,078	0,7	0,030	0,5
3,20									1,497	2,4	0,489	1,5	0,211	1,1	0,087	0,8	0,033	0,5
3,40									1,671	2,6	0,545	1,6	0,235	1,2	0,097	0,8	0,037	0,5
3,60									1,854	2,8	0,604	1,7	0,260	1,2	0,107	0,8	0,041	0,6
3,80									2,045	2,9	0,666	1,8	0,287	1,3	0,118	0,9	0,045	0,6
4,00									2,246	3,1	0,731	1,9	0,314	1,4	0,129	0,9	0,049	0,6
4,20									2,454	3,2	0,798	2,0	0,343	1,4	0,141	1,0	0,054	0,7
4,40									2,672	3,4	0,868	2,1	0,373	1,5	0,153	1,0	0,058	0,7
4,60									2,898	3,5	0,940	2,2	0,404	1,6	0,166	1,1	0,063	0,7
4,80											1,016	2,3	0,436	1,6	0,179	1,1	0,068	0,8
5,00											1,093	2,4	0,469	1,7	0,193	1,2	0,073	0,8

PP-R S5 (PN10) PIPES

water temperature = 50 °C

	20 × 1,9 mm		25 × 2,3 mm		32 × 2,9 mm		40 × 3,7 mm		50 × 4,6 mm		63 × 5,8 mm		75 × 6,8 mm		90 × 8,2 mm		110 × 10 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,005	0,1																
0,02	0,016	0,1	0,005	0,1														
0,03	0,033	0,2	0,009	0,1	0,003	0,1												
0,04	0,055	0,2	0,016	0,1	0,004	0,1												
0,05	0,081	0,3	0,023	0,2	0,007	0,1	0,002	0,1										
0,06	0,112	0,3	0,032	0,2	0,009	0,1	0,003	0,1										
0,07	0,147	0,4	0,042	0,2	0,012	0,1	0,004	0,1	0,001	0,1								
0,08	0,186	0,4	0,053	0,3	0,015	0,2	0,005	0,1	0,002	0,1								
0,09	0,229	0,5	0,065	0,3	0,019	0,2	0,006	0,1	0,002	0,1								
0,10	0,277	0,5	0,079	0,3	0,023	0,2	0,008	0,1	0,003	0,1								
0,12	0,383	0,6	0,109	0,4	0,031	0,2	0,011	0,1	0,004	0,1	0,001	0,1						
0,14	0,505	0,8	0,143	0,4	0,041	0,3	0,014	0,2	0,005	0,1	0,002	0,1						
0,16	0,642	0,9	0,182	0,5	0,052	0,3	0,018	0,2	0,006	0,1	0,002	0,1	0,001	0,1				
0,18	0,793	1,0	0,224	0,6	0,064	0,3	0,022	0,2	0,007	0,1	0,002	0,1	0,001	0,1				
0,20	0,959	1,1	0,271	0,6	0,077	0,4	0,026	0,2	0,009	0,2	0,003	0,1	0,001	0,1				
0,30	2,003	1,6	0,561	1,0	0,158	0,6	0,053	0,4	0,018	0,2	0,006	0,1	0,003	0,1	0,001	0,1		
0,40	3,396	2,1	0,943	1,3	0,264	0,8	0,089	0,5	0,030	0,3	0,010	0,2	0,004	0,1	0,002	0,1	0,001	0,1
0,50	5,132	2,7	1,417	1,6	0,394	0,9	0,132	0,6	0,045	0,4	0,015	0,2	0,006	0,2	0,003	0,1	0,001	0,1
0,60	7,206	3,2	1,978	1,9	0,548	1,1	0,183	0,7	0,062	0,5	0,021	0,3	0,009	0,2	0,004	0,1	0,001	0,1
0,70			2,628	2,2	0,726	1,3	0,242	0,8	0,082	0,5	0,027	0,3	0,012	0,2	0,005	0,2	0,002	0,1
0,80			3,365	2,5	0,926	1,5	0,307	1,0	0,104	0,6	0,034	0,4	0,015	0,3	0,006	0,2	0,002	0,1
0,90			4,188	2,9	1,148	1,7	0,380	1,1	0,128	0,7	0,042	0,4	0,018	0,3	0,008	0,2	0,003	0,1
1,00			5,097	3,2	1,393	1,9	0,460	1,2	0,155	0,8	0,051	0,5	0,022	0,3	0,009	0,2	0,003	0,2
1,20					1,950	2,3	0,642	1,4	0,215	0,9	0,070	0,6	0,030	0,4	0,013	0,3	0,005	0,2
1,40					2,594	2,6	0,851	1,7	0,284	1,1	0,093	0,7	0,040	0,5	0,017	0,3	0,006	0,2
1,60					3,327	3,0	1,087	1,9	0,362	1,2	0,118	0,8	0,051	0,5	0,021	0,4	0,008	0,3
1,80					4,147	3,4	1,351	2,2	0,449	1,4	0,146	0,9	0,063	0,6	0,026	0,4	0,010	0,3
2,00							1,642	2,4	0,545	1,5	0,177	1,0	0,076	0,7	0,031	0,5	0,012	0,3
2,20							1,961	2,6	0,649	1,7	0,210	1,1	0,090	0,7	0,037	0,5	0,014	0,3
2,40							2,306	2,9	0,761	1,8	0,246	1,2	0,105	0,8	0,043	0,6	0,016	0,4
2,60							2,677	3,1	0,882	2,0	0,284	1,3	0,122	0,9	0,050	0,6	0,019	0,4
2,80							3,076	3,4	1,011	2,1	0,325	1,3	0,139	1,0	0,057	0,7	0,022	0,4
3,00									1,149	2,3	0,369	1,4	0,158	1,0	0,064	0,7	0,024	0,5
3,20									1,296	2,4	0,416	1,5	0,177	1,1	0,072	0,8	0,027	0,5
3,40									1,450	2,6	0,464	1,6	0,198	1,2	0,081	0,8	0,031	0,5
3,60									1,613	2,8	0,516	1,7	0,220	1,2	0,089	0,8	0,034	0,6
3,80									1,785	2,9	0,570	1,8	0,242	1,3	0,099	0,9	0,037	0,6
4,00									1,964	3,1	0,626	1,9	0,266	1,4	0,108	0,9	0,041	0,6
4,20									2,152	3,2	0,686	2,0	0,291	1,4	0,118	1,0	0,045	0,7
4,40									2,349	3,4	0,747	2,1	0,317	1,5	0,129	1,0	0,048	0,7
4,60									2,553	3,5	0,811	2,2	0,344	1,6	0,139	1,1	0,053	0,7
4,80											0,878	2,3	0,372	1,6	0,151	1,1	0,057	0,8
5,00											0,947	2,4	0,401	1,7	0,162	1,2	0,061	0,8

PP-R S3,2 (PN16) PIPES

water temperature = 10 °C

	20 × 2,8 mm		25 × 3,5 mm		32 × 4,4 mm		40 × 5,5 mm		50 × 6,9 mm		63 × 8,6 mm		75 × 10,3 mm		90 × 12,3 mm		110 × 15,1 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,008	0,1																
0,02	0,027	0,1	0,009	0,1														
0,03	0,056	0,2	0,019	0,1	0,006	0,1												
0,04	0,093	0,2	0,032	0,2	0,010	0,1	0,003	0,1										
0,05	0,137	0,3	0,047	0,2	0,015	0,1	0,005	0,1										
0,06	0,189	0,4	0,065	0,2	0,020	0,1	0,007	0,1	0,002	0,1								
0,07	0,248	0,4	0,085	0,3	0,027	0,2	0,009	0,1	0,003	0,1								
0,08	0,313	0,5	0,108	0,3	0,034	0,2	0,012	0,1	0,004	0,1								
0,09	0,386	0,6	0,133	0,4	0,041	0,2	0,014	0,1	0,005	0,1	0,002	0,1						
0,10	0,465	0,6	0,160	0,4	0,050	0,2	0,017	0,2	0,006	0,1	0,002	0,1						
0,12	0,641	0,7	0,221	0,5	0,069	0,3	0,023	0,2	0,008	0,1	0,003	0,1	0,001	0,1				
0,14	0,843	0,9	0,290	0,6	0,090	0,3	0,031	0,2	0,010	0,1	0,003	0,1	0,002	0,1				
0,16	1,068	1,0	0,367	0,6	0,114	0,4	0,039	0,2	0,013	0,2	0,004	0,1	0,002	0,1				
0,18	1,316	1,1	0,452	0,7	0,140	0,4	0,048	0,3	0,016	0,2	0,005	0,1	0,002	0,1	0,001	0,1		
0,20	1,588	1,2	0,544	0,8	0,168	0,5	0,058	0,3	0,019	0,2	0,006	0,1	0,003	0,1	0,001	0,1		
0,30	3,277	1,8	1,118	1,2	0,345	0,7	0,118	0,5	0,040	0,3	0,013	0,2	0,006	0,1	0,002	0,1	0,001	0,1
0,40	5,499	2,5	1,868	1,6	0,574	1,0	0,196	0,6	0,066	0,4	0,022	0,2	0,010	0,2	0,004	0,1	0,002	0,1
0,50	8,236	3,1	2,786	2,0	0,854	1,2	0,290	0,8	0,097	0,5	0,032	0,3	0,014	0,2	0,006	0,2	0,002	0,1
0,60			3,869	2,4	1,183	1,4	0,401	0,9	0,134	0,6	0,045	0,4	0,020	0,3	0,008	0,2	0,003	0,1
0,70			5,112	2,8	1,558	1,7	0,528	1,1	0,176	0,7	0,058	0,4	0,026	0,3	0,011	0,2	0,004	0,1
0,80			6,513	3,1	1,980	1,9	0,669	1,2	0,223	0,8	0,074	0,5	0,032	0,3	0,014	0,2	0,005	0,2
0,90			8,071	3,5	2,448	2,2	0,826	1,4	0,275	0,9	0,091	0,6	0,040	0,4	0,017	0,3	0,006	0,2
1,00					2,960	2,4	0,997	1,5	0,332	1,0	0,110	0,6	0,048	0,4	0,020	0,3	0,008	0,2
1,20					4,117	2,9	1,382	1,8	0,459	1,2	0,152	0,7	0,066	0,5	0,028	0,4	0,011	0,2
1,40					5,449	3,4	1,824	2,1	0,604	1,4	0,199	0,9	0,087	0,6	0,037	0,4	0,014	0,3
1,60							2,322	2,5	0,767	1,6	0,253	1,0	0,110	0,7	0,046	0,5	0,018	0,3
1,80							2,874	2,8	0,948	1,7	0,311	1,1	0,136	0,8	0,057	0,5	0,022	0,4
2,00							3,480	3,1	1,145	1,9	0,376	1,2	0,164	0,9	0,069	0,6	0,026	0,4
2,20							4,139	3,4	1,360	2,1	0,446	1,3	0,194	1,0	0,081	0,7	0,031	0,4
2,40									1,591	2,3	0,521	1,5	0,227	1,0	0,095	0,7	0,036	0,5
2,60									1,839	2,5	0,601	1,6	0,261	1,1	0,109	0,8	0,041	0,5
2,80									2,104	2,7	0,686	1,7	0,298	1,2	0,125	0,8	0,047	0,6
3,00									2,385	2,9	0,777	1,8	0,337	1,3	0,141	0,9	0,053	0,6
3,20									2,682	3,1	0,873	2,0	0,379	1,4	0,158	1,0	0,060	0,6
3,40									2,995	3,3	0,974	2,1	0,422	1,5	0,176	1,0	0,067	0,7
3,60									3,324	3,5	1,080	2,2	0,468	1,6	0,195	1,1	0,074	0,7
3,80											1,190	2,3	0,515	1,6	0,215	1,1	0,081	0,8
4,00											1,306	2,4	0,565	1,7	0,235	1,2	0,089	0,8
4,20											1,427	2,6	0,617	1,8	0,257	1,3	0,097	0,8
4,40											1,553	2,7	0,671	1,9	0,279	1,3	0,105	0,9
4,60											1,683	2,8	0,727	2,0	0,302	1,4	0,114	0,9
4,80											1,819	2,9	0,785	2,1	0,326	1,4	0,123	1,0
5,00											1,959	3,1	0,845	2,2	0,361	1,5	0,132	1,0

PP-R S3,2 (PN16) PIPES

water temperature = 50 °C

	20 × 2,8 mm		25 × 3,5 mm		32 × 4,4 mm		40 × 5,5 mm		50 × 6,9 mm		63 × 8,6 mm		75 × 10,3 mm		90 × 12,3 mm		110 × 15,1 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,007	0,1																
0,02	0,022	0,1	0,008	0,1														
0,03	0,045	0,2	0,016	0,1	0,005	0,1												
0,04	0,075	0,2	0,026	0,2	0,008	0,1	0,003	0,1										
0,05	0,112	0,3	0,038	0,2	0,012	0,1	0,004	0,1										
0,06	0,154	0,4	0,053	0,2	0,016	0,1	0,006	0,1	0,002	0,1								
0,07	0,203	0,4	0,070	0,3	0,022	0,2	0,007	0,1	0,002	0,1								
0,08	0,257	0,5	0,088	0,3	0,027	0,2	0,009	0,1	0,003	0,1								
0,09	0,317	0,6	0,108	0,4	0,034	0,2	0,011	0,1	0,004	0,1	0,001	0,1						
0,10	0,382	0,6	0,131	0,4	0,040	0,2	0,014	0,2	0,005	0,1	0,002	0,1						
0,12	0,530	0,7	0,181	0,5	0,056	0,3	0,019	0,2	0,006	0,1	0,002	0,1	0,001	0,1				
0,14	0,698	0,9	0,238	0,6	0,073	0,3	0,025	0,2	0,008	0,1	0,003	0,1	0,001	0,1				
0,16	0,888	1,0	0,302	0,6	0,093	0,4	0,032	0,2	0,011	0,2	0,004	0,1	0,002	0,1				
0,18	1,099	1,1	0,373	0,7	0,115	0,4	0,039	0,3	0,013	0,2	0,004	0,1	0,002	0,1	0,001	0,1		
0,20	1,330	1,2	0,450	0,8	0,138	0,5	0,047	0,3	0,016	0,2	0,005	0,1	0,002	0,1	0,001	0,1		
0,30	2,785	1,8	0,935	1,2	0,285	0,7	0,096	0,5	0,032	0,3	0,011	0,2	0,005	0,1	0,002	0,1	0,001	0,1
0,40	4,731	2,5	1,578	1,6	0,478	1,0	0,161	0,6	0,054	0,4	0,018	0,2	0,008	0,2	0,003	0,1	0,001	0,1
0,50	7,161	3,1	2,376	2,0	0,716	1,2	0,240	0,8	0,080	0,5	0,026	0,3	0,012	0,2	0,005	0,2	0,002	0,1
0,60			3,325	2,4	0,997	1,4	0,334	0,9	0,110	0,6	0,036	0,4	0,016	0,3	0,007	0,2	0,003	0,1
0,70			4,425	2,8	1,322	1,7	0,441	1,1	0,146	0,7	0,048	0,4	0,021	0,3	0,009	0,2	0,003	0,1
0,80			5,675	3,1	1,689	1,9	0,562	1,2	0,185	0,8	0,061	0,5	0,026	0,3	0,011	0,2	0,004	0,2
0,90			7,073	3,5	2,098	2,2	0,696	1,4	0,229	0,9	0,075	0,6	0,033	0,4	0,014	0,3	0,005	0,2
1,00					2,549	2,4	0,843	1,5	0,277	1,0	0,091	0,6	0,039	0,4	0,016	0,3	0,006	0,2
1,20					3,577	2,9	1,178	1,8	0,385	1,2	0,126	0,7	0,055	0,5	0,023	0,4	0,009	0,2
1,40					4,770	3,4	1,565	2,1	0,510	1,4	0,166	0,9	0,072	0,6	0,030	0,4	0,011	0,3
1,60							2,004	2,5	0,650	1,6	0,211	1,0	0,091	0,7	0,038	0,5	0,014	0,3
1,80							2,494	2,8	0,807	1,7	0,261	1,1	0,113	0,8	0,047	0,5	0,018	0,4
2,00							3,036	3,1	0,980	1,9	0,316	1,2	0,136	0,9	0,057	0,6	0,021	0,4
2,20							3,629	3,4	1,168	2,1	0,376	1,3	0,162	1,0	0,067	0,7	0,025	0,4
2,40									1,372	2,3	0,441	1,5	0,190	1,0	0,079	0,7	0,030	0,5
2,60									1,592	2,5	0,511	1,6	0,220	1,1	0,091	0,8	0,034	0,5
2,80									1,828	2,7	0,585	1,7	0,251	1,2	0,104	0,8	0,039	0,6
3,00									2,079	2,9	0,664	1,8	0,285	1,3	0,118	0,9	0,044	0,6
3,20									2,345	3,1	0,748	2,0	0,320	1,4	0,132	1,0	0,050	0,6
3,40									2,627	3,3	0,837	2,1	0,358	1,5	0,148	1,0	0,055	0,7
3,60									2,925	3,5	0,930	2,2	0,398	1,6	0,164	1,1	0,061	0,7
3,80											1,028	2,3	0,439	1,6	0,181	1,1	0,067	0,8
4,00											1,131	2,4	0,483	1,7	0,198	1,2	0,074	0,8
4,20											1,239	2,6	0,528	1,8	0,217	1,3	0,081	0,8
4,40											1,351	2,7	0,575	1,9	0,236	1,3	0,088	0,9
4,60											1,468	2,8	0,624	2,0	0,256	1,4	0,095	0,9
4,80											1,589	2,9	0,676	2,1	0,277	1,4	0,103	1,0
5,00											1,716	3,1	0,729	2,2	0,298	1,5	0,111	1,0

PP-R S2,5 (PN20) PIPES

water temperature = 10 °C

	20 × 3,4 mm		25 × 4,2 mm		32 × 5,4 mm		40 × 6,7 mm		50 × 8,3 mm		63 × 10,5 mm		75 × 12,5 mm		90 × 15,0 mm		110 × 18,3 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,012	0,1																
0,02	0,041	0,1	0,014	0,1	0,004	0,1												
0,03	0,084	0,2	0,028	0,1	0,009	0,1	0,003	0,1										
0,04	0,140	0,3	0,047	0,2	0,015	0,1	0,005	0,1										
0,05	0,207	0,4	0,070	0,2	0,022	0,1	0,007	0,1	0,003	0,1								
0,06	0,286	0,4	0,096	0,3	0,030	0,2	0,010	0,1	0,004	0,1								
0,07	0,375	0,5	0,126	0,3	0,039	0,2	0,013	0,1	0,005	0,1	0,002	0,1						
0,08	0,475	0,6	0,159	0,4	0,050	0,2	0,017	0,1	0,006	0,1	0,002	0,1						
0,09	0,585	0,7	0,196	0,4	0,061	0,3	0,021	0,2	0,007	0,1	0,002	0,1						
0,10	0,704	0,7	0,236	0,5	0,073	0,3	0,025	0,2	0,009	0,1	0,003	0,1	0,001	0,1				
0,12	0,973	0,9	0,325	0,6	0,101	0,3	0,034	0,2	0,012	0,1	0,004	0,1	0,002	0,1				
0,14	1,279	1,0	0,427	0,6	0,133	0,4	0,045	0,3	0,016	0,2	0,005	0,1	0,002	0,1	0,001	0,1		
0,16	1,622	1,2	0,540	0,7	0,168	0,5	0,057	0,3	0,020	0,2	0,006	0,1	0,003	0,1	0,001	0,1		
0,18	2,000	1,3	0,665	0,8	0,206	0,5	0,070	0,3	0,024	0,2	0,008	0,1	0,003	0,1	0,001	0,1		
0,20	2,414	1,5	0,802	0,9	0,249	0,6	0,084	0,4	0,029	0,2	0,010	0,1	0,004	0,1	0,002	0,1		
0,30	4,994	2,2	1,650	1,4	0,510	0,8	0,172	0,5	0,060	0,3	0,019	0,2	0,008	0,2	0,004	0,1	0,001	0,1
0,40	8,397	2,9	2,761	1,8	0,849	1,1	0,286	0,7	0,099	0,5	0,032	0,3	0,014	0,2	0,006	0,1	0,002	0,1
0,50			4,125	2,3	1,264	1,4	0,425	0,9	0,147	0,6	0,048	0,4	0,021	0,3	0,009	0,2	0,003	0,1
0,60			5,735	2,8	1,752	1,7	0,587	1,1	0,203	0,7	0,066	0,4	0,029	0,3	0,012	0,2	0,005	0,1
0,70			7,585	3,2	2,311	2,0	0,773	1,3	0,267	0,8	0,087	0,5	0,038	0,4	0,016	0,2	0,006	0,2
0,80					2,939	2,3	0,981	1,4	0,338	0,9	0,110	0,6	0,048	0,4	0,020	0,3	0,008	0,2
0,90					3,635	2,5	1,211	1,6	0,417	1,0	0,135	0,6	0,059	0,5	0,025	0,3	0,010	0,2
1,00					4,399	2,8	1,463	1,8	0,503	1,2	0,163	0,7	0,071	0,5	0,030	0,4	0,011	0,2
1,20					6,127	3,4	2,031	2,2	0,696	1,4	0,225	0,9	0,097	0,6	0,041	0,4	0,016	0,3
1,40							2,683	2,5	0,917	1,6	0,296	1,0	0,128	0,7	0,054	0,5	0,021	0,3
1,60							3,417	2,9	1,165	1,8	0,375	1,2	0,162	0,8	0,068	0,6	0,026	0,4
1,80							4,233	3,2	1,441	2,1	0,463	1,3	0,200	0,9	0,083	0,6	0,032	0,4
2,00									1,742	2,3	0,559	1,4	0,241	1,0	0,101	0,7	0,039	0,5
2,20									2,070	2,5	0,663	1,6	0,286	1,1	0,119	0,8	0,046	0,5
2,40									2,423	2,8	0,775	1,7	0,334	1,2	0,139	0,8	0,054	0,6
2,60									2,803	3,0	0,894	1,9	0,385	1,3	0,160	0,9	0,062	0,6
2,80									3,208	3,2	1,022	2,0	0,440	1,4	0,183	1,0	0,070	0,7
3,00									3,638	3,5	1,158	2,2	0,498	1,5	0,207	1,1	0,080	0,7
3,20											1,301	2,3	0,559	1,6	0,232	1,1	0,089	0,8
3,40											1,452	2,5	0,623	1,7	0,259	1,2	0,099	0,8
3,60											1,610	2,6	0,691	1,8	0,286	1,3	0,110	0,9
3,80											1,776	2,7	0,761	1,9	0,316	1,3	0,121	0,9
4,00											1,949	2,9	0,835	2,0	0,346	1,4	0,133	1,0
4,20											2,131	3,0	0,912	2,1	0,377	1,5	0,145	1,0
4,40											2,319	3,2	0,992	2,2	0,410	1,6	0,157	1,0
4,60											2,515	3,3	1,075	2,3	0,444	1,6	0,170	1,1
4,80											2,718	3,5	1,161	2,4	0,480	1,7	0,184	1,1
5,00													1,251	2,5	0,516	1,8	0,198	1,2

PP-R S2,5 (PN20) PIPES

water temperature = 50 °C

	20 × 3,4 mm		25 × 4,2 mm		32 × 5,4 mm		40 × 6,7 mm		50 × 8,3 mm		63 × 10,5 mm		75 × 12,5 mm		90 × 15,0 mm		110 × 18,3 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,010	0,1																
0,02	0,034	0,1	0,011	0,1	0,004	0,1												
0,03	0,069	0,2	0,023	0,1	0,007	0,1	0,002	0,1										
0,04	0,114	0,3	0,038	0,2	0,012	0,1	0,004	0,1										
0,05	0,169	0,4	0,057	0,2	0,018	0,1	0,006	0,1	0,002	0,1								
0,06	0,234	0,4	0,078	0,3	0,024	0,2	0,008	0,1	0,003	0,1								
0,07	0,308	0,5	0,102	0,3	0,032	0,2	0,011	0,1	0,004	0,1	0,001	0,1						
0,08	0,390	0,6	0,130	0,4	0,040	0,2	0,014	0,1	0,005	0,1	0,002	0,1						
0,09	0,482	0,7	0,160	0,4	0,050	0,3	0,017	0,2	0,006	0,1	0,002	0,1						
0,10	0,582	0,7	0,193	0,5	0,060	0,3	0,020	0,2	0,007	0,1	0,002	0,1	0,001	0,1				
0,12	0,807	0,9	0,267	0,6	0,082	0,3	0,028	0,2	0,010	0,1	0,003	0,1	0,001	0,1				
0,14	1,065	1,0	0,351	0,6	0,108	0,4	0,037	0,3	0,013	0,2	0,004	0,1	0,002	0,1	0,001	0,1		
0,16	1,356	1,2	0,446	0,7	0,137	0,5	0,046	0,3	0,016	0,2	0,005	0,1	0,002	0,1	0,001	0,1		
0,18	1,679	1,3	0,551	0,8	0,169	0,5	0,057	0,3	0,020	0,2	0,006	0,1	0,003	0,1	0,001	0,1		
0,20	2,033	1,5	0,666	0,9	0,204	0,6	0,069	0,4	0,024	0,2	0,008	0,1	0,003	0,1	0,001	0,1		
0,30	4,273	2,2	1,388	1,4	0,423	0,8	0,141	0,5	0,049	0,3	0,016	0,2	0,007	0,2	0,003	0,1	0,001	0,1
0,40	7,281	2,9	2,348	1,8	0,710	1,1	0,236	0,7	0,081	0,5	0,026	0,3	0,011	0,2	0,005	0,1	0,002	0,1
0,50			3,541	2,3	1,065	1,4	0,353	0,9	0,121	0,6	0,039	0,4	0,017	0,3	0,007	0,2	0,003	0,1
0,60			4,964	2,8	1,486	1,7	0,491	1,1	0,168	0,7	0,054	0,4	0,023	0,3	0,010	0,2	0,004	0,1
0,70			6,616	3,2	1,972	2,0	0,649	1,3	0,221	0,8	0,071	0,5	0,031	0,4	0,013	0,2	0,005	0,2
0,80					2,523	2,3	0,828	1,4	0,281	0,9	0,090	0,6	0,039	0,4	0,016	0,3	0,006	0,2
0,90					3,138	2,5	1,027	1,6	0,348	1,0	0,111	0,6	0,048	0,5	0,020	0,3	0,008	0,2
1,00					3,816	2,8	1,245	1,8	0,421	1,2	0,135	0,7	0,058	0,5	0,024	0,4	0,009	0,2
1,20					5,364	3,4	1,742	2,2	0,587	1,4	0,187	0,9	0,080	0,6	0,033	0,4	0,013	0,3
1,40							2,317	2,5	0,778	1,6	0,247	1,0	0,106	0,7	0,044	0,5	0,017	0,3
1,60							2,971	2,9	0,994	1,8	0,315	1,2	0,135	0,8	0,056	0,6	0,021	0,4
1,80							3,702	3,2	1,235	2,1	0,390	1,3	0,167	0,9	0,069	0,6	0,026	0,4
2,00									1,501	2,3	0,473	1,4	0,202	1,0	0,083	0,7	0,032	0,5
2,20									1,791	2,5	0,563	1,6	0,240	1,1	0,099	0,8	0,038	0,5
2,40									2,106	2,8	0,660	1,7	0,281	1,2	0,116	0,8	0,044	0,6
2,60									2,445	3,0	0,765	1,9	0,325	1,3	0,134	0,9	0,051	0,6
2,80									2,809	3,2	0,877	2,0	0,373	1,4	0,153	1,0	0,058	0,7
3,00									3,197	3,5	0,996	2,2	0,423	1,5	0,174	1,1	0,066	0,7
3,20											1,123	2,3	0,476	1,6	0,195	1,1	0,074	0,8
3,40											1,256	2,5	0,532	1,7	0,218	1,2	0,083	0,8
3,60											1,397	2,6	0,591	1,8	0,242	1,3	0,092	0,9
3,80											1,545	2,7	0,653	1,9	0,267	1,3	0,101	0,9
4,00											1,701	2,9	0,718	2,0	0,293	1,4	0,111	1,0
4,20											1,863	3,0	0,786	2,1	0,321	1,5	0,121	1,0
4,40											2,033	3,2	0,856	2,2	0,349	1,6	0,132	1,0
4,60											2,210	3,3	0,930	2,3	0,379	1,6	0,143	1,1
4,80											2,394	3,5	1,006	2,4	0,410	1,7	0,155	1,1
5,00													1,086	2,5	0,442	1,8	0,167	1,2

PP-R S2,5 (PN20) PIPES

water temperature = 80 °C

	20 × 3,4 mm		25 × 4,2 mm		32 × 5,4 mm		40 × 6,7 mm		50 × 8,3 mm		63 × 10,5 mm		75 × 12,5 mm		90 × 15,0 mm		110 × 18,3 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,01	0,009	1,1																
0,02	0,030	1,1	0,010	0,1	0,003	0,1												
0,03	0,062	0,2	0,021	0,1	0,006	0,1	0,002	0,1										
0,04	0,104	0,3	0,035	0,2	0,011	0,1	0,004	0,1										
0,05	0,155	0,4	0,051	0,2	0,016	0,1	0,005	0,1	0,002	0,1								
0,06	0,214	0,4	0,071	0,3	0,022	0,2	0,007	0,1	0,003	0,1								
0,07	0,282	0,5	0,094	0,3	0,029	0,2	0,010	0,1	0,003	0,1	0,001	0,1						
0,08	0,359	0,6	0,119	0,4	0,037	0,2	0,012	0,1	0,004	0,1	0,001	0,1						
0,09	0,443	0,7	0,146	0,4	0,045	0,3	0,015	0,2	0,005	0,1	0,002	0,1						
0,10	0,536	0,7	0,177	0,5	0,054	0,3	0,018	0,2	0,006	0,1	0,002	0,1	0,001	0,1				
0,12	0,746	0,9	0,245	0,6	0,075	0,3	0,025	0,2	0,009	0,1	0,003	0,1	0,001	0,1				
0,14	0,988	1,0	0,323	0,6	0,099	0,4	0,033	0,3	0,012	0,2	0,004	0,1	0,002	0,1	0,001	0,1		
0,16	1,261	1,2	0,412	0,7	0,126	0,5	0,042	0,3	0,015	0,2	0,005	0,1	0,002	0,1	0,001	0,1		
0,18	1,565	1,3	0,510	0,8	0,155	0,5	0,052	0,3	0,018	0,2	0,006	0,1	0,003	0,1	0,001	0,1		
0,20	1,900	1,5	0,617	0,9	0,188	0,6	0,063	0,4	0,022	0,2	0,007	0,1	0,003	0,1	0,001	0,1		
0,30	4,031	2,2	1,296	1,4	0,391	0,8	0,130	0,5	0,045	0,3	0,014	0,2	0,006	0,2	0,003	0,1	0,001	0,1
0,40	6,918	2,9	2,206	1,8	0,661	1,1	0,218	0,7	0,075	0,5	0,024	0,3	0,010	0,2	0,004	0,1	0,002	0,1
0,50			3,346	2,3	0,995	1,4	0,327	0,9	0,111	0,6	0,036	0,4	0,015	0,3	0,006	0,2	0,002	0,1
0,60			4,712	2,8	1,395	1,7	0,456	1,1	0,155	0,7	0,050	0,4	0,021	0,3	0,009	0,2	0,003	0,1
0,70			6,304	3,2	1,858	2,0	0,605	1,3	0,205	0,8	0,065	0,5	0,028	0,4	0,012	0,2	0,005	0,2
0,80					2,384	2,3	0,774	1,4	0,261	0,9	0,083	0,6	0,036	0,4	0,015	0,3	0,006	0,2
0,90					2,974	2,5	0,963	1,6	0,324	1,0	0,103	0,6	0,044	0,5	0,018	0,3	0,007	0,2
1,00					3,626	2,8	1,171	1,8	0,392	1,2	0,124	0,7	0,053	0,5	0,022	0,4	0,009	0,2
1,20					5,121	3,4	1,645	2,2	0,549	1,4	0,173	0,9	0,074	0,6	0,031	0,4	0,012	0,3
1,40							2,197	2,5	0,730	1,6	0,230	1,0	0,098	0,7	0,040	0,5	0,016	0,3
1,60							2,826	2,9	0,936	1,8	0,293	1,2	0,125	0,8	0,051	0,6	0,020	0,4
1,80							3,532	3,2	1,166	2,1	0,364	1,3	0,155	0,9	0,064	0,6	0,024	0,4
2,00									1,421	2,3	0,443	1,4	0,188	1,0	0,077	0,7	0,029	0,5
2,20									1,700	2,5	0,528	1,6	0,224	1,1	0,092	0,8	0,035	0,5
2,40									2,003	2,8	0,621	1,7	0,263	1,2	0,107	0,8	0,041	0,6
2,60									2,331	3,0	0,721	1,9	0,304	1,3	0,124	0,9	0,047	0,6
2,80									2,682	3,2	0,828	2,0	0,349	1,4	0,142	1,0	0,054	0,7
3,00									3,058	3,5	0,942	2,2	0,397	1,5	0,162	1,1	0,061	0,7
3,20											1,064	2,3	0,447	1,6	0,182	1,1	0,069	0,8
3,40											1,192	2,5	0,501	1,7	0,204	1,2	0,077	0,8
3,60											1,328	2,6	0,557	1,8	0,226	1,3	0,085	0,9
3,80											1,471	2,7	0,616	1,9	0,250	1,3	0,094	0,9
4,00											1,621	2,9	0,679	2,0	0,275	1,4	0,103	1,0
4,20											1,778	3,0	0,744	2,1	0,301	1,5	0,113	1,0
4,40											1,942	3,2	0,812	2,2	0,328	1,6	0,123	1,0
4,60											2,113	3,3	0,882	2,3	0,356	1,6	0,134	1,1
4,80											2,292	3,5	0,956	2,4	0,386	1,7	0,145	1,1
5,00													1,033	2,5	0,416	1,8	0,156	1,2

UNIBETA PIPES S3,2/S4/S5

water temperature = 10 °C

	16 × 2,2 mm		20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm		160 x 14,6 mm		200 x 18,2 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,083	0,2	0,027	0,1	0,001	0,1																				
0,04	0,282	0,4	0,093	0,2	0,015	0,2																				
0,06	0,576	0,6	0,189	0,4	0,033	0,2	0,008	0,1																		
0,08	0,958	0,8	0,313	0,5	0,076	0,3	0,020	0,2	0,006	0,1																
0,10	1,422	1,0	0,465	0,6	0,113	0,4	0,036	0,2	0,009	0,2																
0,12	1,967	1,2	0,641	0,7	0,156	0,5	0,049	0,3	0,016	0,2	0,004	0,1														
0,14	2,588	1,4	0,843	0,9	0,198	0,6	0,063	0,3	0,023	0,2	0,007	0,1														
0,16	3,285	1,6	1,068	1,0	0,252	0,6	0,078	0,4	0,027	0,2	0,010	0,2														
0,18	4,056	1,8	1,316	1,1	0,312	0,7	0,095	0,4	0,034	0,3	0,011	0,2	0,004	0,1												
0,20	4,900	2,0	1,588	1,2	0,377	0,8	0,114	0,5	0,039	0,3	0,014	0,2	0,005	0,1	0,002	0,1										
0,30	10,182	2,9	3,277	1,8	0,757	1,2	0,235	0,7	0,082	0,5	0,027	0,3	0,010	0,2	0,004	0,1										
0,40			5,499	2,5	1,268	1,6	0,393	1,0	0,134	0,6	0,047	0,4	0,015	0,2	0,010	0,2	0,003	0,1								
0,50			8,236	3,1	1,895	2,0	0,586	1,2	0,198	0,8	0,067	0,5	0,023	0,3	0,014	0,2	0,004	0,1								
0,60					2,635	2,4	0,801	1,4	0,272	0,9	0,095	0,6	0,031	0,4	0,017	0,3	0,006	0,2								
0,70					2,487	2,8	1,351	1,7	0,363	1,1	0,122	0,7	0,040	0,4	0,022	0,3	0,007	0,2	0,003	0,1						
0,80					4,449	3,1	2,012	1,9	0,458	1,2	0,157	0,8	0,053	0,5	0,028	0,3	0,010	0,2	0,004	0,1						
0,90					5,484	3,5	2,792	2,2	0,564	1,4	0,192	0,9	0,064	0,6	0,034	0,4	0,012	0,2	0,005	0,2						
1,00							3,713	2,4	0,678	1,5	0,234	1,0	0,076	0,6	0,046	0,5	0,014	0,3	0,005	0,2	0,003	0,1				
1,20							4,729	2,9	0,948	1,8	0,318	1,2	0,106	0,7	0,061	0,5	0,019	0,3	0,007	0,2	0,004	0,2				
1,40							5,559	3,4	1,246	2,1	0,420	1,4	0,141	0,9	0,076	0,6	0,026	0,4	0,009	0,2	0,005	0,2				
1,60									1,594	2,5	0,535	1,6	0,180	1,0	0,095	0,7	0,032	0,4	0,012	0,3	0,007	0,2	0,001	0,119		
1,80									1,967	2,8	0,662	1,7	0,219	1,1	0,113	0,8	0,039	0,5	0,015	0,3	0,008	0,2	0,001	0,134		
2,00									2,392	3,1	0,802	1,9	0,266	1,2	0,136	0,8	0,047	0,5	0,018	0,4	0,010	0,3	0,002	0,148		
2,20									2,838	3,4	0,954	2,1	0,314	1,3	0,157	0,9	0,055	0,6	0,021	0,4	0,012	0,3	0,002	0,164		
2,40											1,118	2,3	0,366	1,5	0,183	1,0	0,066	0,6	0,025	0,4	0,013	0,3	0,003	0,179		
2,60											1,294	2,5	0,425	1,6	0,207	1,1	0,076	0,7	0,028	0,5	0,016	0,4	0,004	0,194		
2,80											1,481	2,7	0,487	1,7	0,236	1,1	0,86	0,7	0,033	0,5	0,018	0,4	0,004	0,208	0,001	0,1
3,00											1,681	2,9	0,548	1,8	0,263	1,2	0,097	0,8	0,037	0,5	0,021	0,4	0,005	0,223	0,002	0,1
3,20											1,892	3,1	0,618	2,0	0,295	1,3	0,111	0,8	0,042	0,6	0,022	0,4	0,005	0,238	0,002	0,2
3,40											2,115	3,3	0,692	2,1	0,325	1,4	0,123	0,9	0,046	0,6	0,025	0,5	0,006	0,253	0,002	0,2
3,60											2,335	3,5	0,763	2,2	0,360	1,4	0,135	0,9	0,052	0,6	0,028	0,5	0,007	0,268	0,002	0,2
3,80													0,844	2,3	0,393	1,5	0,149	1,0	0,056	0,7	0,03	0,5	0,007	0,283	0,003	0,2
4,00													0,929	2,4	0,432	1,6	0,165	1,1	0,062	0,7	0,034	0,5	0,008	0,298	0,003	0,2
4,20													1,018	2,6	0,467	1,7	0,18	1,1	0,067	0,7	0,037	0,6	0,009	0,312	0,003	0,2
4,40													1,102	2,7	0,509	1,7	0,195	1,2	0,074	0,8	0,041	0,6	0,010	0,328	0,003	0,2
4,60													1,198	2,8	0,547	1,8	0,21	1,2	0,079	0,8	0,043	0,6	0,010	0,343	0,004	0,2
4,80													1,297	2,9	0,592	1,9	0,226	1,3	0,086	0,8	0,047	0,7	0,011	0,357	0,004	0,2
5,00													1,391	3,1	0,632	2,0	0,246	1,3	0,092	0,9	0,051	0,7	0,012	0,372	0,004	0,2
5,20															0,680	2,0	0,264	1,4	0,100	0,9	0,053	0,7	0,013	0,387	0,005	0,3
5,40															0,730	2,1	0,281	1,4	0,106	0,9	0,058	0,7	0,013	0,402	0,005	0,3
5,60															0,775	2,2	0,300	1,5	0,114	1,0	0,062	0,8	0,015	0,417	0,005	0,3
5,80															0,828	2,3	0,322	1,5	0,120	1,0	0,065	0,8	0,016	0,431	0,006	0,3
6,00															0,875	2,3	0,342	1,6	0,129	1,1	0,069	0,8	0,017	0,447	0,006	0,3
6,50															0,952	2,4	0,395	1,7	0,147	1,1	0,080	0,9	0,019	0,484	0,0065	0,3
7,00															1,154	2,7	0,451	1,8	0,169	1,2	0,092	1,0	0,022	0,521	0,007	0,3
7,50															1,241	2,9	0,512	2,0	0,193	1,3	0,103	1,0	0,025	0,558	0,009	0,4
8,00															1,399	3,0	0,575	2,1	0,217	1,4	0,116	1,1	0,028	0,596	0,009	0,4
8,50																	0,642	2,2	0,240	1,5	0,130	1,2	0,031	0,633	0,01	0,4
9,00																	0,713	2,4	0,267	1,6	0,145	1,2	0,034	0,670	0,012	0,4
9,50																	0,786	2,5	0,296	1,7	0,160	1,3	0,038	0,707	0,013	0,5
10,00																	0,864	2,6	0,326	1,8	0,174	1,4	0,041	0,745	0,014	0,5
10,50																	0,944	2,7	0,353	1,8	0,191	1,4	0,045	0,782	0,015	0,5
11,00																	1,028	2,9	0,386	1,9	0,208	1,5	0,049	0,819	0,017	0,5
11,50																	1,122	3,0	0,419	2,0	0,226	1,6	0,054	0,856	0,018	0,6
12,00																			0,450	2,1	0,243	1,6	0,057	0,894	0,02	0,6
12,50																			0,486	2,2	0,262	1,7	0,062	0,931	0,021	0,6
13,00																			0,524	2,3	0,282	1,8	0,067	0,968	0,023	0,6
13,50																			0,563	2,4	0,303	1,8	0,070	1,005	0,024	0,6
14,00																			0,598	2,4	0,321	1,9	0,076	1,042	0,026	0,7
14,50																			0,639	2,5	0,342	2,0	0,081	1,08	0,028	0,7
15,00																			0,681	2,6	0,366	2,0	0,086	1,117	0,029	0,7
15,50																			0,725	2,7	0,89	2,1	0,091	1,154	0,031	0,7
16,00																			0,765	2,8	0,414	2,2	0,096	1,191	0,033	0,8
16,50																			0,811	2,9	0,435	2,2	0,102	1,229	0,034	0,8
17,00																			0,858	3,0	0,460	2,3	0,108	1,266	0,037	0,8
17,50																					0,486	2,4	0,113	1,303	0,038	0,8
18,00																					0,513	2,4	0,119	1,34	0,41	0,9
18,50																					0,536	2,5	0,126	1,378	0,043	0,9
19,00																					0,564	2,6	0,131	1,415	0,044	0,9
19,50																					0,593	2,6	0,138	1,452	0,047	0,9
20,00																					0,622	2,7	0,145	1,489	0,049	1
20,50																					0,647	2,8	0,152	1,526	0,052	1
21,00																					0,678	2,8	0,158	1,564	0,054	1
21,50																					0,709	2,9	0,165	1,601	0,056	1
22,00																					0,741	3,0	0,173	1,638	0,059	1,1

UNIBETA PIPES S3,2/S4/S5

water temperature = 50 °C

	16 × 2,2 mm		20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm		160 x 14,6 mm		200 x 18,2 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,068	0,2	0,022	0,1	0,004	0,1																				
0,04	0,230	0,4	0,075	0,2	0,019	0,2	0,005	0,1	0,001	0,1																
0,06	0,473	0,6	0,154	0,4	0,035	0,2	0,011	0,1	0,004	0,1	0,001	0,1														
0,08	0,792	0,8	0,257	0,5	0,06	0,3	0,019	0,2	0,007	0,1	0,002	0,1														
0,10	1,183	1,0	0,382	0,6	0,089	0,4	0,028	0,2	0,009	0,2	0,003	0,1	0,001	0,1												
0,12	1,644	1,2	0,53	0,7	0,124	0,5	0,038	0,3	0,013	0,2	0,004	0,1	0,001	0,1												
0,14	2,175	1,4	0,698	0,9	0,158	0,6	0,05	0,3	0,018	0,2	0,006	0,1	0,002	0,1												
0,16	2,773	1,6	0,888	1,0	0,206	0,6	0,062	0,4	0,021	0,2	0,008	0,2	0,002	0,1												
0,18	3,439	1,8	1,099	1,1	0,252	0,7	0,076	0,4	0,027	0,3	0,009	0,2	0,003	0,1	0,001	0,1										
0,20	4,172	2,0	1,330	1,2	0,306	0,8	0,091	0,5	0,031	0,3	0,011	0,2	0,004	0,1	0,002	0,1										
0,30	8,828	2,9	2,785	1,8	0,624	1,2	0,191	0,7	0,066	0,5	0,022	0,3	0,007	0,2	0,003	0,1	0,001	0,1								
0,40			4,731	2,5	1,059	1,6	0,323	1,0	0,109	0,6	0,037	0,4	0,012	0,2	0,005	0,2	0,002	0,1								
0,50			7,161	3,1	1,599	2,0	0,486	1,2	0,162	0,8	0,055	0,5	0,025	0,3	0,008	0,2	0,003	0,1								
0,60					2,242	2,4	0,669	1,4	0,224	0,9	0,077	0,6	0,035	0,4	0,011	0,3	0,005	0,2								
0,70					2,989	2,8	0,891	1,7	0,301	1,1	0,100	0,7	0,038	0,4	0,014	0,3	0,006	0,2	0,002	0,1						
0,80					3,837	3,1	1,142	1,9	0,382	1,2	0,129	0,8	0,043	0,5	0,018	0,3	0,008	0,2	0,003	0,1						
0,90					4,757	3,5	1,409	2,2	0,471	1,4	0,159	0,9	0,052	0,6	0,023	0,4	0,010	0,2	0,004	0,2						
1,00							1,718	2,4	0,570	1,5	0,194	1,0	0,062	0,6	0,028	0,5	0,011	0,3	0,004	0,2	0,002	0,1				
1,20							2,404	2,9	0,802	1,8	0,265	1,2	0,088	0,7	0,037	0,5	0,015	0,3	0,006	0,2	0,003	0,2				
1,40							3,221	3,4	1,062	2,1	0,352	1,4	0,117	0,9	0,05	0,6	0,021	0,4	0,008	0,2	0,004	0,2				
1,60									1,366	2,5	0,451	1,6	0,150	1,0	0,063	0,7	0,026	0,4	0,010	0,3	0,006	0,2	0,001	0,119		
1,80									1,694	2,8	0,561	1,7	0,183	1,1	0,079	0,8	0,032	0,5	0,012	0,3	0,007	0,2	0,002	0,134		
2,00									2,071	3,1	0,682	1,9	0,223	1,2	0,094	0,8	0,039	0,5	0,015	0,4	0,008	0,3	0,002	0,149		
2,20									2,467	3,4	0,815	2,1	0,266	1,3	0,113	0,9	0,046	0,6	0,017	0,4	0,010	0,3	0,002	0,164		
2,40											0,958	2,3	0,309	1,5	0,131	1,0	0,055	0,6	0,021	0,4	0,011	0,3	0,003	0,179		
2,60											1,113	2,5	0,36	1,6	0,153	1,1	0,063	0,7	0,023	0,5	0,013	0,4	0,003	0,194		
2,80											1,279	2,7	0,414	1,7	0,174	1,1	0,072	0,7	0,027	0,5	0,015	0,4	0,004	0,208		
3,00											1,455	2,9	0,467	1,8	0,199	1,2	0,081	0,8	0,03	0,5	0,017	0,4	0,004	0,223	0,001	0,1
3,20											1,642	3,1	0,528	2,0	0,222	1,3	0,093	0,8	0,035	0,6	0,017	0,4	0,005	0,238	0,002	0,2
3,40											1,841	3,3	0,592	2,1	0,25	1,4	0,103	0,9	0,038	0,6	0,021	0,5	0,005	0,253	0,002	0,2
3,60											2,038	3,5	0,654	2,2	0,275	1,4	0,114	0,9	0,043	0,6	0,023	0,5	0,006	0,268	0,002	0,2
3,80													0,725	2,3	0,306	1,5	0,125	1,0	0,047	0,7	0,025	0,5	0,006	0,283	0,002	0,2
4,00													0,800	2,4	0,334	1,6	0,139	1,1	0,047	0,7	0,027	0,5	0,007	0,298	0,002	0,2
4,20													0,878	2,6	0,368	1,7	0,152	1,1	0,056	0,7	0,031	0,6	0,007	0,313	0,003	0,2
4,40													0,953	2,7	0,399	1,7	0,164	1,2	0,062	0,8	0,034	0,6	0,008	0,328	0,003	0,2
4,60													1,038	2,8	0,435	1,8	0,178	1,2	0,066	0,8	0,036	0,6	0,008	0,343	0,003	0,2
4,80													1,126	2,9	0,469	1,9	0,192	1,3	0,073	0,8	0,039	0,7	0,009	0,357	0,003	0,2
5,00													1,210	3,1	0,508	2	0,209	1,3	0,077	0,9	0,042	0,7	0,010	0,372	0,003	0,2
5,20															0,544	2	0,224	1,4	0,084	0,9	0,045	0,7	0,011	0,387	0,004	0,3
5,40															0,586	2,1	0,239	1,4	0,089	0,9	0,048	0,7	0,011	0,402	0,004	0,3
5,60															0,623	2,2	0,255	1,5	0,096	1,0	0,052	0,8	0,012	0,417	0,004	0,3
5,80															0,669	2,3	0,275	1,5	0,102	1,0	0,054	0,8	0,013	0,432	0,005	0,3
6,00															0,716	2,3	0,292	1,6	0,109	1,1	0,058	0,8	0,013	0,447	0,005	0,3
6,50															0,826	2,4	0,338	1,7	0,125	1,1	0,067	0,9	0,016	0,484	0,005	0,3
7,00															0,95	2,7	0,388	1,8	0,144	1,2	0,078	1,0	0,018	0,521	0,006	0,3
7,50															1,083	2,9	0,441	2,0	0,164	1,3	0,087	1,0	0,021	0,558	0,007	0,4
8,00															1,225	3	0,497	2,1	0,185	1,4	0,098	1,1	0,023	0,596	0,008	0,4
8,50																	0,556	2,2	0,205	1,5	0,111	1,2	0,026	0,633	0,009	0,4
9,00																	0,618	2,4	0,229	1,6	0,123	1,2	0,029	0,670	0,01	0,4
9,50																	0,684	2,5	0,254	1,7	0,137	1,3	0,032	0,707	0,011	0,5
10,00																	0,753	2,6	0,280	1,8	0,149	1,4	0,034	0,745	0,012	0,5
10,50																	0,824	2,7	0,304	1,8	0,163	1,4	0,038	0,782	0,013	0,5
11,00																	0,9	2,9	0,333	1,9	0,178	1,5	0,041	0,819	0,014	0,5
11,50																	0,984	3,0	0,362	2,0	0,194	1,6	0,045	0,856	0,015	0,6
12,00																			0,39	2,1	0,208	1,6	0,048	0,894	0,016	0,6
12,50																			0,422	2,2	0,225	1,7	0,052	0,931	0,017	0,6
13,00																			0,455	2,3	0,243	1,8	0,056	0,968	0,019	0,6
13,50																			0,489	2,4	0,261	1,8	0,06	1,005	0,02	0,6
14,00																			0,521	2,4	0,277	1,9	0,064	1,042	0,022	0,7
14,50																			0,557	2,5	0,297	2,0	0,069	1,080	0,023	0,7
15,00																			0,595	2,6	0,317	2,0	0,074	1,117	0,024	0,7
15,50																			0,634	2,7	0,337	2,1	0,077	1,154	0,026	0,7
16,00																			0,669	2,8	0,359	2,2	0,082	1,191	0,028	0,8
16,50																			0,711	2,9	0,378	2,2	0,087	1,229	0,029	0,8
17,00																			0,753	3,0	0,400	2,3	0,093	1,266	0,031	0,8
17,50																					0,423	2,4	0,097	1,303	0,032	0,8
18,00																					0,447	2,4	0,102	1,340	0,035	0,9
18,50																					0,468	2,5	0,108	1,378	0,036	0,9
19,00																					0,493	2,6	0,112	1,415	0,038	0,9
19,50																					0,518	2,6	0,118	1,452	0,04	0,9
20,00																					0,544	2,7	0,125	1,489	0,042	1
20,50																					0,567	2,8	0,131	1,526	0,044	1
21,00																					0,594	2,8	0,136	1,564	0,046	1
21,50																					0,622	2,9	0,142	1,601	0,047	1
22,00																					0,651	3,0	0,150	1,638	0,05	1,1

UNIBETA PIPES S3,2/S4/S5

water temperature = 80 °C

	16 × 2,2 mm		20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm		160 x 14,6 mm		200 x 18,2 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,061	0,2	0,019	0,1	0,005	0,1																				
0,04	0,198	0,4	0,067	0,2	0,017	0,2	0,005	0,1	0,002	0,1																
0,06	0,414	0,6	0,134	0,4	0,031	0,2	0,009	0,1	0,003	0,1	0,001	0,1														
0,08	0,686	0,8	0,221	0,5	0,053	0,3	0,017	0,2	0,006	0,1	0,002	0,1														
0,10	1,040	1,0	0,328	0,6	0,079	0,4	0,025	0,2	0,008	0,2	0,003	0,1	0,001	0,1												
0,12	1,462	1,2	0,465	0,7	0,111	0,5	0,034	0,3	0,012	0,2	0,004	0,1	0,001	0,1												
0,14	1,926	1,4	0,612	0,9	0,141	0,6	0,044	0,3	0,016	0,2	0,005	0,1	0,002	0,1												
0,16	2,479	1,6	0,777	1,0	0,181	0,6	0,055	0,4	0,019	0,2	0,007	0,2	0,002	0,1												
0,18	3,067	1,8	0,976	1,1	0,226	0,7	0,068	0,4	0,024	0,3	0,008	0,2	0,003	0,1	0,001	0,1										
0,20	3,496	2,0	1,180	1,2	0,275	0,8	0,081	0,5	0,027	0,3	0,010	0,2	0,003	0,1	0,002	0,1										
0,30	8,047	2,9	2,492	1,8	0,567	1,2	0,172	0,7	0,059	0,5	0,019	0,3	0,007	0,2	0,003	0,1	0,001	0,1								
0,40			4,299	2,5	0,969	1,6	0,292	1,0	0,098	0,6	0,033	0,4	0,011	0,2	0,005	0,2	0,002	0,1								
0,50			6,536	3,1	1,471	2,0	0,442	1,2	0,146	0,8	0,049	0,5	0,017	0,3	0,007	0,2	0,003	0,1								
0,60					2,071	2,4	0,612	1,4	0,203	0,9	0,069	0,6	0,023	0,4	0,010	0,3	0,004	0,2								
0,70					2,774	2,8	0,818	1,7	0,274	1,1	0,090	0,7	0,029	0,4	0,013	0,3	0,005	0,2	0,002	0,1						
0,80					3,574	3,1	1,052	1,9	0,348	1,2	0,117	0,8	0,038	0,5	0,016	0,3	0,007	0,2	0,003	0,1						
0,90					4,445	3,5	1,301	2,2	0,431	1,4	0,143	0,9	0,047	0,6	0,020	0,4	0,009	0,2	0,003	0,2						
1,00							1,591	2,4	0,522	1,5	0,176	1,0	0,056	0,6	0,025	0,5	0,010	0,3	0,004	0,2	0,002	0,1				
1,20							2,236	2,9	0,739	1,8	0,242	1,2	0,079	0,7	0,034	0,5	0,014	0,3	0,005	0,2	0,003	0,2				
1,40							3,001	3,4	0,981	2,1	0,323	1,4	0,106	0,9	0,045	0,6	0,019	0,4	0,007	0,2	0,004	0,2				
1,60									1,267	2,5	0,414	1,6	0,136	1,0	0,057	0,7	0,024	0,4	0,009	0,3	0,005	0,2	0,001	0,119		
1,80									1,576	2,8	0,517	1,7	0,177	1,1	0,071	0,8	0,029	0,5	0,011	0,3	0,006	0,2	0,001	0,134		
2,00									1,931	3,1	0,630	1,9	0,207	1,2	0,085	0,8	0,035	0,5	0,013	0,4	0,007	0,3	0,002	0,149	0,001	0,1
2,20									2,306	3,4	0,734	2,1	0,244	1,3	0,103	0,9	0,041	0,6	0,016	0,4	0,009	0,3	0,002	0,164	0,001	0,1
2,40											0,888	2,3	0,284	1,5	0,119	1,0	0,050	0,6	0,019	0,4	0,010	0,3	0,002	0,179	0,001	0,11
2,60											1,034	2,5	0,331	1,6	0,140	1,1	0,057	0,7	0,021	0,5	0,011	0,4	0,003	0,194	0,001	0,12
2,80											1,190	2,7	0,381	1,7	0,159	1,1	0,065	0,7	0,025	0,5	0,013	0,4	0,003	0,208	0,001	0,13
3,00											1,356	2,9	0,430	1,8	0,182	1,2	0,074	0,8	0,027	0,5	0,015	0,4	0,003	0,223	0,001	0,14
3,20											1,534	3,1	0,487	2,0	0,203	1,3	0,084	0,8	0,031	0,6	0,017	0,4	0,004	0,238	0,001	0,15
3,40											1,721	3,3	0,548	2,1	0,229	1,4	0,094	0,9	0,035	0,6	0,019	0,5	0,004	0,253	0,002	0,16
3,60											1,908	3,5	0,606	2,2	0,253	1,4	0,104	0,9	0,039	0,6	0,021	0,5	0,005	0,268	0,002	0,17
3,80													0,673	2,3	0,282	1,5	0,114	1,0	0,042	0,7	0,023	0,5	0,005	0,283	0,002	0,18
4,00													0,743	2,4	0,308	1,6	0,127	1,1	0,047	0,7	0,025	0,5	0,006	0,298	0,002	0,19
4,20													0,817	2,6	0,340	1,7	0,139	1,1	0,051	0,7	0,028	0,6	0,006	0,313	0,002	0,2
4,40													0,887	2,7	0,368	1,7	0,151	1,2	0,056	0,8	0,031	0,6	0,007	0,328	0,002	0,21
4,60													0,697	2,8	0,403	1,8	0,163	1,2	0,06	0,8	0,032	0,6	0,008	0,343	0,003	0,22
4,80													1,051	2,9	0,434	1,9	0,176	1,3	0,066	0,8	0,035	0,7	0,008	0,357	0,003	0,23
5,00													1,130	3,1	0,471	2,0	0,192	1,3	0,071	0,9	0,038	0,7	0,009	0,372	0,003	0,24
5,20															0,504	2,0	0,206	1,4	0,077	0,9	0,041	0,7	0,010	0,387	0,003	0,25
5,40															0,544	2,1	0,221	1,4	0,081	0,9	0,044	0,7	0,010	0,402	0,004	0,26
5,60															0,585	2,2	0,235	1,5	0,088	1,0	0,047	0,8	0,011	0,417	0,004	0,27
5,80															0,622	2,3	0,254	1,5	0,093	1,0	0,05	0,8	0,012	0,432	0,004	0,28
6,00															0,666	2,3	0,270	1,6	0,100	1,1	0,053	0,8	0,013	0,447	0,004	0,29
6,50															0,77	2,4	0,313	1,7	0,115	1,1	0,062	0,9	0,014	0,484	0,005	0,3
7,00															0,888	2,7	0,360	1,8	0,132	1,2	0,071	1,0	0,016	0,521	0,006	0,33
7,50															1,013	2,9	0,409	2,0	0,151	1,3	0,080	1,0	0,019	0,558	0,006	0,36
8,00															1,147	3,0	0,462	2,1	0,171	1,4	0,090	1,1	0,021	0,596	0,007	0,38
8,50																	0,517	2,2	0,189	1,5	0,102	1,2	0,023	0,633	0,008	0,4
9,00																	0,576	2,4	0,212	1,6	0,113	1,2	0,026	0,670	0,009	0,43
9,50																	0,638	2,5	0,235	1,7	0,126	1,3	0,029	0,707	0,01	0,45
10,00																	0,703	2,6	0,259	1,8	0,137	1,4	0,031	0,745	0,011	0,48
10,50																	0,771	2,7	0,282	1,8	0,151	1,4	0,035	0,782	0,012	0,5
11,00																	0,842	2,9	0,309	1,9	0,165	1,5	0,039	0,819	0,013	0,52
11,50																	0,922	3,0	0,337	2,0	0,180	1,6	0,041	0,856	0,014	0,55
12,00																			0,362	2,1	0,192	1,6	0,044	0,894	0,015	0,57
12,50																			0,393	2,2	0,209	1,7	0,048	0,931	0,016	0,59
13,00																			0,424	2,3	0,225	1,8	0,052	0,968	0,017	0,62
13,50																			0,456	2,4	0,242	1,8	0,055	1,005	0,018	0,64
14,00																			0,486	2,4	0,257	1,9	0,059	1,042	0,02	0,67
14,50																			0,520	2,5	0,276	2,0	0,063	1,08	0,021	0,69
15,00																			0,556	2,6	0,295	2,0	0,068	1,117	0,022	0,71
15,50																			0,593	2,7	0,314	2,1	0,071	1,154	0,024	0,74
16,00																			0,627	2,8	0,334	2,2	0,076	1,191	0,025	0,76
16,50																			0,666	2,9	0,352	2,2	0,081	1,229	0,026	0,78
17,00																			0,706	3,0	0,373	2,3	0,085	1,266	0,028	0,81
17,50																					0,395	2,4	0,089	1,303	0,03	0,83
18,00																					0,417	2,4	0,094	1,340	0,032	0,86
18,50																					0,437	2,5	0,100	1,378	0,033	0,88
19,00																					0,460	2,6	0,104	1,415	0,035	0,9
19,50																					0,485	2,6	0,110	1,452	0,037	0,93
20,00																					0,509	2,7	0,115	1,489	0,038	0,95
20,50																					0,531	2,8	0,121	1,526	0,04	0,98
21,00																					0,557	2,8	0,126	1,564	0,042	1
21,50																					0,583	2,9	0,132	1,601	0,044	1,02
22,00																					0,610	3,0	0,139	1,638	0,046	1,05

CARBO^{CRP} PIPES S3,2/S4

water temperature = 10 °C

	16 × 2,2 mm		20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,083	0,2	0,027	0,1	0,009	0,1																
0,04	0,028	0,4	0,093	0,2	0,032	0,2																
0,06	0,576	0,6	0,189	0,4	0,065	0,2	0,020	0,1														
0,08	0,958	0,8	0,313	0,5	0,108	0,3	0,034	0,2	0,012	0,1												
0,10	0,422	1,0	0,465	0,6	0,16	0,4	0,050	0,2	0,017	0,2												
0,12	0,967	1,2	0,641	0,7	0,221	0,5	0,069	0,3	0,023	0,2	0,008	0,1										
0,14	2,588	1,4	0,843	0,9	0,290	0,6	0,090	0,3	0,031	0,2	0,010	0,1										
0,16	3,285	1,6	1,068	1,0	0,367	0,6	0,114	0,4	0,039	0,2	0,013	0,2										
0,18	4,056	1,8	1,316	1,1	0,452	0,7	0,140	0,4	0,048	0,3	0,016	0,2	0,005	0,1								
0,20	4,900	2,0	1,588	1,2	0,544	0,8	0,168	0,5	0,058	0,3	0,019	0,2	0,006	0,1	0,002	0,1						
0,30	10,182	2,9	3,277	1,8	1,118	1,2	0,345	0,7	0,118	0,5	0,040	0,3	0,013	0,2	0,004	0,1						
0,40			5,499	2,5	1,868	1,6	0,574	1,0	0,196	0,6	0,066	0,4	0,022	0,2	0,010	0,2	0,003	0,1				
0,50			8,236	3,1	2,786	2,0	0,854	1,2	0,290	0,8	0,097	0,5	0,032	0,3	0,014	0,2	0,004	0,1				
0,60					3,869	2,4	1,183	1,4	0,401	0,9	0,134	0,6	0,045	0,4	0,017	0,3	0,006	0,2				
0,70					5,112	2,8	1,558	1,7	0,528	1,1	0,176	0,7	0,058	0,4	0,022	0,3	0,007	0,2	0,003	0,1		
0,80					6,513	3,1	1,980	1,9	0,669	1,2	0,223	0,8	0,074	0,5	0,028	0,3	0,01	0,2	0,004	0,1		
0,90					8,071	3,5	2,448	2,2	0,826	1,4	0,275	0,9	0,091	0,6	0,034	0,4	0,012	0,2	0,005	0,2		
1,00							2,960	2,4	0,997	1,5	0,332	1,0	0,110	0,6	0,046	0,5	0,014	0,3	0,005	0,2	0,003	0,1
1,20							4,117	2,9	1,382	1,8	0,459	1,2	0,152	0,7	0,061	0,5	0,019	0,3	0,007	0,2	0,004	0,2
1,40							5,449	3,4	1,824	2,1	0,604	1,4	0,199	0,9	0,076	0,6	0,026	0,4	0,009	0,2	0,005	0,2
1,60									2,322	2,5	0,767	1,6	0,253	1,0	0,095	0,7	0,032	0,4	0,012	0,3	0,007	0,2
1,80									2,874	2,8	0,948	1,7	0,311	1,1	0,113	0,8	0,039	0,5	0,015	0,3	0,008	0,2
2,00									3,48	3,1	1,145	1,9	0,376	1,2	0,136	0,8	0,047	0,5	0,018	0,4	0,010	0,3
2,20									4,139	3,4	1,360	2,1	0,446	1,3	0,157	0,9	0,550	0,6	0,021	0,4	0,012	0,3
2,40											1,591	2,3	0,521	1,5	0,183	1,0	0,066	0,6	0,025	0,4	0,013	0,3
2,60											1,839	2,5	0,601	1,6	0,207	1,1	0,076	0,7	0,028	0,5	0,016	0,4
2,80											2,104	2,7	0,686	1,7	0,236	1,1	0,086	0,7	0,033	0,5	0,018	0,4
3,00											2,385	2,9	0,777	1,8	0,263	1,2	0,097	0,8	0,037	0,5	0,021	0,4
3,20											2,682	3,1	0,873	2,0	0,295	1,3	0,111	0,8	0,042	0,6	0,022	0,4
3,40											2,995	3,3	0,974	2,1	0,325	1,4	0,123	0,9	0,046	0,6	0,025	0,5
3,60											3,324	3,5	1,08	2,2	0,36	1,4	0,135	0,9	0,052	0,6	0,028	0,5
3,80													1,190	2,3	0,393	1,5	0,149	1,0	0,056	0,7	0,03	0,5
4,00													1,306	2,4	0,432	1,6	0,165	1,1	0,062	0,7	0,034	0,5
4,20													1,427	2,6	0,467	1,7	0,180	1,1	0,067	0,7	0,037	0,6
4,40													1,553	2,7	0,509	1,7	0,195	1,2	0,074	0,8	0,041	0,6
4,60													1,683	2,8	0,547	1,8	0,210	1,2	0,079	0,8	0,043	0,6
4,80													1,819	2,9	0,592	1,9	0,226	1,3	0,086	0,8	0,047	0,7
5,00													1,959	3,1	0,632	2,0	0,246	1,3	0,092	0,9	0,051	0,7
5,20															0,680	2,0	0,264	1,4	0,100	0,9	0,053	0,7
5,40															0,73	2,1	0,281	1,4	0,106	0,9	0,058	0,7
5,60															0,775	2,2	0,300	1,5	0,114	1,0	0,062	0,8
5,80															0,828	2,3	0,322	1,5	0,120	1,0	0,065	0,8
6,00															0,875	2,3	0,342	1,6	0,129	1,1	0,069	0,8
6,50															0,952	2,4	0,395	1,7	0,147	1,1	0,08	0,9
7,00															1,154	2,7	0,451	1,8	0,169	1,2	0,092	1,0
7,50															1,241	2,9	0,512	2,0	0,193	1,3	0,010	1,0
8,00															1,399	3	0,575	2,1	0,217	1,4	0,116	1,1
8,50																	0,642	2,2	0,240	1,5	0,130	1,2
9,00																	0,713	2,4	0,267	1,6	0,145	1,2
9,50																	0,786	2,5	0,296	1,7	0,160	1,3
10,00																	0,864	2,6	0,326	1,8	0,174	1,4
10,50																	0,944	2,7	0,353	1,8	0,191	1,4
11,00																	1,028	2,9	0,386	1,9	0,208	1,5
11,50																	1,122	3,0	0,419	2,0	0,226	1,6
12,00																			0,450	2,1	0,243	1,6
12,50																			0,486	2,2	0,262	1,7
13,00																			0,524	2,3	0,282	1,8
13,50																			0,563	2,4	0,303	1,8
14,00																			0,598	2,4	0,321	1,9
14,50																			0,639	2,5	0,342	2,0
15,00																			0,681	2,6	0,366	2,0
15,50																			0,725	2,7	0,389	2,1
16,00																			0,765	2,8	0,414	2,2
16,50																			0,811	2,9	0,435	2,2
17,00																			0,858	3,0	0,460	2,3
17,50																					0,486	2,4
18,00																					0,513	2,4
18,50																					0,536	2,5
19,00																					0,564	2,6
19,50																					0,593	2,6
20,00																					0,622	2,7
20,50																					0,647	2,8
21,00																					0,780	2,8
21,50																					0,709	2,9
22,00																					0,741	3,0

CARBO^{CRP} PIPES S3,2/S4

water temperature = 50 °C

	20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,022	0,1	0,008	0,1																
0,04	0,075	0,2	0,026	0,2	0,008	0,1	0,003	0,1												
0,06	0,154	0,4	0,053	0,2	0,016	0,1	0,006	0,1	0,002	0,1										
0,08	0,257	0,5	0,088	0,3	0,027	0,2	0,009	0,1	0,003	0,1										
0,10	0,382	0,6	0,131	0,4	0,040	0,2	0,014	0,2	0,005	0,1	0,002	0,1								
0,12	0,530	0,7	0,181	0,5	0,056	0,3	0,019	0,2	0,006	0,1	0,002	0,1								
0,14	0,698	0,9	0,238	0,6	0,073	0,3	0,025	0,2	0,008	0,1	0,003	0,1								
0,16	0,888	1,0	0,302	0,6	0,093	0,4	0,032	0,2	0,011	0,2	0,004	0,1								
0,18	1,099	1,1	0,373	0,7	0,115	0,4	0,039	0,3	0,013	0,2	0,004	0,1	0,001	0,1						
0,20	1,330	1,2	0,450	0,8	0,138	0,5	0,047	0,3	0,016	0,2	0,005	0,1	0,002	0,1						
0,30	2,785	1,8	0,935	1,2	0,285	0,7	0,096	0,5	0,032	0,3	0,011	0,2	0,003	0,1	0,001	0,1				
0,40	4,731	2,5	1,578	1,6	0,478	1,0	0,161	0,6	0,054	0,4	0,018	0,2	0,005	0,2	0,002	0,1				
0,50	7,161	3,1	2,376	2,0	0,716	1,2	0,240	0,8	0,080	0,5	0,026	0,3	0,008	0,2	0,003	0,1				
0,60			3,325	2,4	0,997	1,4	0,334	0,9	0,110	0,6	0,036	0,4	0,011	0,3	0,005	0,2				
0,70			4,425	2,8	1,322	1,7	0,441	1,1	0,146	0,7	0,048	0,4	0,014	0,3	0,006	0,2	0,002	0,1		
0,80			5,675	3,1	1,689	1,9	0,562	1,2	0,185	0,8	0,061	0,5	0,018	0,3	0,008	0,2	0,003	0,1		
0,90			7,073	3,5	2,098	2,2	0,696	1,4	0,229	0,9	0,075	0,6	0,023	0,4	0,010	0,2	0,004	0,2		
1,00					2,549	2,4	0,843	1,5	0,277	1,0	0,091	0,6	0,028	0,5	0,011	0,3	0,004	0,2	0,002	0,1
1,20					5,677	2,9	1,118	1,8	0,285	1,2	0,126	0,7	0,037	0,5	0,015	0,3	0,006	0,2	0,003	0,2
1,40					4,770	3,4	1,565	2,1	0,510	1,4	0,166	0,9	0,050	0,6	0,021	0,4	0,008	0,2	0,004	0,2
1,60							2,004	2,5	0,650	1,6	0,211	1,0	0,063	0,7	0,026	0,4	0,010	0,3	0,006	0,2
1,80							2,494	2,8	0,807	1,7	0,261	1,1	0,079	0,8	0,032	0,5	0,012	0,3	0,007	0,2
2,00							3,036	3,1	0,980	1,9	0,316	1,2	0,094	0,8	0,039	0,5	0,015	0,4	0,008	0,3
2,20							3,629	3,4	1,168	2,1	0,376	1,3	0,113	0,9	0,046	0,6	0,017	0,4	0,010	0,3
2,40									1,372	2,3	0,441	1,5	0,131	1,0	0,055	0,6	0,021	0,4	0,011	0,3
2,60									1,592	2,5	0,511	1,6	0,153	1,1	0,063	0,7	0,023	0,5	0,013	0,4
2,80									1,828	2,7	0,585	1,7	0,174	1,1	0,072	0,7	0,027	0,5	0,015	0,4
3,00									2,079	2,9	0,664	1,8	0,199	1,2	0,081	0,8	0,030	0,5	0,017	0,4
3,20									2,345	3,1	0,748	2,0	0,222	1,3	0,093	0,8	0,035	0,6	0,017	0,4
3,40									2,627	3,3	0,837	2,1	0,250	1,4	0,103	0,9	0,038	0,6	0,021	0,5
3,60									2,925	3,5	0,930	2,2	0,275	1,4	0,114	0,9	0,043	0,6	0,023	0,5
3,80											1,028	2,3	0,306	1,5	0,125	1,0	0,047	0,7	0,025	0,5
4,00											1,131	2,4	0,334	1,6	0,139	1,1	0,047	0,7	0,027	0,5
4,20											1,239	2,6	0,368	1,7	0,152	1,1	0,056	0,7	0,031	0,6
4,40											1,351	2,7	0,399	1,7	0,164	1,2	0,062	0,8	0,034	0,6
4,60											1,468	2,8	0,435	1,8	0,178	1,2	0,066	0,8	0,036	0,6
4,80											1,589	2,9	0,469	1,9	0,192	1,3	0,073	0,8	0,039	0,7
5,00											1,716	3,1	0,508	2,0	0,209	1,3	0,077	0,9	0,042	0,7
5,20													0,544	2,0	0,224	1,4	0,084	0,9	0,045	0,7
5,40													0,586	2,1	0,239	1,4	0,089	0,9	0,048	0,7
5,60													0,623	2,2	0,255	1,5	0,096	1,0	0,052	0,8
5,80													0,669	2,3	0,275	1,5	0,102	1,0	0,054	0,8
6,00													0,716	2,3	0,292	1,6	0,109	1,1	0,058	0,8
6,50													0,826	2,4	0,338	1,7	0,125	1,1	0,067	0,9
7,00													0,95	2,7	0,388	1,8	0,144	1,2	0,078	1,0
7,50													1,083	2,9	0,441	2,0	0,164	1,3	0,087	1,0
8,00													1,225	3,0	0,497	2,1	0,185	1,4	0,098	1,1
8,50															0,556	2,2	0,205	1,5	0,111	1,2
9,00															0,618	2,4	0,229	1,6	0,123	1,2
9,50															0,684	2,5	0,254	1,7	0,137	1,3
10,00															0,753	2,6	0,280	1,8	0,149	1,4
10,50															0,824	2,7	0,304	1,8	0,163	1,4
11,00															0,900	2,9	0,333	1,9	0,178	1,5
11,50															0,984	3,0	0,362	2,0	0,194	1,6
12,00																	0,390	2,1	0,208	1,6
12,50																	0,422	2,2	0,225	1,7
13,00																	0,455	2,3	0,243	1,8
13,50																	0,489	2,4	0,261	1,8
14,00																	0,521	2,4	0,277	1,9
14,50																	0,557	2,5	0,297	2,0
15,00																	0,595	2,6	0,317	2,0
15,50																	0,634	2,7	0,337	2,1
16,00																	0,669	2,8	0,359	2,2
16,50																	0,711	2,9	0,378	2,2
17,00																	0,753	3,0	0,400	2,3
17,50																			0,423	2,4
18,00																			0,447	2,4
18,50																			0,468	2,5
19,00																			0,493	2,6
19,50																			0,518	2,6
20,00																			0,544	2,7
20,50																			0,567	2,8
21,00																			0,594	2,8
21,50																			0,622	2,9
22,00																			0,651	3,0

CARBO^{CRP} PIPES S3,2/S4

water temperature = 80 °C

	20 × 2,8 mm		25 × 2,8 mm		32 × 3,6 mm		40 × 4,5 mm		50 × 5,6 mm		63 × 7,1 mm		75 × 8,4 mm		90 × 10,1 mm		110 × 12,3 mm		125 × 14,0 mm	
Q	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v	R	v
l/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s	kPa/m	m/s
0,02	0,019	0,1	0,007	0,1																
0,04	0,067	0,2	0,023	0,2	0,007	0,1	0,002	0,1												
0,06	0,134	0,4	0,047	0,2	0,013	0,1	0,005	0,1	0,002	0,1										
0,08	0,221	0,5	0,074	0,3	0,023	0,2	0,008	0,1	0,003	0,1										
0,10	0,328	0,6	0,111	0,4	0,034	0,2	0,011	0,2	0,004	0,1	0,001	0,1								
0,12	0,465	0,7	0,155	0,5	0,048	0,3	0,016	0,2	0,006	0,1	0,002	0,1								
0,14	0,612	0,9	0,206	0,6	0,064	0,3	0,021	0,2	0,008	0,1	0,003	0,1								
0,16	0,777	1,0	0,263	0,6	0,082	0,4	0,028	0,2	0,01	0,2	0,003	0,1								
0,18	0,976	1,1	0,327	0,7	0,097	0,4	0,034	0,3	0,011	0,2	0,004	0,1	0,001	0,1						
0,20	1,180	1,2	0,397	0,8	0,119	0,5	0,041	0,3	0,013	0,2	0,004	0,1	0,002	0,1						
0,30	2,492	1,8	0,828	1,2	0,247	0,7	0,083	0,5	0,027	0,3	0,009	0,2	0,003	0,1	0,001	0,1				
0,40	4,299	2,5	1,406	1,6	0,419	1,0	0,139	0,6	0,047	0,4	0,015	0,2	0,005	0,2	0,002	0,1				
0,50	6,536	3,1	2,129	2,0	0,631	1,2	0,212	0,8	0,700	0,5	0,023	0,3	0,007	0,2	0,003	0,1				
0,60			3,018	2,4	0,885	1,4	0,293	0,9	0,095	0,6	0,032	0,4	0,010	0,3	0,004	0,2				
0,70			4,030	2,8	1,180	1,7	0,388	1,1	0,127	0,7	0,042	0,4	0,013	0,3	0,005	0,2	0,002	0,1		
0,80			5,183	3,1	1,530	1,9	0,501	1,2	0,164	0,8	0,053	0,5	0,016	0,3	0,007	0,2	0,003	0,1		
0,90			6,513	3,5	1,907	2,2	0,621	1,4	0,200	0,9	0,065	0,6	0,020	0,4	0,009	0,2	0,003	0,2		
1,00					2,323	2,4	0,761	1,5	0,244	1,0	0,079	0,6	0,025	0,5	0,010	0,3	0,004	0,2	0,002	0,1
1,20					3,277	2,9	1,062	1,8	0,346	1,2	0,109	0,7	0,034	0,5	0,014	0,3	0,005	0,2	0,003	0,2
1,40					4,389	3,4	1,423	2,1	0,457	1,4	0,148	0,9	0,045	0,6	0,019	0,4	0,007	0,2	0,004	0,2
1,60							1,835	2,5	0,583	1,6	0,188	1,0	0,057	0,7	0,024	0,4	0,009	0,3	0,005	0,2
1,80							2,281	2,8	0,731	1,7	0,233	1,1	0,071	0,8	0,029	0,5	0,011	0,3	0,006	0,2
2,00							2,792	3,1	0,888	1,9	0,282	1,2	0,085	0,8	0,035	0,5	0,013	0,4	0,007	0,3
2,20							3,354	3,4	1,067	2,1	0,34	1,3	0,103	0,9	0,041	0,6	0,016	0,4	0,009	0,3
2,40									1,253	2,3	0,399	1,5	0,119	1,0	0,050	0,6	0,019	0,4	0,01	0,3
2,60									1,465	2,5	0,462	1,6	0,140	1,1	0,057	0,7	0,021	0,5	0,011	0,4
2,80									1,68	2,7	0,529	1,7	0,159	1,1	0,065	0,7	0,025	0,5	0,013	0,4
3,00									1,91	2,9	0,607	1,8	0,182	1,2	0,074	0,8	0,027	0,5	0,015	0,4
3,20									2,167	3,1	0,684	2	0,203	1,3	0,084	0,8	0,031	0,6	0,017	0,4
3,40									2,426	3,3	0,765	2,1	0,229	1,4	0,094	0,9	0,035	0,6	0,019	0,5
3,60									2,715	3,5	0,85	2,2	0,253	1,4	0,104	0,9	0,039	0,6	0,021	0,5
3,80											0,947	2,3	0,282	1,5	0,114	1,0	0,042	0,7	0,023	0,5
4,00											1,042	2,4	0,308	1,6	0,127	1,1	0,047	0,7	0,025	0,5
4,20											1,14	2,6	0,34	1,7	0,139	1,1	0,051	0,7	0,028	0,6
4,40											1,244	2,7	0,368	1,7	0,151	1,2	0,056	0,8	0,031	0,6
4,60											1,36	2,8	0,403	1,8	0,163	1,2	0,060	0,8	0,032	0,6
4,80											1,492	2,9	0,434	1,9	0,176	1,3	0,066	0,8	0,035	0,7
5,00											1,589	3,1	0,471	2,0	0,192	1,3	0,071	0,9	0,038	0,7
5,20													0,504	2,0	0,206	1,4	0,077	0,9	0,041	0,7
5,40													0,544	2,1	0,221	1,4	0,081	0,9	0,044	0,7
5,60													0,585	2,2	0,235	1,5	0,088	1,0	0,047	0,8
5,80													0,622	2,3	0,254	1,5	0,093	1,0	0,05	0,8
6,00													0,666	2,3	0,270	1,6	0,100	1,1	0,053	0,8
6,50													0,77	2,4	0,313	1,7	0,115	1,1	0,062	0,9
7,00													0,888	2,7	0,36	1,8	0,132	1,2	0,071	1,0
7,50													1,013	2,9	0,409	2,0	0,151	1,3	0,080	1,0
8,00													1,147	3,0	0,462	2,1	0,171	1,4	0,090	1,1
8,50															0,517	2,2	0,189	1,5	0,102	1,2
9,00															0,576	2,4	0,212	1,6	0,113	1,2
9,50															0,638	2,5	0,235	1,7	0,126	1,3
10,00															0,703	2,6	0,259	1,8	0,137	1,4
10,50															0,771	2,7	0,282	1,8	0,151	1,4
11,00															0,842	2,9	0,309	1,9	0,165	1,5
11,50															0,922	3,0	0,337	2,0	0,180	1,6
12,00																	0,362	2,1	0,192	1,6
12,50																	0,393	2,2	0,209	1,7
13,00																	0,424	2,3	0,225	1,8
13,50																	0,456	2,4	0,242	1,8
14,00																	0,486	2,4	0,257	1,9
14,50																	0,52	2,5	0,276	2,0
15,00																	0,556	2,6	0,295	2,0
15,50																	0,593	2,7	0,314	2,1
16,00																	0,627	2,8	0,334	2,2
16,50																	0,666	2,9	0,352	2,2
17,00																	0,706	3,0	0,373	2,3
17,50																			0,395	2,4
18,00																			0,417	2,4
18,50																			0,437	2,5
19,00																			0,460	2,6
19,50																			0,485	2,6
20,00																			0,509	2,7
20,50																			0,531	2,8
21,00																			0,557	2,8
21,50																			0,583	2,9
22,00																			0,610	3,0

6. DISTRIBUTION SYSTEMS OF DRINKING WATER, COLD AND HOT WATER

6.1. PIPING MAINS

- The assembly is performed, based on the project documentation which complies to the valid standards EN 806-1 – 3.
- Method of installation of piping and its protection should be designed properly so that no pressure is transferred to the piping from the construction structures.
- The piping should be asshort and straight as possible.
- It is not possible to install in parallel the mains of drinking water and the piping of central heating in channels that are inaccessible for person.
- Water mains laid in constructional structures must be permanently secured against freezing, and the thermal characteristics of the object outside sheathing should not be impaired by he piping installation. The failure of the piping must not endanger the object.
- Water mains must not pass through chimney flues.
- Mains for drinking water must no pass through spaces with increased concentration of the vapours from oil products (PHM stores).
- Piping of an internal water distibution system may be laid in the ground under floor of constructional object only when it is laid in a protective structure with the possibility of check (in protective tube, in an installation channel atc.)

Covered pipeline

- Concealed pipes stored in protective pipes or insulation muct be conducted in an installation shaft or grooves in the walls, respectively in a properly conducted ducts in the floor.
- When the pipe is placed in protective tubes or in insulation into the building structure (eg. In concrete floors or walls), it is necessary to ensure that there can be no deformation or displacement.
- Protective pipes in ceilings must be completed at least 30 mm higher than the finished floor level, to prevent any possible leak of liqud spills.
- Thermal expansion pipe is in plastic pipes maintained in protective pipes secured by suitable fastening but is water and the protective pipe at the point of exit from the wall of floor.

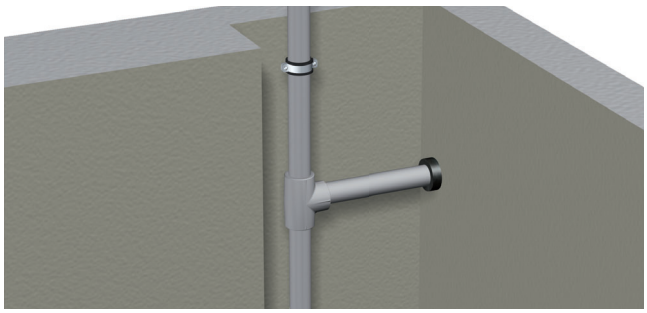
Connecting piping

- The connecting piping should be oriented in places without any assumed mechanical damage by drilling or cutting during fixing of supports, brackets, mirrors, handrails etc.
- Each intake armature must be fixed firmly, either with use of a wall-mounted structure in a classic masonry structure or with use of fixing elements for the attachement to walls of the service duct in flats.
- Attaching of pipes may be carried out using similar method as at attachment of cables by special clapms. It is necessary to insert a separation inserts from felt, foam, rubber, polyethylene etc. between pipes and clamps, which will prevent rubbing of pipes during dilatation movements, and protecting the pipe against mechanical damage in the place of attachment, or it is possible to use special metal clamps with rubber insert. It is necessary to use the separation insert of plastic clamps are used.
- For the fixing of the pipes, it is not recommended to use metal hooks as these may damage the pipes when the hooks are driven in the masonry.
- For the grooves in masonry, it is recommended to use pipes made with even shape, because a pipe from coil retains its shape memory. Fixing of pipes in grooves is made by plaster through a thermal insulation of protective part.
- Determination of places for laying of piping is carried out acc. to the projecting documentation and with observance of the specified pipe slopes. If the slope degree is not determined in the documentation, the piping is mounted with slope min 0,3 % towards the discharge or outlet armatures.

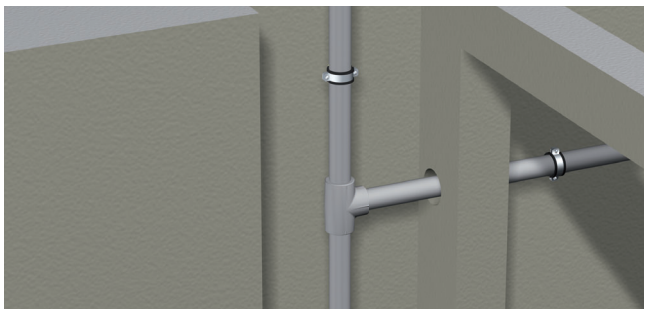
Vertical piping

- A branch from vertical piping to the connection piping is made indirectly by an elbow creating a flexible bending arm between the vertical and the connecting piping. By this adjustment an efficient compensation of dilatation or plastic mains is reached (see pict. 3). In the pict. 1 and 2 are shown other possible alternatives , i.e. a long arm of free passing through the wall.
- The vertical piping must be equipped with compensation elements.
- The vertical piping must be equipped with a system of fixed and sliding gripping located in dependence on the applied compensation elements (see the project documentation, chapter 7 of this manual).

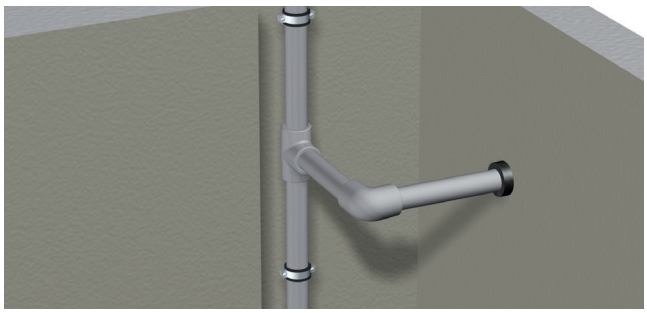
- Gripping of vertical piping may be performed by the existing clipps equipped with lastic protection or by plumber clamps with a rubber insert.
- Each passing through the constructional structure (ceiling spaces) must be equipped with suitable plastic bushing (polyethylene pipe, PVC pipe etc.) so that the plastic piping is not in a direct contact with the constructional structure (pict. 4).
- From the point of view of fire, it is necessary to fill the space between the rising pipe and gland with a non-flammable mastic (prevention of chimney effect).
- The vertical piping must be equipped with an independent closing armature.
- The vertical piping must be connected to horrizontal distribution system with elimination of influences caused by its own weight of vertical piping and influences caused by thermal changes.



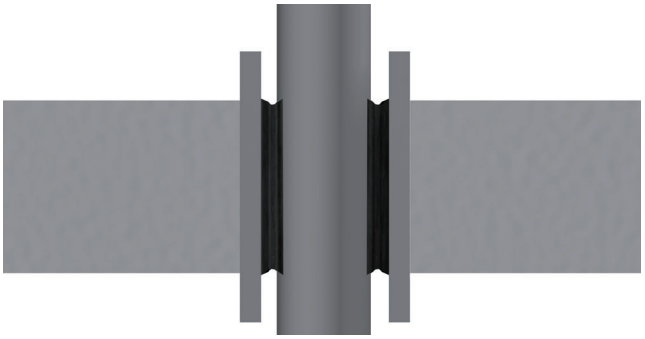
pic. 1



pic. 2



pic. 3



pic. 4

Horizontal distribution

- The horizontal distribution may be laid on benches under ceiling in grooves in masonry, in channels in floor, in gutters in soil or in plastic or metal sheets troughs. It is not recommended to fix the plastic pipes to the original steel mains.
- The horizontal distribution, as well as vertical piping, must be equipped with compensation elements of the fixed and sliding systems, which will assure the correct function of compensators.
- The closing armatures for the individual vertical piping (sections) must be oriented in accesible areas for the case of necessary quick closing.

Piping slope

- Horizontal piping must be installed with slope min. 0,3 % towards the lowest point of possible drainage and towards the highest point for ventilation.
- It is recommended that the horizontal mains of cold water are with slope towards the water connection (to the water metering set with a discharge armature). The horizontal distribution systems of hot water and circulation piping should have the slope towards the hot water reservoir.
- Parts of horizontal piping which cannot be ventilated to the vertical piping must be equipped with an independent vent valve located at the highest point. Piping parts that cannot be drained by discharges must be equipped with an independent discharge armature.

6.2. DISTANCE OF SUPPORTS

In case of when the piping is laid on surface of walls or installed under ceilings, it is necessary to observe the correct pitch at the supports or attachments.

In the following tables you can allways find the maximum distance of supports for individual pipes and PP-R/PP-RCT system INSTAPLAST.

PP-R S2,5 (PN20)

Ø piping [mm]	Supports distance [cm]					
	20 °C	30 °C	40 °C	50 °C	60 °C	80 °C
20	95	90	85	85	80	70
25	100	100	100	95	90	85
32	120	115	115	110	100	90
40	130	130	125	120	115	100
50	150	150	140	130	125	110
63	170	160	155	150	145	125
75	185	180	175	160	155	140
90	200	200	185	180	175	150
110	220	215	210	195	190	165

PP-R S5 (PN10)

Ø piping [mm]	Supports distance [cm]	
	20 °C	30 °C
20	80	75
25	85	85
32	100	95
40	110	110
50	125	120
63	140	135
75	155	150
90	165	165
110	185	180

UNIBETA

Ø piping [mm]	Supports distance [cm]					
	20 °C	30 °C	40 °C	50 °C	60 °C	80 °C
16	80	75	75	70	70	60
20	85	80	75	75	70	65
25	90	90	90	85	80	75
32	105	100	100	95	90	80
40	115	115	110	105	100	90
50	130	125	120	115	110	95
63	145	140	135	130	125	110
75	160	155	150	140	135	120
90	170	170	160	155	150	130
110	190	185	180	170	165	145
125	205	200	190	185	180	160
160	210	200	190	180	170	155
200	245	235	225	215	205	190

PP-R S3,2 (PN16)

Ø piping [mm]	Supports distance [cm]					
	20 °C	30 °C	40 °C	50 °C	60 °C	80 °C
20	90	80	80	80	70	65
25	95	95	95	90	80	75
32	110	105	105	100	95	80
40	120	120	115	105	100	95
50	135	130	125	120	115	100
63	155	150	145	135	130	115
75	170	165	160	150	145	125
90	180	180	170	165	160	135
110	200	195	190	180	175	155

CARBO^{CRP}

Ø piping [mm]	Supports distance [cm]
	Independently of the water temperature
20	80
25	100
32	110
40	120
50	130
63	145
75	150
90	155
110	160
125	165

Spacing supports for vertical pipes acc. to the above table may be multiplied by a factor of up to 1.3m i.e. greater spacing than the horizontal piping. Here it is necessary to proceed from the disposition acc. to the factsand options location of fixed and sliding, as well as consultations with the designer.

7. COMPENSATION OF PLASTIC PIPING

Due to the differences in temperature during assembly of piping, and the respective operation, the expansion of piping may occur (or shrinkage). Magnitude of this longitudinal change depends on the length of piping, coefficient of linear expansion and the differences in temperature.

Table for comparison of coefficients of linear expansion

Pipe	α (mm/(m.K))
PP-R	0,150
UNIBETA	0,150
CARBO^{CRP}	0,045

Expansion properties of the pipes - Linear expansion formula

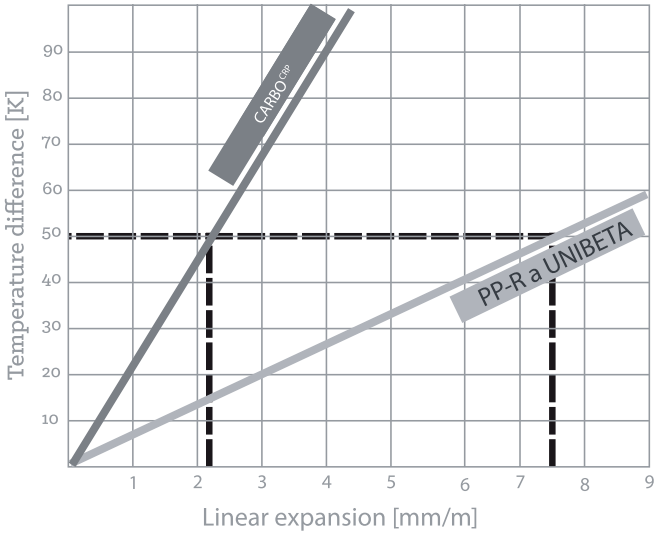
$$\Delta L = \alpha \times L \times \Delta T$$

ΔL elongation [mm]
α thermal coefficient of expansion
L length of pipe during installation [m]
ΔT temperature difference when installing and operating temperatures [K]

Examples

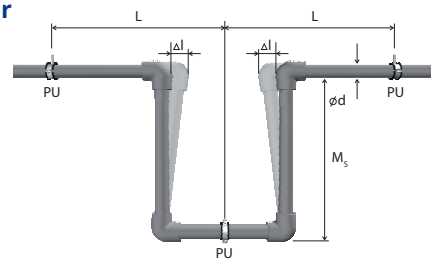
PP-R: ΔL = 0,15 . 6 . 50 = 45 mm
t_m installing temperature 15 °C
t_p operating temperature hot water 65 °C
L piping length 6 m
α 0,15 mm/(m.K)
where $\Delta t = t_p - t_m$

CARBO^{CRP}: ΔL = 0,045 . 6 . 50 = 13,5 mm
t_m installing temperature 15 °C
t_p operating temperature hot water 65 °C
L piping length 6 m
α 0,045 mm/(m.K)



The calculated linear expansion may be compensated by a suitable compensator:

a) U – compensator



PU - fixed fit
L - pipe length
Δl - elongation
Ød - pipe diameter
M_s - extension

The length of the flexible arm M_s depends on the expansion and the pipe diameter.

$$M_s = k \cdot \sqrt{\Delta l \cdot d}$$

k material constant (PP-R k = 20)
Δ l elongation (mm)
d piping diameter (mm)

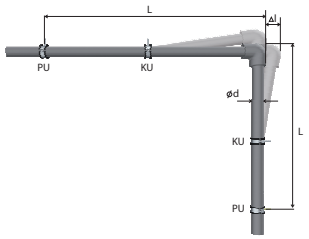
$$M_s = 20 \cdot \sqrt{45 \cdot 32} = 758 \text{ mm}$$

Conclusion:

If PP-R piping with dimension 32 mm and length 6 meters is heated, it is extended by 45 mm. For the compensation of this expansion, a flexible arm must be used with minimum length 758 mm. Correct function of a compensator is dependant on the suitable location of fixed and sliding fits.

b) L – compensator

PU - fixed fit
KU - sliding fit
L - pipe length
Δl - elongation
Ød - pipe diameter



c) Dilatation loop

PU - fixed fit
KU - sliding fit
L - pipe length
Ød - pipe diameter

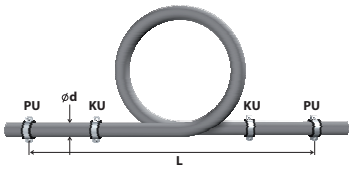


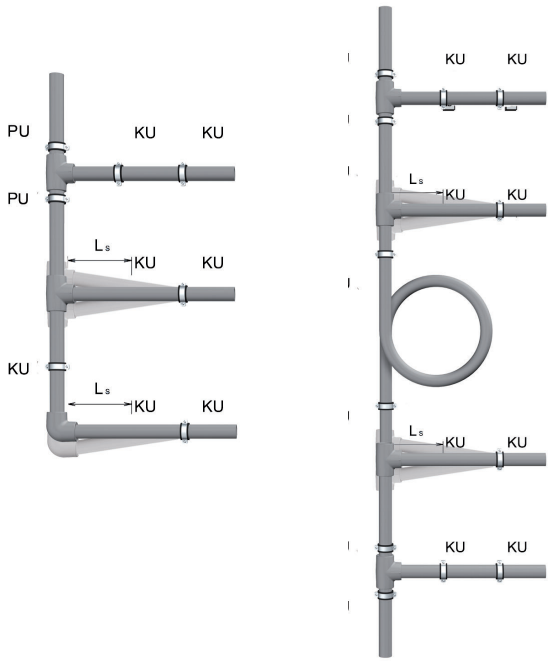
Table of extensions transferred by the dilatation loop:

d [mm]	max. Δ l (mm)
16	90
20	80
25	70
32	55
40	45

Fixed fit - gripping, where the piping cannot dilate. This may be carried out, e.g. at the bent piping (pic. 1), at a branch (pic. 2) or at a place of a fitting or water meter (pic. 3).

Sliding fit - method of fixing where the piping cannot move from the mains axis, however it can move and dilate axially inside a loose clamp (pic. 4), laying of piping in a trough (pic. 5) and installation under plaster with use of an insulation (pic. 6).

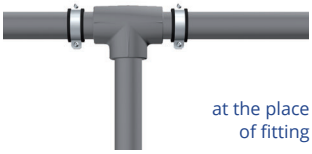
Ascending pipe line



Notice: Thee above given compensators may be used either for horizontal or for vertical piping. However in case of installation of plastic pipes under plaster, it is not possible to use these compensators. Linear expansion is in this cases compensated by waving of piping.
It is necessary to take in mind the dilation also at the connected mains. In the ascending shafts at branches of connecting piping, it must be assured that this piping can accommodate to the changes in length of the ascending pipe, i.e. that it can dilate sufficiently (see the picture in chapter Ascending piping). Compensation of linear expansion of piping is an important factor for the correct function of plastic mains. If the piping cannot extend and shrink, additional tensile or pressure strains are concentrated in the piping walls which shorten dramatically the piping lifetime.

at the place of fitting

pic. 1

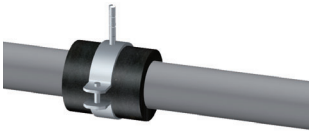


at the place of fitting

pic. 2

at the bent piping

pic. 3



loose clamp

pic. 4

laying of piping in trough

pic. 5

installation of piping under plaster

pic. 6

8. ASSEMBLY AND REPAIRS OF THE SYSTEM

Installation is based on TNI CEN / TR 12 108. Before installing the necessary control external and within the limits of possibility and the inner surface of the tube. For pressure application can be used only undamaged components can not use tubes with damage exceeding 1/10 of the wall thickness.

8.1. PIPING CONNECTION

- The plastic piping from PP-R and PP-RCT system INSTAPLAST is connected by welding, it also possible to use mechanical method of connecting with use of flanged connections in specific cases, in transitions to metal piping with threaded transition pieces (DG-transition pieces). The piping cannot be glued.
- The plastic mechanical couplings which may be also used for transitions of various plastic materials; it is necessary to ask the manufacturer to provide the Declaration about suitability of use for cold or hot water and the allowed max. pressures of media.
- Reduction of piping is made strictly by formed pieces determined for this purpose, it is prohibited to modify or change the existing formed pieces with using of any method.
- Bending at the mains are made with use of formed pieces.
- For the connection and repairs of pipes, it is possible to use welding methods by electroforming, whereas the electro-formed piece must be weldable with the given piping.
- Use of plastic pipes for hot water downwards of a through-flow water heater or the reservoir-type water heater is possible only at regulated heating systems where the medium temperature does not exceed in a long term 60 °C at max. operation pressure 10,9 bar at tube S2,5 (PN20) and in a short term 70 °C at max. operation pressure 8.3 bar at tube S2,5 (PN20).

Sealing of threaded transition pieces

1. It is prohibited to use hemp with respect to the necessary high tightening torque and the possibility of tearing the metal injection out of the plastic material; at the internal injections, there exists the risk of metal cracking.
2. It is allowed to use PTFE tape, special textile tapes (+GF ± Paraliq) or mastics based on PTFE which must be applied acc. to recommendations and manufacturer's instructions. The used sealing materials must be tested according to valid legislation and standards.

8.2. WELDABILITY OF MATERIALS

Weldability of plastic materials is assessed according to the weldability class as determined by the index of melt flow of the respective material - IT (MFR).

1. **Guaranteed weldability:** The materials have the same weldability class and IT are overlapping.
2. **Conditional weldability:** The materials have the same weldability class and IT are not overlapping, whereas the manufacturer guarantees their reciprocal weldability.

Warning: The index values of flow which are given in chapter 1.6. are valid for polypropylene material. Other combinations of materials (e.g. polypropylene - polyethylene) are basically unweldable. In such cases, it is necessary to use other connecting method.

8.3. POLYFUSION WELDING

Similar procedure of preparation and polyfusion welding of pipes of plastic materials is involved in the program of professional training courses for welders organized in compliance with the valid standards, unified methodology of welding of plastic materials and the Technical rules of Czech welding association ANB.

- **Course Z - u/7** - basic course for installers by polyfusion welding - 4 days
- **Course Z - u/V** - basic course for welding of external and internal distribution systems from plastic materials by various methods, including gluing - 10 days
- **Course C - u/V** - a course with certification test

8.3.1. TOOLS AND ACCESSORIES

The welding equipment for polyfusion welding is selected acc. to the diameter of welded piping and the character of welding works.

- up to diameter 40 mm (included) - Input 500 W Polys P - 1b
- up to diameter 63 mm (included) - Input 650 W Polys P - 1a, Polys P - 4/650 thorn-type
- up to diameter 75 mm (included) - Input 850 W Polys P - 4/850
- up to diameter 110 mm (included) - Input 1200 W Polys P - 4/1200 s

The individual polyfusion welding machines have (acc. to their design) the following options: the continuous analog regulation of temperature, continuous electronic regulation, or by steps by switching over to the required temperature. Also welding machines with one set temperature are manufactured.

Welding machines and fixtures are used from diameter 40 mm and higher:

- Fixture MP - 75 from Ø 40 mm to 75 mm (a corresponding welding machine must be used in compliance with the piping diameter used)
- Fixture MP - 110 form Ø 63 to 110 mm (welding machine 850 W and extensions in the fixture set)
- Welding machine ST - 160 from Ø 40 mm to 90 mm (welding machine 1200 W with extensions in the machine accessories - possibility of butt welding up to Ø 160 mm)

Polyfusion extensions may be jaw-type, or split extensions are used, acc. to the type of welding equipment, however all are provided with PTFE layer on the active surface which prevents sticking of plastic material to the heated up smelting surface.

Cutters and cutting equipment for plastic piping are manufactured in various sizes, acc. to the diameter of piping; cutters with cutting moment divided in to multiplied compression.

Cleaning paper for the surfaces on formed pieces and pipe should be without fibres and not coloured (it is possible to use toilet paper). Also special single-use cleaning tissues containing isopropyl alcohol are suitable, which are compressed in sealing foil against drying up.

Cleaning agent for pipes and formed pieces used for cleaning of welded surfaces from mechanical or chemical impurities before welding. Cleaning agent Tangit is suitable, or isopropyl alcohol, or 96 % alcohol, respectively. It is not allowed to use for cleaning the petrol based li- quids, organic solvents, or cleaning agents containing traces of these chemicals, respectively. Scale, marker and knife - we recommend to use this tools for measuring and marking of length for inserting of pipe in the formed piece, and smoothing of burrs before welding.

8.3.2. PRINCIPLE AND PROCEDURE OF POLYFUSION WELDING

A polyfusion weld is created by the simultaneous heating of cone throat of formed piece and the tube end in highly plastic state, and pressing the pipe in the throat of the formed piece in plastic state, fixing and cooling down of the connection, through which a homogenous connection is created with high stiffness.
In the cold state, the formed piece must not allow sliding on to the pipe of the same dimension. The harder the from piece goes on pipe, the better the resulting connection.

During the welding, it is necessary to maintain, additionally to others, the basic parameters of welding: **Temperature, Pressure, Time**. Maintaining of these parameters will influence the quality and longevity of the weld.

Temperature of welding: welding temperature for PP-R and PP--RCT (PP type 3 and 4) 260 °C.

Pressure: conic design of the formed piece and polyfusion extensions will ensure the pressure of heated up materials and complete bonding of macromolecular chains.

Time: time necessary for production of weld, divided in phases as given in the table for the individual diameters.

8.3.3. PROCEDURE FOR THE POLYFUSION WELDING

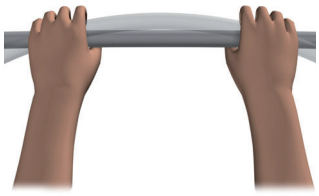
1) Generally

Connecting of plastic parts is done by polyfusion welding, butt welding and welding by electroforming. It is necessary to follow exact procedure and use the suitable tools.

- For the assembly, it is possible to use only elements that are not damaged or polluted.
- Welding of elements PP-R/PP-RCT system INSTAPLAST may be performed at temperature min +5 °C (pic. 1).

pic. 1

pic. 2

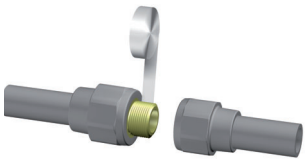


pic. 3

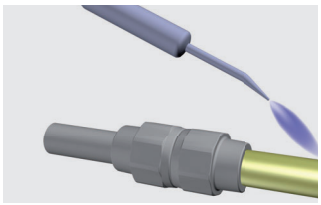
pic. 4

- The connected parts should be tempered at least 1 hour before the welding to the same temperature as it is specified in the work procedure.
- During the time of transport, handling and assembly, the system elements PP-R/PP-RCT system INSTAPLAST should be protected against shocks and other possible mechanical damage (pic. 2).
- Bending of pipes is performed without heating up at temperature min. +15 °C (pic. 3).
- Crossing of pipes is performed with use of special elements (pic. 4).
- It is not allowed to bend the pipes with use of hot air of open flame!!! (pic. 5).
- Threaded formed pieces are used for threaded connections. It is not admissible to cut threads directly on pipes!!! Sealing of threads is made by PTFE tape, sealing thread based on PTFE or by special sealing mastics (pic. 6). **It is prohibited to use hemp for sealing of threaded connections!!!**
- In cases where a metal pipe continues behind the formed piece, it is not possible to connect this piece by soldering or welding in the vicinity of the formed piece, with respect to the possible heat transfer in the formed piece!!! (pic. 7)

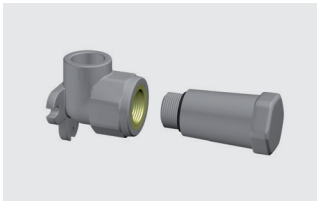
pic. 5



pic. 6



pic. 7



pic. 8

- During the pressure test, we recommend to use special mounting plastic plugs for closing of branches (wall-mounted structures, wall-mounted assemblies) (pic. 8).

2) Preparation

Fix the relevant welding extensions to the welding equipment, set the corresponding temperature by the regulator and plug in. In the heated state, using a cleaning cloth from non-synthetic textile material, clean the active surface from the rests of previous welding. The welding may be started after the welding equipment is heated up sufficiently.

Measure the necessary length of tube and cut it off (pic. 9).

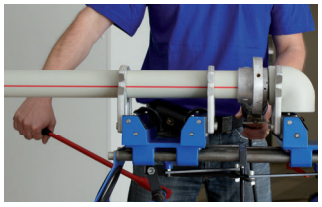
pic. 9

Clean and degrease pipe active surface - throats of formed pieces and tube parts for sliding in the throat.

3) Heating

At first, slide the formed piece on a heated extension and check for proper gripping at the extension. Formed piece which does not have the contact with the extension over the whole surface should be rejected because an uneven heating would cause a weld with poor quality. After the formed piece, slide the the pipe on the extension.
For the tightness of sliding in, the same is valid as for the formed piece (pic. 10, pic. 11).

pic. 10



pic. 11

Heat up both parts during the time specified in the table. The heating time is measured from the time when both, the formed piece and the pipe, are slid on the welding extension over the whole length. During sliding in, it is allowed to rotate slightly both parts (max. by 10°), before complete sliding over the required length. During the heating up, any rotation with the pipe or the formed piece is not allowed, to avoid any deformations of material.

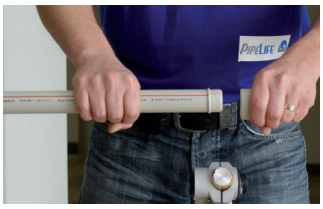
Table of welding for PP-R and PP-RCT (MRS8) (with use of DVS 2207, part 1, for temperature 260 °C)

Diameter [mm]	Heating time [sec]	Displacement time [sec]	Time of setting the weld [min]
16	5	3	2
20	5	3	2
25	7	3	2
32	8	6	4
40	12	6	4
50	18	6	4
63	24	8	6
75	30	8	6
90	40	8	6
110	50	10	8
125	60	90	8
160/200	butt welding at 210 °C		

DO NOT EXCEED THE HEATING TIME!

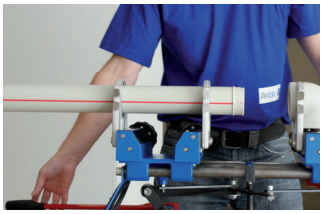
4) Displacement, connection and cooling down (setting)

After the heating time remove pipe and formed piece from the heating extension and connect them. Slide the pipe by a slow even pressure without rotation in the throat of formed piece up to the measured length of sliding in (pict. 12, 13, 14 and 15). The table contents the maximum allowed time from removing from extension up to the sliding of pipe in the formed piece, i.e. time during which the fresh connection should be completed before it is cooled down partially, and the setting time of welds at the individual diameters.

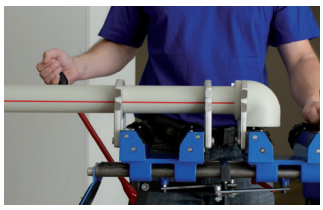


pic. 12

pic. 13



pic. 14



pic. 15

WARNING: after the cooling phase is finished (setting), the equilibrium condition is not achieved in the connection. The connection must be cooled down naturally before the first filling with cold water (permanent mechanical load) within this specified minimum time from the last welding:

- diameters 16, 20, 25 and 32 mm - 60 minutes
- diameters 40, 50, 63 and 75 mm - 90 minutes
- diameters 90,110, 125, 160 and 200 mm - 120 minutes

8.4. PIPING REPAIRS

When applying plastic materials, it is not possible to avoid damages caused by unprofessional assembly, unqualified performance of welding operations, damages caused by external influence during the lifetime of the mains, e.g. mechanical damage (drilling in, cutting through, piercing etc.), or unexpected change of operation conditions (increase in temperature and/or pressure of media in the distribution system). Due to this facts, a damage of piping can occur, which is manifested by cracking or other destruction of a part of mains. To restore the correct function, it is necessary to carry out professional repair of the distribution system. The scope of repairs depends on the rate of damage. In majority of cases, the damage of mains is of local nature, and because the connection is not demountable, it can be repaired by cutting off of the damaged part and its replacement. Repairs with use of gluing must be excluded for majority of polyolefin materials owing to limited ability for gluing and complexity of technology.

In praxis, the repair is made in the simplest way, i.e. by cutting out and welding on of a new part with use of suitable formed pieces. This method is used the most, but at the same time, it is also time consuming and requires extensive constructional works even by smaller damages.

Up to date, the electroformed pieces are used for these kinds of repairs. This method is using basically the plastic formed pieces which have a resistance wire coiled inside and terminated by two contacts determined for the connection to welding machine.

The weld itself is performed inside the connection: pipe - formed piece. This connection has several advantages:

- Only small space is necessary to complete this connection which is decreasing the constructional works to minimum.
- For polypropylene, it is possible to create the connection at temperature up to +5 °C (provided that the manufacturer does not require different temperature range).
- The technology decreases the probability of failure caused by human factor

During the use of electroformed pieces, the differences in comparison to polyfusion welding should be noted. Each worker should be trained in DU/8 course, as the minimum, or should pass the courses ZU/V, CU/V. A closer explanation is given in the frame procedure of welding which in no case can replace the professional training.

8.5. ADDITIONAL INSTALLATION OF THE WELD IN SADDLE

A wide range of weld in saddles allows you to create a branch in diameter 20 - 63 mm or branch with internal and external thread (up to dim 2") for all types of PP-R/PP-RCT pipes of the INSTAPLAST system in diameters 63 - 200 mm.

By installing the saddle, the T-piece can be replaced and subsequently reduced to the required one branch dimension.

Welding is polyfusion - type C. For each diameter of the branch pipe is a special weliding tool attachment, it is universal for all types flat welders. Welding takes place at a temperature of 260 °C (with permitted tolerance ± 10 °C). Welding tools must be clean and should be cleaned before each welding process.

1) Drill a hole with a special drill for a given diameter of pipe and saddle.

2) Clean this hole. and the saddle, degrease it.

3) Slide the weld in saddle onto the tool so that they follow each other lines on the seat and extension. Heat the hole and the welding saddle. Time warm-up for saddles: 90 x 32 mm is 8 s, for saddles 110 × 32 and 110 × 40 is 12 s, and for the other saddles 30 seconds.

4) Slide the heated saddle into the heated hole and fix for approx. 15 s. After one hour, it can be filled with water and subjected to pressure.

8.6. WELDING BY ELECTRO-FORMING

1) Preparation of material

- Adjust the pipe length using the cutter of wheel cutter.
- The pipe ends determined for sliding in the formed piece should be scraped, so that the oxidized layer is removed (approx. 0,1 mm). Then the formed piece and pipes are cleaned by cleaning agent.
- Select the piece for electroforming with a suitable diameter and from the identical material as the pipe. The pipe should be inserted easily in the formed piece (otherwise the tube must be scrapped more).

2) Procedure of the welding

- Assemble both connected parts and fix (by special yoke or otherwise), so that the tube is not extruded from the formed piece due to internal stress during welding.
- For the welding process itself, use a suitable welding equipment (e.g. welding equipment DYTRON), and connect it to power source and wait until the required working mode is set. After setting of required parameters connect the adapters to the contacts on the formed piece and start the welding process. completion of welding is signaled by the control lamp on the welding equipment.
- When the weld is made correctly, the control points are marked on the formed piece.
- The connection must not be stressed mechanically during 60 - 120 min. (depending on the formed piece) from the time of completion of weld.

8.7. WORKING CONDITIONS

The working place and working areas must comply with safety regulations. The working spaces must have sufficient lighting, be protected against wind, ideally with a roof against rain and solar radiation, with such manipulation and storage conditions which can prevent any mechanical damage of plastic materials. In winter period, the working place and the structure where the welding procedures of piping routes or the preparation of prefabricates will be performed, should be heated. Welding of elements of PP-R/PP-RCT system INSTAPLAST system (with exception of pieces made by electroforming) may be performed from ambient temperature + 5 °C; for the preparation of prefabricates, it is recommended to warm up the working space to min. + 10 °C. The connected parts should be tempered at least 1 hour before the welding to the same temperature in a heated working space.

Composition of working group:

● Installer - welder ● Installer - helper

9.
PRESSURE TEST

After finishing the assembly, and before connecting to public water mains or an own water resource, the internal water distribution system must be checked visually and pressure tested (see ČSN 73 6660). A record is made of the pressure test in compliance with the relevant regulations. The test of piping verifies its completeness, resistance to internal overpressure and tightness.

Before the pressure test, it is necessary to flush all sections of the internal water distribution system by water to sludge at the lowest point at the same time. The pressure test is performed after the assembly of all accessories, installation objects, appliances.

and equipment (outlet and safety armatures, pumps, heaters etc.). The internal water distribution system is tested by 1,5 multiple of the operation overpressure, however at least with overpressure 1,5 MPa. After filling with water, the internal water distribution system should be stabilised by operation overpressure min. during 12 hours. After this time, the pressure is increased to the value of test overpressure. After one hour from the time when the testing overpressure was reached, the pressure must not decrease by more than 0,02 MPa. When the decrease is higher, the pressure test is not compliant.

Example of record of the inspection and pressure test of an internal water mains acc. Czech norm

Protocol of pressure test performed on:

1. Name of the building object: . . . . . .
2. Construction site – address: . . . . . .
3. Water resources: . . . . . .
4. Project: . . . . . .
Changes of project: . . . . . .
5. Installed dimensions and lengths of piping: . . . . . .
6. Installed armatures: . . . . . .
7. Procedure of pressure test - pressure equipment:
start: . . . . . end: . . . . . .
test pressure: . . . . . pressure after 1 hour: . . . . . .
pressure decrease: . . . . . .
result of the test: . . . . . .
results of respective partial pressure tests: . . . . . .
8. Investor: . . . . . .
9. Supplier: . . . . . .

. . . . . .
Stamp & signature

. . . . . .
Stamp & signature

10. CONNECTION OF THE INTERNAL WATER SUPPLY AND THE ELECTRICAL PROTECTIVE CONDUCTOR DEVICE

Water system is connected to the protective guidance of heavy equipment according to CSN 33 2000-4-41 ed. 2 and CSN 33 2000-5-54 ed. 3.

Protection against electric shock in bathrooms, lavatories and showers must comply with CSN 33 2000-7-701 ed. 2.

Bridging the water meter fitted on a conductive water pipe, which is connected to the protective conductor of the electrical equipment must be in accordance with the CSN 33 2000-4-41 ed. 2 and CSN 33 2000-5-54 ed. 3.

If the repair of water pipes replaced part of conductive material, it is still necessary before the interruption in the pipeline this part of the bridge that while working to prevent electric shock.

If the pipe between the conductive material is non-conductive pipe material (plastic) must be some continuity of grounding and equipotential bonding according to CSN 33 2000-5-54 ed. 3.

11.
INSULATION OF PIPING

- Internal water mains must not be installed in areas where the temperature during normal operation decreases under 5 °C, provided that the distribution system is not secured against the influences by temperature decrease (e.g. by insulation).
- Piping of cold water (installed loosely, laid in grooves in installation channels etc.) must be secured against condensation of moisture.
- Piping for cold water installed loosely in warm or heated environment, and installed in parallel with the heating system or the system of hot circulation water, must be protected against warming up and propagation of undesirable germs.
- Piping of hot water and circulation piping with forced circulation of water must be thermally insulated because of the thermal losses and linear expansion, in compliance with the requirements of valid standards.
- It is possible to use various materials for the insulation, e.g. foam, expanded polystyrene, mineral wool, or the insulation based on foam PE, PP or PUR, respectively. Minimum thickness of insulating layer is 5 mm for cold water. The minimum thickness of insulation layer for hot water is intended by Czech notice 193/2007. It depends on pipe diameter, wall thickness, insulation material and determing the heat transfer coefficient.
- Insulation pipes must be installed with pre-tension according to the instructions by the manufacturer because it is necessary to take in mind the natural shrinkage at the expanded materials - in longitudinal direction.

Determining the heat transfer coefficient insulated pipeline interior wiring Uo ≤ minimum requirement for thermal heat transfer coefficient per unit length U

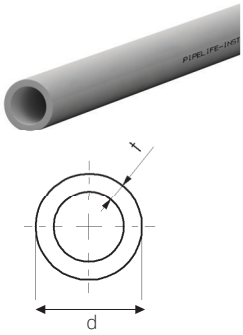
Diameter [mm]	U [W/(m.k)]
DN 10 - DN 15	0,15
DN 20 - DN 32	0,18
DN 40 - DN 65	0,27
DN 80 - DN 125	0,34
DN 150 - DN 200	0,40

E.g. for pressure range of PN 20 is the minimum insulation thickness internal distribution in mm:

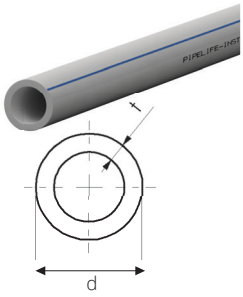
Diameter d [mm]	Stone wool (Thermal Conductivity λiz = 0,041 W/(m.K))	Mineral wool (Thermal Conductivity λiz = 0,038 W/(m.K))
16	30	18
20	25	22
25	32	28
32	42	37
40	25	22
50	32	28
63	40	36
75	35	30
90	40	36
110	50	45
125	61	55
160	63	57

12. PRODUCTS

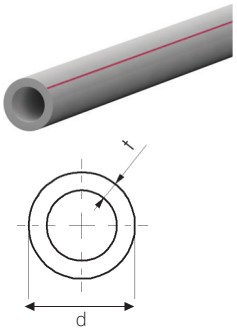
PIPES

PP-R S5	d [mm]	t [mm]	Code	SP	LB	kg/m
	**20**	1,9	3296400012	4	100	0,107
	25	2,3	3296401005	4	100	0,164
	32	2,9	3296401015	4	40	0,261
	40	3,7	3296402003	4	40	0,412
	50	4,6	3296402010	4	16	0,638
	63	5,8	3296403003	4	8	1,010
	75	6,8	☎	4	8	1,410
	90	8,2	☎	4	4	2,030
	110	10,0	☎	4	4	3,010

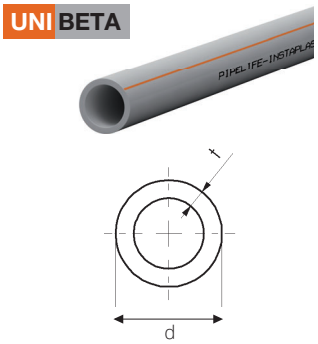
Pipes are available in rods 4 m length without stripe

PP-R S3,2	d [mm]	t [mm]	Code	SP	LP	kg/m
	**20**	2,8	3296400013	4	100	0,148
	25	3,5	3296401006	4	100	0,230
	32	4,4	3296401016	4	40	0,370
	40	5,5	3296402004	4	40	0,575
	50	6,9	3296402011	4	16	0,896
	63	8,6	3296403004	4	8	1,410
	75*	10,3	☎	4	8	2,010
	90*	12,3	☎	4	4	2,870
	110*	15,1	☎	4	4	4,300

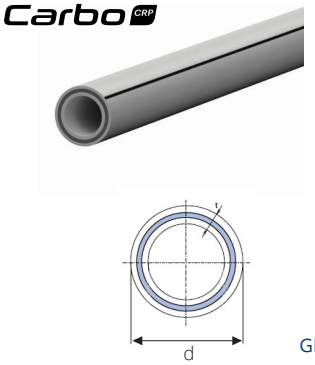
Pipes are available in rods 4 m length with blue stripe

PP-R S2,5	d [mm]	t [mm]	Code	SP	LP	kg/m
	**20**	3,4	3296400014	4	100	0,172
	25	4,2	3296401007	4	40	0,266
	32	5,4	3296401017	4	40	0,434
	40	6,7	3296402005	4	16	0,671
	50	8,3	3296402012	4	8	1,040
	63	10,5	3296403005	4	8	1,650
	75*	12,5	☎	4	4	2,340
	90*	15,0	☎	4	4	3,360
	110*	18,3	☎	4	4	5,010

Pipes are available in rods 4 m length with red stripe

UNIBETA (PP-RCT)		d [mm]	t [mm]	Code		SP		LP		kg/m
				3 m	4 m	3 m	4 m	3 m	4 m	
		**16**	2,2	3296430003	3296430002	3	4	75	100	0,091
		20	2,3	3296430006	3296430005	3	4	75	100	0,122
		25	2,8	3296431003	3296431002	3	4	75	100	0,185
		32	3,6	3296431007	3296431006	3	4	30	40	0,304
		40	4,5	3296432003	3296432002	3	4	30	40	0,474
		50	5,6	3296432007	3296432006	3	4	12	16	0,736
		63	7,1	3296433003	3296433002	3	4	6	8	1,176
		75	8,4	3296433007	3296433006	3	4	6	8	1,654
		90	10,1	3296433011	3296433010	3	4	3	4	2,386
		110	12,3	3296434003	3296434002	3	4	3	4	3,548
	GR	**125**	14,0	–	3296434004	–	4	–	4	4,580
	GR	**160**	14,6	–	3295404001	–	4	–	4	6,270
	GR	**200**	18,2	–	3295404002	–	4	–	4	9,950

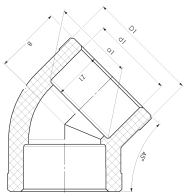
Pipes are available in rods 3 and 4 m length with orange stripe. GR – green color.

CARBO^{CRP} (PP-RCT/PP-RCT+CF/PP-RCT)		d [mm]	t [mm]	Code		SP		LP		kg/m
				3 m	4 m	3 m	4 m	3 m	4 m	
		**20**	2,8	3296410003	3296410002	3	4	75	100	0,145
		25	3,5	3296411003	3296411002	3	4	75	100	0,226
		32	4,4	3296411006	3296411005	3	4	30	40	0,364
		40	5,5	3296412003	3296412002	3	4	30	40	0,568
		50	6,9	3296412006	3296412005	3	4	12	16	0,887
		63	8,6	3296413003	3296413002	3	4	6	8	1,396
		75	8,4	3296413006	3296413005	3	4	6	8	1,672
		90	10,1	3296413009	3296413008	3	4	3	4	2,412
		110	12,3	3296414003	3296414002	3	4	3	4	3,587
	GR	**125**	14,0	–	3296454007	–	4	–	4	4,630

Pipes are available in rods 3 and 4 m length with black stripe. GR – green color.

FITTINGS

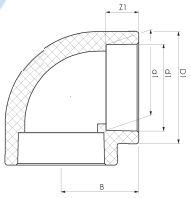
Elbow 45°



	d [mm]	d1 [mm]	B [mm]	Z1 [mm]			Code	SP	LP	kg/pcs
	16	15,5	18,0	13,3			3297440203	50	200	0,008
	20	19,5	18,7	14,5			3297440210	50	500	0,019
	25	24,5	21,2	16,0			3297441205	50	300	0,023
	32	31,5	39,0	18,1			3297441214	20	100	0,036
	40	39,4	38,0	20,5			3297442203	5	25	0,060
	50	49,4	46,0	23,5			3297442210	5	20	0,101
	63	62,5	50,0	27,4			3297443203	5	20	0,208
	75	74,9	48,5	31,0			3297443210	2	8	0,402
	90	89,9	56,2	35,5			3297443216	1	6	0,685
	110	110,0	66,3	41,5			3297444202	1	5	1,025
GR	**125**	125,0	77,0	40,0			3295414201	1	1	1,410
GR	**160**	160,0	BUTT WELDED				3295414202	1	1	2,420
GR	**200**	200,0	BUTT WELDED				3295414005	1	1	4,400

GR – green color

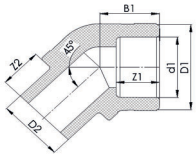
Elbow 90°



	d [mm]	d1 [mm]	B [mm]	Z1 [mm]			Code	SP	LP	kg/pcs
	16	15,5	22,5	13,3			3297440204	50	250	0,008
	20	19,5	28,0	14,5			3297440211	50	400	0,015
	25	24,5	29,9	16,0			3297441206	50	300	0,028
	32	31,5	40,0	18,1			3297441215	20	100	0,050
	40	39,4	40,0	20,5			3297442204	10	70	0,084
	50	49,4	48,0	23,5			3297442211	10	40	0,141
	63	62,5	58,7	27,4			3297443204	5	20	0,258
	75	74,9	70,5	31,0			3297443211	2	6	0,455
	90	89,9	81,5	35,5			3297443217	1	4	0,788
	110	110,0	98,1	41,5			3297444203	1	4	1,376
GR	**125**	125,0	124,0	40,0			3295414203	1	1	2,056
GR	**160**	160,0	BUTT WELDED				3295414204	1	1	2,940
GR	**200**	200,0	BUTT WELDED				3295414205	1	1	5,610

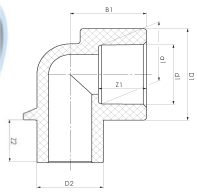
GR – green color

Elbow 45° pin



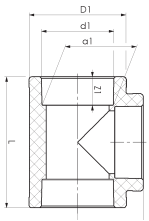
d [mm]	d1 [mm]	B [mm]	Z1 [mm]	D2 [mm]	Code	SP	LP	kg/pcs
20	19,5	18,7	14,5	20,0	3297440213	20	200	0,011
25	24,5	21,2	16,0	25,0	3297441219	20	200	0,019

Elbow 90° pin



d [mm]	d1 [mm]	B [mm]	Z1 [mm]	D2 [mm]	Z2 [mm]	Code	SP	LP	kg/pcs
20	19,5	23,5	14,5	20,0	14,0	3297440212	50	300	0,014
25	24,5	32,5	16,0	25,0	16,0	3297441207	50	250	0,026
32	31,5	34,0	18,1	32,0	18,1	3297441220	20	100	0,057

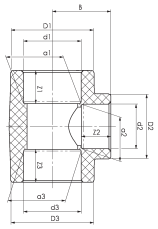
T-piece



	d [mm]	d1 [mm]	B [mm]	Z1 [mm]	L [mm]		Code	SP	LP	kg/pcs
	16	15,5	22,0	13,3	44,0		3297440303	50	250	0,012
	20	19,5	26,0	14,5	54,0		3297440312	50	300	0,021
	25	24,5	27,0	16,0	65,0		3297441310	50	150	0,035
	32	31,5	36,0	18,1	78,0		3297441330	20	100	0,063
	40	39,4	42,0	20,5	94,0		3297442305	10	50	0,114
	50	49,4	50,0	23,5	114,0		3297442322	5	30	0,200
	63	62,5	70,0	27,4	140,0		3297443304	2	16	0,448
	75	74,9	70,0	31,0	142,0		3297443314	1	6	0,527
	90	89,9	81,3	35,5	162,6		3297443319	1	6	0,940
	110	110,0	97,5	41,5	195,0		3297444301	1	4	1,590
GR	**125**	125,0	124,0 | 41,5 | 248				3295414301	1	1	2,510
GR	**160**	160,0	BUTT WELDED				3295414302	1	1	4,060
GR	**200**	200,0	BUTT WELDED				3295414303	1	1	7,300

GR – green color

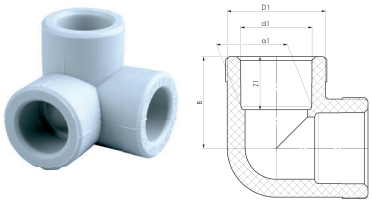
Reducing T-piece



	d [mm]	d1 [mm]	d2 [mm]	Z1 [mm]	Z2 [mm]	B [mm]	L [mm]	Code	SP	LP	kg/pcs
	20x16x20	19,5	15,5	14,5	13,3	26,0	54,0	3297440313	50	300	0,026
	20x25x20	19,5	24,5	14,5	16,0	27,0	64,0	3297440314	50	150	0,033
	25x20x25	24,5	19,5	16,0	14,5	33,0	60,0	3297441311	50	200	0,036
	25x25x20	24,5	24,5	16,0	16,0	27,0	64,0	3297441312	50	150	0,038
	25x32x25	24,5	31,5	16,0	18,1	36,0	76,0	3297441313	20	120	0,049
	25x20x20	24,5	19,5	16,0	14,5	30,0	60,0	3297441314	20	100	0,035
	32x20x32	31,5	19,5	18,1	14,5	32,0	69,0	3297441331	20	100	0,045
	32x20x25	31,5	19,5	18,1	14,5	32,0	69,0	3297441332	20	100	0,047
	32x25x32	31,5	24,5	18,1	16,0	33,0	70,0	3297441333	20	100	0,049
	32x32x25	31,5	31,5	18,1	18,1	39,0	77,0	3297441334	20	100	0,061
	32x40x32	31,5	39,4	18,1	20,5	44,5	89,0	3297441335	10	50	0,081
	40x20x40	39,4	19,5	20,5	14,5	36,0	78,0	3297442306	10	60	0,083
	40x25x40	39,4	24,5	20,5	16,0	37,5	81,0	3297442307	10	60	0,104
	40x32x40	39,4	31,5	20,5	18,1	43,5	90,0	3297442308	10	50	0,103
	50x25x50	49,4	24,5	23,5	16,0	40,5	80,0	3297442323	5	30	0,142
	50x32x50	49,4	31,5	23,5	18,1	42,5	80,0	3297442324	5	30	0,146
	50x40x50	49,4	39,4	23,5	20,5	57,5	114,0	3297442325	5	15	0,223
	63x32x63	62,5	31,5	27,4	18,1	52,0	92,0	3297443306	5	20	0,259
	63x40x63	62,5	39,4	27,4	20,5	53,0	92,0	3297443305	5	20	0,260
	63x50x63	62,5	49,4	27,4	23,5	66,5	140,0	3297443307	5	16	0,414
	75x50x75	74,9	49,4	31,0	23,5	70,5	142,0	3297443315	2	12	0,496
	75x63x75	74,9	62,5	31,0	27,4	70,0	142,0	3297443316	2	8	0,531
	90x63x90	89,9	62,5	35,5	27,4	73,3	136,0	3297443320	2	6	0,727
	90x75x90	89,9	74,9	35,5	31,0	76,8	148,0	3297443321	2	6	0,805
	110x63x110	110,0	62,5	41,5	27,4	83,0	148,0	3297444302	1	5	1,076
	110x75x110	110,0	74,9	41,5	31,0	86,6	160,0	3297444303	1	4	1,170
	110x90x110	110,0	89,9	41,5	35,5	91,2	175,0	3297444304	1	4	1,270
GR	**125x75x125**	124,5	74,5	40,0		30,0	248,0	3295414304	1	1	2,320
GR	**125x90x125**	124,5	74,5	40,0		35,0	248,0	3295414305	1	1	2,330
GR	**125x110x125**	124,5	74,5	40,0		40,0	248,0	3295414306	1	1	2,400
GR	**160x90x160**	BUTT WELDED						3295414307	1	1	3,520
GR	**160x110x160**	BUTT WELDED						3295414308	1	1	3,650
GR	**200x90x200**	BUTT WELDED						3295414319	1	1	6,170
GR	**200x110x200**	BUTT WELDED						3295414320	1	1	6,280
GR	**200x125x200**	BUTT WELDED						3295414321	1	1	6,370
GR	**200x160x200**	BUTT WELDED						3295414322	1	1	6,700

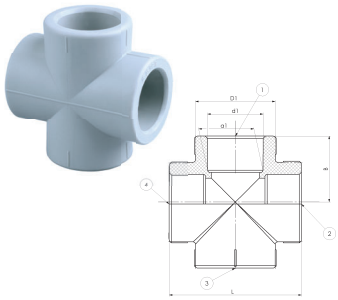
GR – green color

Three way branch



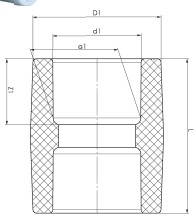
d [mm]	d1 [mm]	Z1 [mm]	B[mm]				Code	SP	LP	kg/pcs
20x20x20	19,5	14,5	25,0				3297440311	10	50	0,030

Cross



d [mm]	d1 [mm]	L [mm]	B [mm]				Code	SP	LP	kg/pcs
20	19,5	51,0	25,5				3297440315	25	100	0,022
25	24,5	58,0	29,0				3297441315	25	100	0,037
32	31,5	69,0	34,5				3297441336	10	50	0,064
40/25	39,4	67,0	33,5				3297442309	10	50	0,075

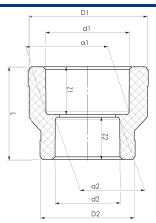
Pipe coupling



	d [mm]	d1 [mm]	Z1 [mm]	L [mm]			Code	SP	LP	kg/pcs
	16	15,5	13,3	28,0			3297440402	50	250	0,006
	20	19,5	14,5	30,0			3297440407	50	600	0,011
	25	24,5	16,0	40,0			3297441406	50	400	0,019
	32	31,5	18,1	46,0			3297441420	20	200	0,024
	40	39,4	20,5	53,5			3297442406	20	100	0,053
	50	49,4	23,5	62,0			3297442419	10	70	0,095
	63	62,5	27,4	62,0			3297443405	5	30	0,120
	75	74,9	31,0	71,5			3297443417	1	30	0,260
	90	89,9	35,5	76,0			3297443424	1	16	0,436
	110	110,0	41,5	90,0			3297444402	1	10	0,614
GR	**125**	125,0	40,0	90,0			3295414414	1	1	0,76

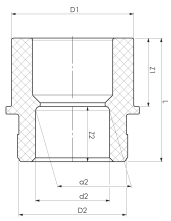
GR – green color

Reducing pipe coupling



d [mm]	d1 [mm]	d2 [mm]	Z1 [mm]	Z2 [mm]	L [mm]	Code	SP	LP	kg/pcs
20/16	19,5	15,5	14,5	13,3	30,0	3297440409	50	200	0,010
25/20	24,5	19,5	16,0	14,5	32,0	3297441408	50	450	0,012
32/20	31,5	19,5	18,1	14,5	39,0	3297441424	50	250	0,025
32/25	31,5	24,5	18,1	16,0	35,0	3297441423	50	250	0,017
40/32	39,4	31,5	20,5	18,1	40,0	3297442410	10	100	0,031
50/40	49,4	39,4	23,5	20,5	46,0	3297442422	10	100	0,054

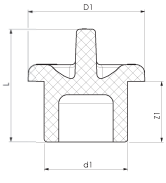
Reduction



	d [mm]	d1 [mm]	d2 [mm]	Z1 [mm]	Z2 [mm]	L [mm]	Code	SP	LP	kg/pcs
	20/16	20,0	15,5	32,0	13,3	32,0	3297440408	50	250	0,006
	25/20	25,0	19,5	16,5	14,5	32,0	3297441407	50	500	0,010
	32/20	32,0	19,5	18,0	14,5	32,5	3297441421	50	250	0,017
	32/25	32,0	24,5	18,0	16,0	38,0	3297441422	50	300	0,020
	40/20	40,0	19,5	20,5	14,5	34,0	3297442407	10	100	0,018
	40/25	40,0	24,5	20,5	16,0	35,5	3297442408	10	100	0,019
	40/32	40,0	31,5	18,5	18,1	39,0	3297442409	20	100	0,021
	50/32	50,0	31,5	29,5	18,1	62,0	3297442420	10	100	0,044
	50/40	50,0	39,4	29,5	20,5	66,0	3297442421	10	100	0,054
	63/32	63,0	31,5	35,0	18,1	75,5	3297443406	10	70	0,093
	63/40	63,0	39,4	28,5	20,5	65,0	3297443407	10	60	0,083
	63/50	63,0	49,4	28,0	23,5	62,5	3297443408	10	70	0,093
	75/50	75,0	49,4	30,0	23,5	57,5	3297443419	2	20	0,121
	75/63	75,0	62,5	30,0	27,4	65,0	3297443418	1	25	0,178
	90/63	90,0	63,0	33,4	27,5	64,5	3295413401	1	1	0,210
	90/75	90,0	75,0	34,0	30,0	78,0	3295413402	1	1	0,270
	110/75	110,0	75,0	39,4	30,0	60,0	3295413403	1	1	0,480
	110/90	110,0	80,0	39,4	30,0	87,0	3295414411	1	1	0,500
GR	**125/110**	125,0	BUTT WELDED				3295414402	1	1	1,050
GR	**160/110**	160,0	BUTT WELDED				3295414403	1	1	1,150
GR	**160/125**	160,0	BUTT WELDED				3295414404	1	1	1,160
GR	**200/110**	200,0	BUTT WELDED				3295414417	1	1	1,100
GR	**200/160**	200,0	BUTT WELDED				3295414418	1	1	2,610

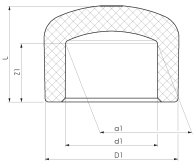
GR – green color

Plug



d [mm]	L [mm]	H [mm]			Code	SP	LP	kg/pcs
16	13,0	25,0			3297440604	50	200	0,003
20	14,5	29,0			3297440612	50	250	0,006
25	16,0	31,0			3297441606	50	200	0,009
32	23,0	36,5			3297441613	10	100	0,013

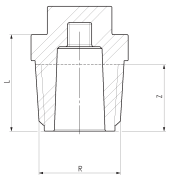
Blinder



	d [mm]	d1 [mm]	Z1 [mm]	L [mm]		Code	SP	LP	kg/pcs
	16	15,5	13,3	16,0		3297440603	50	400	0,004
	20	19,5	14,5	24,0		3297440611	50	200	0,006
	25	24,5	16,0	25,0		3297441605	50	200	0,011
	32	31,5	18,1	26,2		3297441612	10	100	0,016
	40	39,4	20,5	30,8		3297442603	5	50	0,040
	50	49,4	23,5	35,4		3297442607	5	30	0,074
	63	62,5	27,4	44,0		3297443602	5	25	0,150
	75	74,9	31,0	58,2		3297443605	5	20	0,254
	90	89,9	35,5	66,0		3297443606	2	6	0,364
	110	110,0	41,5	79,0		3297444601	2	8	0,602
GR	**125**	125,0	40,0	87,0		3295414601	1	1	0,790
GR	**160**	160,0	BUTT WELDED			3295414602	1	1	0,890
GR	**200**	200,0	BUTT WELDED			3295414419	1	1	2,040

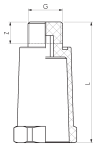
GR – green color

Plug with thread



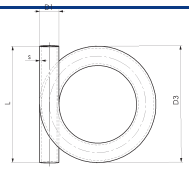
	Colour	Type	Z [mm]	L [mm]	Code	SP	LP	kg/pcs
CW	blue	**1/2"**	17,5	24,0	3297440613	50	250	0,006
	red	**1/2"**	17,5	24,0	3297440614	50	250	0,006
	grey	**1/2"**	17,5	24,0	3297440615	50	250	0,006
	grey	**3/4"**	18,0	24,0	3297441607	50	500	0,009

Plug for template with seal



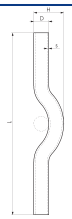
	Colour	Type	Z [mm]	L [mm]	Code	SP	LP	kg/pcs
CW	blue	**1/2"**	12,0	70,0	3297440617	10	250	0,020
	red	**1/2"**	12,0	70,0	3297440618	10	250	0,020
	grey	**1/2"**	12,0	70,0	3297440616	10	250	0,020

Dilatation loop



Type	d1 [mm]	L [mm]	d3 [mm]		Code	SP	LP	kg/pcs
20	20,0	185,0	480,0		3295440208	1	100	0,181
25	25,0	205,0	490,0		3295441206	1	80	0,280
32	32,0	210,0	450,0		3295441212	1	60	0,478
40	40,0	235,0	510,0		3295442202	1	40	0,738

Shifter

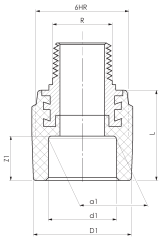


Type	d [mm]	L [mm]	H [mm]		Code	SP	LP	kg/pcs
20	20,0	45,0	400,0		3295440207	10	50	0,069
25	25,0	50,0	400,0		3295441205	10	50	0,106
32	32,0	70,0	400,0		3295441211	5	20	0,173

Socket crossing

Type	d [mm]	L [mm]	B [mm]	B1 [mm]	Code	SP	LP	kg/pcs
20	20,0	184,0	53,0	31,5	3297440327	10	50	0,040
25	25,0	184,0	60,0	32,5	3297440328	10	50	0,060

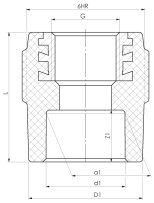
DG coupling MZV (male)



	Type	d1 [mm]	Z1 [mm]	L [mm]	Code	SP	LP	kg/pcs
	16x3/8“	15,5	13,3	29,5	3297450703	10	50	0,050
	16x1/2“	15,5	13,3	34,0	3297450704	10	50	0,063
	20x3/8“	19,5	14,5	32,5	3297450716	10	100	0,052
	20x1/2“	19,5	14,5	37,5	3297450714	10	150	0,065
	20x3/4“	19,5	14,5	41,0	3297450715	10	100	0,113
	25x1/2“	24,5	16,0	35,0	3297451710	10	50	0,069
	25x3/4“	24,5	16,0	42,5	3297451711	10	100	0,115
	32x3/4“	31,5	18,1	45,0	3297451729	5	50	0,129
	32x1“	31,5	18,1	45,0	3297451730	5	60	0,145
	40x5/4“	39,4	20,5	52,0	3297452702	4	40	0,365
	50x6/4“	49,4	23,5	55,0	3297452704	5	20	0,521
	63x2“	62,5	27,4	71,0	3297453702	2	14	0,750
	75x2 1/2“	74,9	31,0	80,0	3297453705	1	9	1,288
	90x3“	89,9	35,5	86,5	3297453707	1	6	1,715
GR	**110x4"**	108,9	40,0	161,0	3295414701	1	1	2,922
GR	**125x5"**	123,8	40,0	170,0	3295414702	1	1	4,380

GR – green color

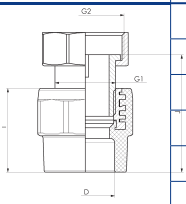
DG coupling MZD (female)



	Type	d1 [mm]	Z1 [mm]	L [mm]	Code	SP	LP	kg/pcs
	16x3/8“	15,5	13,3	30,0	3297450804	10	100	0,034
	16x1/2“	15,5	13,3	33,0	3297450824	10	50	0,050
	20x3/8“	19,5	14,5	32,5	3297450822	10	100	0,041
	20x1/2“	19,5	14,5	37,5	3297450823	10	200	0,042
	20x3/4“	19,5	14,5	41,0	3297451812	10	100	0,058
	25x1/2“	24,5	16,0	40,0	3297451813	10	50	0,043
	25x3/4“	24,5	16,0	42,5	3297451832	10	100	0,058
	32x3/4“	31,5	18,1	45,0	3297451833	5	40	0,075
	32x1“	31,5	18,1	45,0	3297452802	5	60	0,125
	40x5/4“	39,4	20,5	53,0	3297452805	4	40	0,359
	50x6/4“	49,4	23,5	69,0	3297453802	5	20	0,414
	63x2“	62,5	27,4	92,0	3297453804	2	14	0,662
	75x2 1/2“	74,9	31,0	106,0	3297453805	2	8	1,075
	90x3“	89,9	35,5	99,5	580414.01	1	6	1,623
GR	**110x4"**	108,9	40,0	121,0	3295414801	1	1	2,270
GR	**125x5"**	123,8	40,0	125,0	3295414703	1	1	3,510

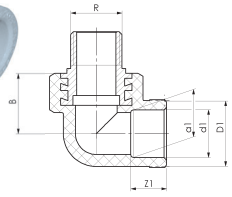
GR – green color

DG coupling with PM



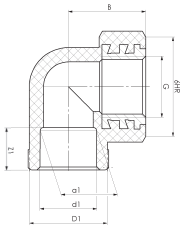
Type	d [mm]	l [mm]	J [mm]	Code	SP	LP	kg/pcs
16x1/2“	16,0	31,0	44,0	3295440804	10	100	0,085
16x3/4“	16,0	33,5	49,0	3295440819	10	100	0,115
20x1/2“	20,0	32,0	45,0	3295440817	10	100	0,097
20x3/4“	20,0	40,0	60,0	3295440818	10	100	0,091
20x1“	20,0	42,0	58,0	3295441809	10	50	0,173
25x3/4“	25,0	40,5	53,5	3295441808	10	50	0,095
25x1“	25,0	42,0	57,0	3295441823	10	40	0,168
32x1“	32,0	45,0	60,0	3295441822	5	50	0,185
32x5/4“	32,0	45,5	63,0	3295442802	5	50	0,292
40x6/4“	40,0	63,0	84,0	580608.01	2	16	0,512

Elbow 90° MZV (male)



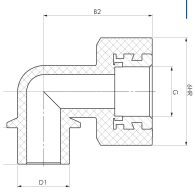
Type	d1 [mm]	Z1 [mm]	B [mm]	Code	SP	LP	kg/pcs
16x1/2“	15,5	13,3	29,0	3297450705	10	100	0,064
20x1/2“	19,5	14,5	30,0	3297450717	10	150	0,080
20x3/4“	24,5	16,0	33,0	3297450718	10	50	0,126
25x1/2“	19,5	14,5	35,0	3297451712	10	50	0,082
25x3/4“	24,5	16,0	37,5	3297451713	10	100	0,129
32x3/4“	31,5	18,1	41,5	3297451731	10	50	0,153
32x1“	31,5	18,1	41,0	3297451732	5	50	0,145

Elbow 90° MZD (female)



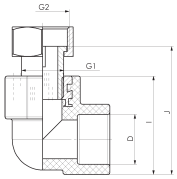
Type	d1 [mm]	Z1 [mm]	B [mm]		Code	SP	LP	kg/pcs
16x1/2“	15,5	13,3	28,5		3297450803	10	100	0,054
20x1/2“	19,5	14,5	30,0		3297450817	10	150	0,064
20x3/4“	19,5	14,5	30,0		3297450818	10	50	0,066
25x1/2“	24,5	16,0	33,5		3297451808	10	50	0,065
25x3/4“	24,5	16,0	32,0		3297451809	10	100	0,068
32x3/4“	31,5	18,1	36,0		3297451827	5	50	0,073
32x1“	31,5	18,1	41,0		3297451828	5	50	0,130

Elbow 90° MZD pin (female)



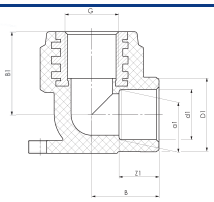
Type	d1 [mm]	Z1 [mm]	B1 [mm]	B2 [mm]	Code	SP	LP	kg/pcs
20x1/2“	20,0	14,0	25,0	42,0	3297450816	10	100	0,060

Elbow 90° MZD with PM



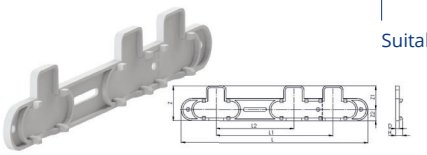
Type	d [mm]	l [mm]	J [mm]		Code	SP	LP	kg/pcs
16x3/4“	16,0	41,0	54,0		3295440805	10	100	0,115
20x3/4“	20,0	48,0	63,0		3295440820	10	50	0,119
20x1“	20,0	45,0	64,0		3295440821	10	50	0,168
25x3/4“	25,0	51,0	65,0		3295441811	10	50	0,134
32x1“	32,0	57,0	76,0		3295441825	5	50	0,179
32x5/4“	32,0	61,0	83,0		3295441824	5	30	0,266

Wall piece MZD (female)



Type	B [mm]	B1 [mm]	Z1 [mm]		Code	SP	LP	kg/pcs
16x3/8"	26,0	24,5	13,3		3297450601	10	50	0,047
16x1/2"	26,0	24,5	13,3		3297450602	10	50	0,056
20x1/2"	26,0	32,0	14,5		3297450610	10	150	0,069
25x1/2"	26,5	32,0	16,0		3297451605	10	50	0,073
25x3/4"	35,0	32,0	16,0		3297451606	10	100	0,084

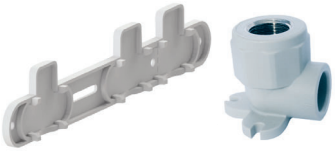
Fixing plate for wall elbows



L(mm)	L1 (mm)	L2(mm)	Z(mm)	H2(mm)	Code	SP	LP	kg/pcs
240,0	150,0	100,0	44,0	9,2	3297470006	5	100	0,047

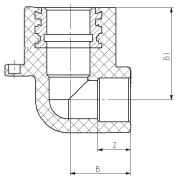
Suitable for fixing wall elbows 20x½ “and 25x½“

Set - Fixing plate and wall elbows



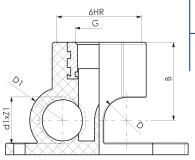
Type	Item		Code	SP	BP	kg/set
20x1/2“	2x wall elbows MZD + 1x fixing plate		3295440605	1	20	0,185
25x1/2“	2x wall elbows MZD + 1x fixing plate		3295441603	1	20	0,193

Wall piece MZD for plaster



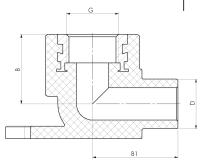
Type	B [mm]	B1 [mm]	Z1 [mm]		Code	SP	LP	kg/pcs
20x1/2“	27,0	41,0	32,0		3295440601	2	20	0,0959

Terminal wall piece MZD (female) right, left



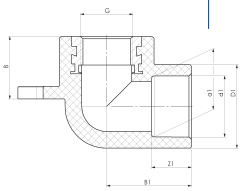
Type	d [mm]	Z1 [mm]	B [mm]		Code	SP	LP	kg/pcs
20x1/2" P	29,0	34,0	14,5		3297450612	10	100	0,078
20x1/2" L	29,0	34,0	14,5		3297450613	10	100	0,078

Wall piece MZD pin (female)



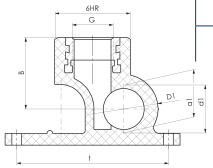
Type	d [mm]	B1 [mm]	B [mm]		Code	SP	LP	kg/pcs
20x1/2“	28,0	34,0	14,5		3297450616	10	150	0,071

Partition wall piece MZD (female)



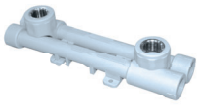
Type	d1 [mm]	Z1 [mm]	B1 [mm]		Code	SP	LP	kg/pcs
20x1/2“	28,0	34,0	14,5		3297450615	10	100	0,065

Through wall pieceí MZD (female)



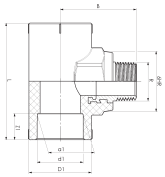
Type	d1 [mm]	t [mm]	B [mm]		Code	SP	LP	kg/pcs
20x1/2“	19,5	68,0	35,0		3297450611	10	100	0,067
25x1/2“	24,5	78,0	36,5		3297451604	5	50	0,085

Wall set MZD (female)



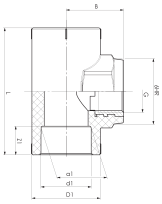
Type	d1 [mm]	Z1 [mm]	L1 [mm]	L [mm]	Code	SP	LP	kg/pcs
20x1/2“	27,0	14,5	151,5	226,5	3297450614	1	10	0,192

T-piece MZV (male)



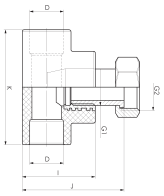
Type	d1 [mm]	Z1 [mm]	B [mm]	L [mm]	Code	SP	LP	kg/pcs
20x1/2“	19,5	14,5	30,5	65,0	3297450713	10	100	0,084
25x1/2“	24,5	16,0	32,5	68,0	3297451708	10	100	0,090
25x3/4“	24,5	16,0	35,5	80,0	3297451709	5	20	0,148
32x1/2“	31,5	18,1	36,0	68,0	3297451728	5	20	0,094

T-piece MZD (female)



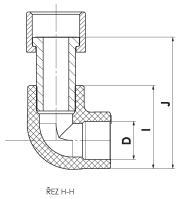
Type	d1 [mm]	Z1 [mm]	B [mm]	L [mm]	Code	SP	LP	kg/pcs
20x1/2“	19,5	14,5	30,0	66,0	3297450819	10	120	0,072
20x3/4“	19,5	14,5	32,0	74,0	3297450820	5	30	0,084
25x1/2“	24,5	16,0	32,5	76,0	3297451810	5	100	0,075
25x3/4“	24,5	16,0	35,0	81,0	3297451811	5	25	0,100
32x1/2“	31,5	18,1	38,0	68,0	3297451829	5	25	0,091
32x3/4“	31,5	18,1	33,0	80,0	3297451830	5	25	0,100
32x1“	31,5	18,1	38,0	86,0	3297451831	5	20	0,135

T-piece with PM



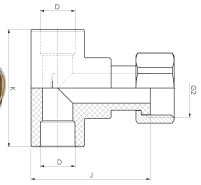
Type	d [mm]	J [mm]	K [mm]		Code	SP	LP	kg/pcs
20x3/4“	20,0	61,0	66,0		3295440815	10	100	0,141
20x1“	20,0	67,0	74,0		3295440816	5	50	0,198
25x3/4“	25,0	66,0	75,0		3295441806	5	50	0,141
25x1“	25,0	69,0	80,0		3295441807	5	50	0,202
32x3/4“	32,0	73,0	68,0		3295441819	5	40	0,157
32x1“	32,0	71,0	79,0		3295441820	5	30	0,207
32x5/4“	32,0	78,0	85,0		3295441821	5	25	0,290

Elbow 90°BJ with PM



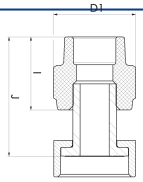
	Type	d [mm]	J [mm]	K [mm]	Code	SP	LP	kg/pcs
CW	**16x1/2“**	16,0	34,0	57,0	3295440901	10	150	0,032
	20x1/2“	20,0	40,0	60,0	3295440908	10	100	0,048
	20x3/4“	20,0	40,0	60,0	3295440909	10	100	0,055
	25x3/4“	25,0	48,0	68,0	3295441904	10	100	0,060
	25x1“	25,0	48,0	70,0	3295441905	10	50	0,074

T-piece BJ with PM



	Type	d [mm]	J [mm]	K [mm]	Code	SP	LP	kg/pcs
CW	**16x1/2“**	16,0	58,0	44,0	3295440902	10	40	0,006
	16x3/4“	16,0	59,0	46,0	590602.01	5	50	0,011
	20x1/2“	20,0	64,0	55,0	3295440910	10	40	0,019
	20x3/4“	20,0	62,0	52,0	3295440911	5	50	0,024
	20x1“	20,0	67,0	65,0	3295440912	5	50	0,053
	25x3/4“	25,0	73,0	60,0	3295441906	5	50	0,095
	25x1“	25,0	69,0	59,0	3295441907	5	25	0,120
	32x3/4“	32,0	77,0	59,0	3295441909	5	25	0,436
	32x1“	32,0	77,0	70,0	3295441910	5	25	0,614

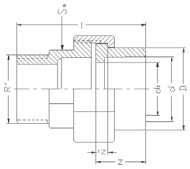
DG coupling BJ with PM



	Type	d [mm]	l [mm]	J [mm]	Code	SP	LP	kg/pcs
CW	**20x1/2“**	27,0	32,0	55,0	3295440905	10	100	0,040
	20x3/4“	28,0	38,0	61,0	3295440906	10	100	0,050
	25x3/4“	34,0	39,0	60,0	3295441901	10	100	0,060
	25x1“	34,0	38,0	60,0	3295441902	10	50	0,100
	***20x3/4"**	28,0	38,0	61,0	3295440907	10	100	0,050
	***25x3/4"**	34,0	39,0	60,0	3295441903	10	100	0,060

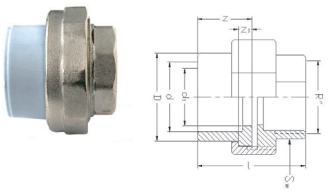
**PM with a hole for the seal*

Transition union (male)



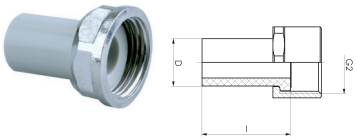
Type	d [mm]	z [mm]	l [mm]	SW [mm]	Code	SP	LP	kg/pcs
20x1/2"	26,5	20,1	49,5	27,0	3295410005	25	100	0,111
20x3/4"	26,5	20,1	53,0	32,0	3295410006	25	75	0,157
20x1"	26,5	20,1	61,0	38,0	3295410012	25	50	0,209
25x3/4"	34,5	22,5	55,5	32,0	3295411008	25	75	0,154
25x1"	34,5	24,5	61,0	38,0	3295411010	25	50	0,180
32x1"	40,0	24,5	61,0	38,0	3295411009	25	50	0,202
40x5/4"	50,5	27,5	62,4	48	3295412003	25	25	0,293
50x6/4"	64,0	27,7	65,7	53	3295412004	10	20	0,413
63x2"	81,5	33,7	78,2	70	3295413005	5	10	0,881
75x2,5"	97,0	43,0	80	88	3295413006	5	5	1,016

Transition union (female)



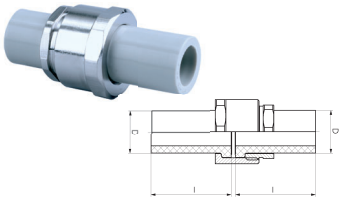
Type	d [mm]	z [mm]	l [mm]	SW [mm]	Code	SP	BP	kg/psc
20x1/2''	26,5	20,1	37,0	27,0	3295410003	25	100	0,093
20x3/4''	26,5	20,1	42,0	32,0	3295410004	25	75	0,150
20x1''	26,5	20,1	46,5	38,0	3295410013	25	50	0,160
25x3/4''	34,5	22,5	44,5	32,0	3295411005	25	75	0,147
25x1''	34,5	24,5	46,5	38,0	3295411007	25	50	0,165
32x1''	40,0	24,5	46,5	38,0	3295411006	25	50	0,189
40x5/4''	50,5	27,5	49,8	48	3295412005	25	25	0,241
50x6/4''	64,0	27,7	52	57	3295412006	10	20	0,388
63x2''	81,5	33,7	60,6	70	3295413007	5	10	0,767
75x2,5''	97,0	43,0	69	88	3295413008	5	5	0,980

Hollander



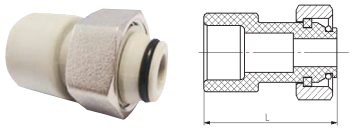
	Type	d [mm]	l [mm]		Code	SP	LP	kg/psc
CW	**16x1/2“**	16,0	35,0		3295440001	10	50	0,025
	20x3/4“	20,0	35,0		3295440002	10	100	0,040
	25x1“	25,0	35,0		3295441002	5	50	0,063

Detachable joint



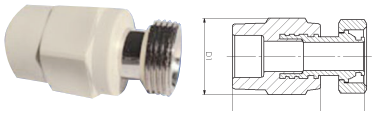
Type	d [mm]	l [mm]		Code	SP	LP	kg/psc
20	20,0	35,0		3295440003	10	100	0,098
25	25,0	41,0		3295441001	10	50	0,124
32	32,0	46,0		3295441003	10	30	0,190
40	40,0	53,0		3295442001	5	15	0,301
50	50,0	130,0		3295442002	2	8	0,805

Europlast PM



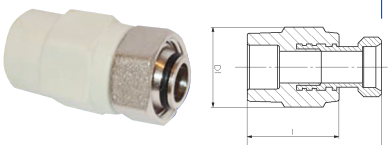
Type	L [mm]		Code	SP	LP	kg/psc
20x3/4“	47,5		3295440507	10	100	0,045

Euroconus MZV



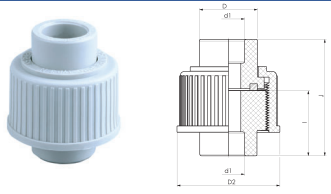
Type	d1 [mm]	L [mm]	l [mm]	Code	SP	LP	kg/pcs
20x3/4“	35,5	60	41	3295410701	10	100	0,045

Euroconus MZD PM



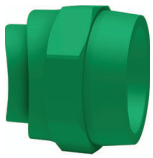
Type	d1 [mm]	L [mm]	l [mm]	Code	SP	LP	kg/pcs
20x3/4“	35,5	61,5	41	3295410801	10	100	0,095

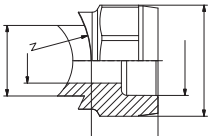
Direct coupling



	Type	d [mm]	l [mm]	J [mm]	Code	SP	LP	kg/pcs
CW	**20**	44,1	40,0	71,0	3295440405	10	50	0,075
	25	34,4	40,0	71,0	3295441406	10	50	0,088
	32	34,4	45,0	87,0	3295441417	10	50	0,124

Weld in saddle

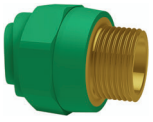


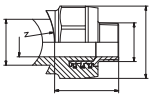


	Type	d2 (mm)	di (mm)	H (mm)	SW (mm)	Code	SP	BP	kg/psc
	40-50x20	25,0	15,0	29,0	38,0	3295412302	1	1	0,001
	63x32	32,0	20,5	27,0	38,0	3295413301	1	1	0,040
	75x32	32,0	20,5	27,0	51,0	3295413801	1	1	0,040
	90x32	32,0	20,5	27,0	51,0	3295413302	1	1	0,040
	110x32	32,0	20,5	25,7	51,0	3295414310	1	1	0,047
	110x40	40,0	25,5	25,7	63,0	3295414311	1	1	0,052
GR	**63/125 x 20**	25,0	15,0	29,0	38,0	3295414312	1	1	0,025
GR	**63/125 x 25**	25,0	15,0	29,0	38,0	3295414323	1	1	0,022
GR	**63/125 x 32**	32,0	20,5	35,0	51,0	3295414324	1	1	0,035
GR	**75/125 x 40**	40,0	25,5	38,0	63,0	3295414325	1	1	0,083
GR	**90/125 x 50**	50,0	32,0	39,0	70,0	3295414326	1	1	0,098
GR	**110/125 x 63**	63,0	40,0	45,0	85,0	3295414327	1	1	0,163
GR	**160/250 x 20**	25,0	15,0	29,0	38,0	3295414328	1	1	0,027
GR	**160/250 x 25**	25,0	15,0	29,0	38,0	3295414313	1	1	0,020
GR	**160/250 x 32**	32,0	20,5	35,0	51,0	3295414314	1	1	0,050
GR	**160/250 x 40**	40,0	25,5	38,0	63,0	3295414315	1	1	0,090
GR	**160/250 x 50**	50,0	32,0	39,0	70,0	3295414316	1	1	0,100
GR	**160/250 x 63**	63,0	40,0	45,0	85,0	3295414317	1	1	0,160

GR – green color

Weld in saddle - MZV

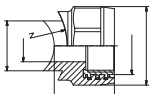




	Type	d2 (mm)	di (mm)	H (mm)	SW (mm)	Code	SP	BP	kg/psc
	75x3/4"	32,0	20,5	82,3	51,0	3295413303	1	1	0,135
	90x3/4"	32,0	20,5	89,8	51,0	3295413304	1	1	0,135
GR	**63-125x1/2"**	25,0	15,0	42,0	38,0	3295414340	1	1	0,090
GR	**63-125x3/4"**	32,0	20,5	49,0	51,0	3295414341	1	1	0,130
GR	**75-125x1"**	40,0	25,5	54,0	63,0	3295414342	1	1	0,210
GR	**90-125x5/4"**	50,0	32,0	59,0	70,0	3295414343	1	1	0,340
GR	**90-125x6/4"**	50,0	34,0	59,0	70,0	3295414344	1	1	0,350
GR	**110-125x2"**	63,0	40,0	68,0	85,0	3295414345	1	1	0,650
GR	**160-250x1/2"**	25,0	15,0	42,0	38,0	3295414346	1	1	0,090
GR	**160-250x3/4"**	32,0	20,5	49,0	51,0	3295414347	1	1	0,130
GR	**160-250x1"**	40,0	25,5	54,0	63,0	3295414348	1	1	0,220
GR	**160-250x5/4"**	50,0	32,0	59,0	70,0	3295414349	1	1	0,330
GR	**160-250x6/4"**	50,0	34,0	59,0	70,0	3295414350	1	1	0,350
GR	**160-250x2"**	63,0	40,0	68,0	85,0	3295414351	1	1	0,730

GR – green color

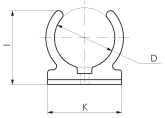
Weld in saddle - MZD



	Type	d2 (mm)	di (mm)	H (mm)	SW (mm)	Code	SP	BP	kg/psc
	75x3/4"	32,0	20,5	64,5	51,0	3295413410	1	1	0,091
	90x3/4"	32,0	20,5	72,0	51,0	3295413802	1	1	0,130
GR	**63/125 x 1/2"**	25,0	15,0	29,0	38	3295414318	1	1	0,025
GR	**63-125x3/4"**	32,0	20,5	35,0	51	3295414329	1	1	0,110
GR	**75-125x1"**	40,0	25,5	38,0	63	3295414330	1	1	0,170
GR	**90-125x5/4"**	50,0	32,0	39,0	70	3295414331	1	1	0,250
GR	**90-125x6/4"**	50,0	34,0	39,0	70	3295414332	1	1	0,220
GR	**110-125x2"**	63,0	40,0	45,0	85	3295414333	1	1	0,460
GR	**160-250x1/2"**	25,0	15,0	29,0	38	3295414334	1	1	0,070
GR	**160-250x3/4"**	32,0	20,5	35,0	51	3295414335	1	1	0,110
GR	**160-250x1"**	40,0	25,5	38,0	63	3295414336	1	1	0,170
GR	**160-250x5/4"**	50,0	32,0	39,0	70	3295414337	1	1	0,240
GR	**160-250x6/4"**	50,0	34,0	39,0	70	3295414338	1	1	0,240
GR	**160-250x2"**	63,0	40,0	45,0	85	3295414339	1	1	0,490

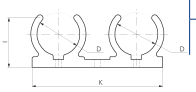
GR – green color

Clip



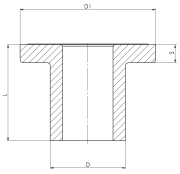
Type	d [mm]	l [mm]	K [mm]		Code	SP	LP	kg/psc
16	16,0	25,0	20,0		3295410507	50	250	0,002
20	20,0	27,0	26,0		3295411509	50	1000	0,003

Double clip



Type	d [mm]	l [mm]	K [mm]		Code	SP	LP	kg/psc
16	16,0	25,0	50,0		3295410506	20	500	0,006
20	20,0	27,0	60,0		3295411508	20	500	0,007

Flange adaptor



	Type	d [mm]	L [mm]	d1 [mm]	S [mm]	Code	SP	LP	kg/pcs
	40	40,0	58,0	80,0	12,5	3295412401	2	10	0,078
	50	50,0	60,0	90,0	12,5	3297442608	2	10	0,109
	63	63,0	62,0	105,0	13,5	3297443603	1	10	0,165
	75	75,0	73,0	123,0	14,7	3295413405	1	5	0,275
	90	90,0	92,0	140,0	17,0	3295413406	1	1	0,440
	110	110,0	103,0	160,0	19,0	3295414412	1	1	0,644
GR	**125**	125,0	53,0	162,0	25,0	3295414405	1	1	0,360
GR	**160**	BUTT WELDED				3295414406	1	1	1,610
GR	**200**	BUTT WELDED				3295414407	1	1	3,020

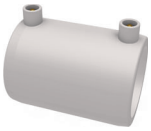
GR – green color

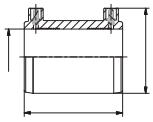
Flange

	Type	d1 [mm]	d2 [mm]	d [mm]	Y [mm]	Code	SP	LP	kg/pcs
	40/DN32	100,0	140,0	46,0	4	3295412402	1	1	1,618
	50/DN40	110,0	150,0	54,0	4	3295412403	1	1	1,811
	63/DN50	125,0	165,0	66,0	4	3295413407	1	1	2,400
	75/DN65	145,0	185,0	83,0	8	3295413408	1	1	2,860
	90/DN80	160,0	200,0	94,0	8	3295413409	1	1	3,520
	110/DN100	180,0	220,0	114,0	8	3295414413	1	1	3,875
GR	**125/DN100**	180,0	220,0	109,0	8	3295414416	1	1	2,120
GR	**160/DN150**	240,0	285,0	160,0	8	3295414415	1	1	2,720
GR	**200/DN200**	295,0	340,0	221,0	8	3295414420	1	1	8,700
GR	**200/DN200/ PN20**	295,0	340,0	221,0	12	3295414421	1	1	8,700

Y - number of the bores. GR – green color

Electrofusion socket





	Type	d (mm)	L (mm)	H (mm)	Code	SP	BP	kg/psc
	20	20,0	70,0	52,0	3295410007	1	1	0,037
	25	25,0	70,0	57,0	☎	1	1	
	32	32,0	80,0	65,0	3295411011	1	1	0,050
	40	40,0	90,0	74,0	3295412001	1	1	0,060
	50	50,0	100,0	85,0	3295412002	1	1	0,080
	63	63,0	111,0	97,0	3295413001	1	1	0,110
	75	75,0	120,0	114,0	3295413002	1	1	0,160
	90	90,0	130,0	130,0	3295413003	1	1	0,350
	110	110,0	140,0	152,0	3295414003	1	1	0,393
GR	**125**	125,0	151,0	168,0	3295414001	1	1	1,110
GR	**160**	160,0	172,0	205,0	3295414002	1	1	1,610
GR	**200**	200,0	203,0	245,0	3295414004	1	1	1,900

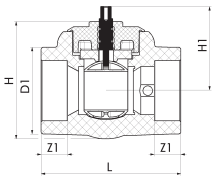
GR – green color

Galvanized gutter

Type	L [mm]	Code	SP	BP	kg/psc
20	2000	3295410101	1	25	0,331
25	2000	3295411101	1	25	0,428
32	2000	3295411102	1	25	0,596
40	2000	3295412101	1	25	0,607
50	2000	3295412102	1	25	0,732
63	2000	3295413101	1	25	0,879
75	2000	3295413102	1	25	0,995

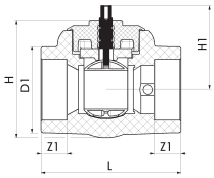
VALVES

Ball valve - lever



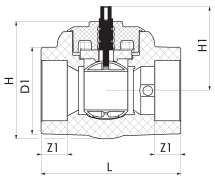
Type	d [mm]	I [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440408	10	50	0,117
25	35,5	17,0	70,0	70,0	3295441409	10	40	0,130
32	44,5	18,0	81,0	87,0	3295441422	10	30	0,231
40	55,5	20,5	98,0	105,0	3295442402	2	16	0,384
50	69,0	23,5	126,0	122,0	3295442409	1	6	0,611
63	90,0	27,5	145,0	145,0	3295443402	1	5	0,961
75	105,0	31,0	163,0	180,0	3295443406	1	4	1,607

Ball valve - bow tie



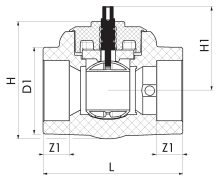
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440409	10	40	0,117
25	35,5	17,0	70,0	70,0	3295441410	10	40	0,130
32	44,5	18,0	81,0	87,0	3295441423	5	20	0,231
40	55,5	20,5	98,0	105,0	3295442403	2	10	0,384

Ball velve - lever with outlet right



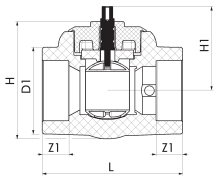
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440410	10	50	0,172
25	35,5	17,0	70,0	70,0	3295441412	10	40	0,172
32	44,5	18,0	81,0	87,0	3295441426	5	20	0,322
40	55,5	20,5	98,0	105,0	3295442405	2	10	0,422
50	69,0	23,5	126,0	122,0	3295442411	1	6	0,611
63	90,0	27,5	145,0	145,0	3295443404	1	4	0,969
75	105,0	31,0	163,0	180,0	3295443408	1	4	1,607

Ball valve - bow tie with outlet right



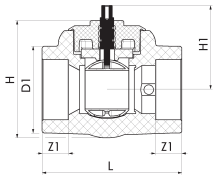
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440411	10	40	0,172

Ball valve - lever dismoutable



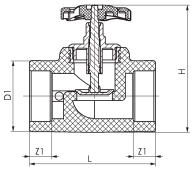
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440406	10	50	0,180
25	35,5	17,0	70,0	70,0	3295441407	10	40	0,191
32	44,5	18,0	81,0	87,0	3295441420	5	20	0,313

Ball valve - bow tie dismoutable



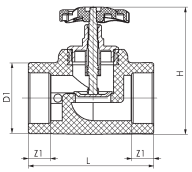
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	15,5	65,0	67,0	3295440407	10	40	0,180
25	35,5	17,0	70,0	70,0	3295441408	10	40	0,191
32	44,5	18,0	81,0	87,0	3295441421	5	20	0,312

Direct valve



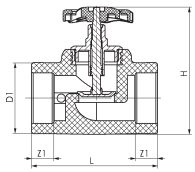
Type	d [mm]	I [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	14,5	65,0	73,0	3295440504	10	50	0,126
25	36,0	16,0	72,0	95,0	3295441505	10	40	0,243
32	45,5	18,0	104,0	84,0	3295441514	10	10	0,369
40	56,0	20,5	108,0	105,0	3295442502	2	8	0,423
50	69,0	23,5	115,0	126,0	3295442508	1	4	0,640
63	87,0	27,4	155,0	155,0	3295443501	1	4	1,125

Direct valve with outlet left



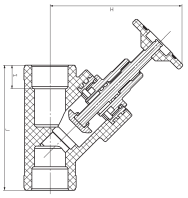
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	14,5	65,0	73,0	3295440505	5	30	0,170
25	36,0	16,0	72,0	95,0	3295441506	5	20	0,253
32	45,5	18,0	104,0	84,0	3295441515	5	10	0,396
40	56,0	20,5	108,0	105,0	3295442503	2	10	0,448
50	69,0	23,5	115,0	126,0	3295442509	2	12	0,655
63	87,0	27,4	155,0	155,0	3295443502	2	4	1,125

Under plaster ball valve direct with chromium cover



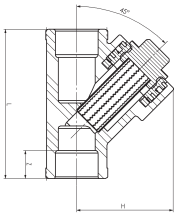
Type	d [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
20	29,0	14,5	65,0	99,0	3295440506	5	20	0,200
25	36,0	16,0	72,0	99,0	3295441508	5	20	0,200

Angle valve



Type	d1 [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
22	35,0	16,0	117,0	107,0	3295441504	2	12	0,22

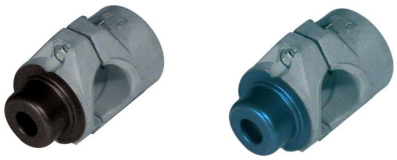
Filter

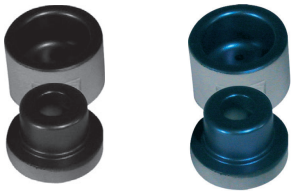


Type	d1 [mm]	Z1 [mm]	L [mm]	H [mm]	Code	SP	LP	kg/pcs
25	34,4	16,0	85,0	55,4	3295441503	2	20	0,14

TOOLS AND CONSUMEABLE MATERIALS

Teflon tape	Type	Code	Length [m]
	**TEFLON**	3295490098	12

Jaw adapters black/blue	Type	Code for black	Code for blue	kg/pcs
	**16**	3295490004	3295490039	0,099
	20	3295490005	3295490045	0,116
	25	3295490006	3295490040	0,144
	32	3295490007	3295490041	0,220
	40	3295490008	3295490042	0,330
	50	3295490009	3295490043	0,480
	63	3295490010	3295490044	0,770

Pair adapters black/blue	Type	Code for black	Code for blue	kg/pcs
	**16**	☎	☎	0,084
	20	3295490011	3295490032	0,112
	25	3295490012	3295490033	0,140
	32	3295490013	3295490034	0,190
	40	3295490014	3295490035	0,280
	50	3295490015	3295490036	0,400
	63	3295490016	3295490037	0,740
	75	3295490017	☎	1,006
	90	3295490018	3295490038	1,478
	110	3295490019	02340	1,950
	125	☎	☎	2,658

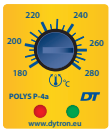
Driller weld in saddle	Type	Code	kg/psc
	**25**	3295490134	0,15
	32	3295490135	0,22
	40	3295490136	0,23
	50	3295490137	0,33
	63	3295490138	0,45

Welding tool weld in saddle	Type	Code	kg/psc
	**75-125 x 25**	3295490139	0,28
	75-125 x 32	3295490140	0,41
	75-125 x 40	3295490141	0,36
	75-125 x 50	3295490142	0,65
	75-125 x 63	3295490143	1,05
	160-250 x 25	3295490144	0,17
	160-250 x 32	3295490145	0,23
	160-250 x 40	3295490146	0,36
	160-250 x 50	3295490147	0,65
	160-250 x 63	3295490148	1,04

Hand welder POLYS P-1B 500 W with thermostat	Type	Code	kg/pcs
	**500 W**	3295490002	1,300

Hand welder POLYS P-1a 650 W with thermostat	Type	Code	kg/pcs
	**650 W**	3295490028	1,300

Hand welder POLYS P-1a 850 W with thermostat	Type	Code	kg/pcs
	**650 W**	3295490028	1,600

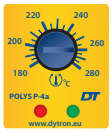
Hand welder POLYS P-4a 650 W with electric control	Type	Code	kg/pcs
 	**650 W**	01118	1,570

Hand welder POLYS P-4b 650 W TW Plus with electric control	Type	Code	kg/pcs
 	**650 W**	04826	1,570

Hand welder POLYS P-4c 650 W TW with electric control	Type	Code	kg/pcs
 	**650 W**	01124	1,570

Hand welder POLYS P-4a 850 W with electric control	Type	Code	kg/pcs
 	**850 W**	3295490031	2,000

Hand welder POLYS P-4a 1200 W with electric control	Type	Code	kg/pcs
	1200 W	01117	2,000



Hand welder set POLYS P-1b 500 W	Type	Code	kg/pcs
	HOBBY BLACK*	00909	6,400

Black jaw adapters Ø 20-40 mm, pipe cutter, clamp, imbus wrench, big metal case.

Hand welder set POLYS P-1a 650 W	Type	Code	kg/pcs
	HOBBY BLACK*	01924	6,400
	MINI BLACK**	3295490050	5,060

Black jaw adapters Ø 16-32 mm, pipe cutter, clamp, imbus wrench, big metal case.

***Black jaw adapters Ø 20-32 mm, clamp, imbus wrench, metal case MINI.*

Hand welder set POLYS P-1a 850 W	Type	Code	kg/pcs
	HOBBY BLACK*	02196	6,400

Black pair adapters Ø 16-32 mm, pipe cutter, clamp, stand, big metal case.

Hand welder set POLYS P-5a 650 W	Type	Code	kg/pcs
	PROFI BLACK*	3295490001	8,700
	PROFI BLUE**	3295490046	8,700
	MINI BLACK***	3295490051	5,100
	MINI BLUE****	3295490054	5,100

Black jaw adapters Ø 16-63+110 mm, pipe cutter, clamp, foot stand, big metal case.

***Blue jaw adapters Ø 16-63+110 mm, pipe cutter, clamp, foot stand, big metal case.*

****Black jaw adapters Ø 20-32 mm, pipe cutter, clamp, foot stand, metal case MINI.*

*****Blue jaw adapters Ø 20-3 2mm, pipe cutter, clamp, foot stand, metal case MINI.*

Hand welder set POLYS P-4a 850 W	Type	Code	kg/pcs
	PROFI BLACK*	3295490030	8,800
	PROFI BLUE**	02369	8,800
	MINI BLACK***	3295490052	5,200

Black pair adapters Ø 16-63 mm, pipe cutter, clamp, foot stand, big metal case.

***Blue pair adapters Ø 16-63 mm, pipe cutter, clamp, foot stand, big metal case.*

****Black pair adapters Ø 20-32 mm, pipe cutter, clamp, foot stand, metal case MINI.*

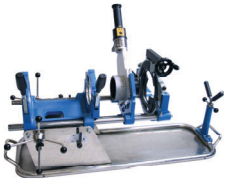
Hand welder set POLYS P-4a 1200 W	Type	Code	kg/pcs
	BLACK 40-90*	00911	9,600
	BLUE 40-90**	02366	9,600

Black pair adapters Ø 40-90 mm, clamp, foot stand, big metal case.

***Blue pair adapters Ø 40-90 mm, clamp, foot stand, big metal case.*

Electrofusion machine for electrofusion socket	Type	Code	kg/pcs
	**SVEL 950**	01989	9,500

Socket welding machine	Type	Code	kg/pcs
	**MP - 75**	01413	22,000

Socket welding machine	Type	Code	kg/pcs
	**MP - 110 UM**	3295490053	47,900

Pipe cutter	Type	d [mm]	Code	kg/pcs
	**STANDARD PLAST 42**	42	02595	0,350
	DYNO 42	42	3295490047	0,350
	75	75	38272	1,240

Pipe cutter SABAT	Type	d	kg/pcs
	**SABAT**	42	0,322

Tube cutter	Type	Code	kg/pcs
	**50 - 140**	3295490029	1,420
	100 - 160	02054	1,510

SHORTCUTS

D - pipe diameter
t - pipe wall thickness
Code - product catalogue number
SP - small package

LP - large package
CW - for cold water only
R - red colour
B - blue colour

G - grey colour
GR - green colour

AUTHORIZED BODY No. 224
Institute for Testing and Certification, Inc., Třída Tomáše Bati 299, Louky, 763 02 Zlín, Czech Republic
Authorization granted by the Decision No. 2/2014 dated 10th March 2014

PRODUCT CERTIFICATE
No. 06 0397 V/AO/d

In compliance with the provision of Section 5, Subsection 2 of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which lays down technical requirements for selected building products, the Authorized Body No. 224 confirms that for the construction product

INSTAPLAST system – a system of pipes, fittings, ball cocks and valves for potable water supply, hot service water and hot-water central heating made from PP-R (BOREALIS RA 130 E, Innopol CS 4-8000, VESTOLEN P 9421), d 16 mm – d 110 mm

placed on the market by the manufacturer
PIPELIFE Czech s. r. o.
Kučovaniny 1778, 765 02 Otrokovice, Czech Republic
having company´s registration number: CZ60709391

from production site
Pipes
PIPELIFE Czech s.r.o., Kučovaniny 1778, 765 02 Otrokovice, Czech Republic

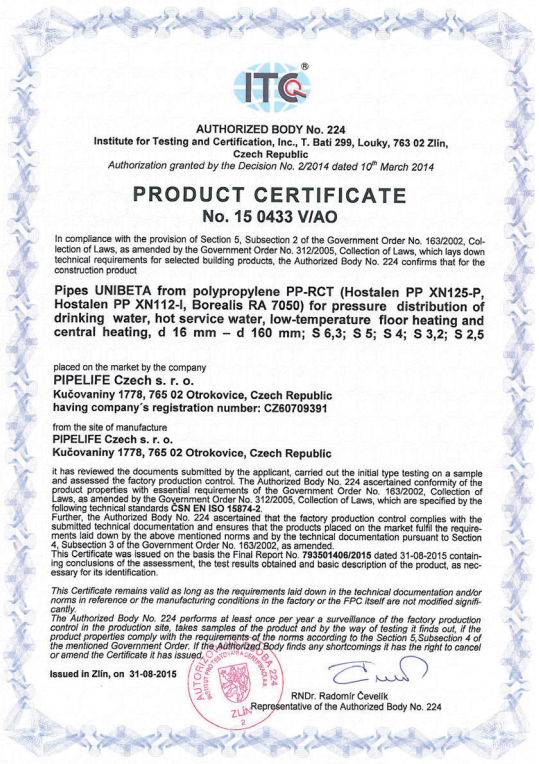
Fittings, ball cocks, valves
PIPELIFE Czech s.r.o., Závod Zápy, Zápy 151, 250 01 Brandýs nad Labem, Czech Republic

it has reviewed the documents submitted by the applicant, carried out the initial type testing on a sample and assessed the factory production control.
The Authorized Body No. 224 ascertained conformity of the product properties with essential requirements of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which are specified by the Building Technical Certificate No. **STO – AO 224 – 2212/2006/d**.
Further, it ascertained that the factory production control system ensures that the products placed on the market fulfilled the requirements laid down by the Building Technical Certificate and met the technical documentation pursuant to Section 4, Subsection 3.
A part of the present Certificate is the Final Report No. **793501407/2015** dated 25th August 2015 containing conclusions of ascertainment verification performed and the test results obtained.
At least once in 12 months, the Authorized Body exercises a supervision of a proper operation of the factory production control system pursuant to provision of Section 5, Subsection 4, and conducts product tests. If the Authorized Body finds any shortcomings it has the right to cancel or amend the Certificate it has issued.

Issued in Zlín on **11-08-2006**
Revision d): **25-08-2015**

RNDr. Radomír Čevelík
Representative of the Authorized Body No. 224

(Replaces the withdrawn certificate 06 0397 V/AO/c 31-08-2012)



AUTHORIZED BODY No. 224
Institute for Testing and Certification, Inc., T. Bati 299, Louky, 763 02 Zlín, Czech Republic
Authorization granted by the Decision No. 2/2014 dated 10th March 2014

PRODUCT CERTIFICATE
No. 15 0433 V/AO

In compliance with the provision of Section 5, Subsection 2 of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which lays down technical requirements for selected building products, the Authorized Body No. 224 confirms that for the construction product

Pipes UNIBETA from polypropylene PP-RCT (Hostalen PP XN125-P, Hostalen PP XN112-I, Borealis RA 7050) for pressure distribution of drinking water, hot service water, low-temperature floor heating and central heating, d 16 mm – d 160 mm; S 6,3; S 5; S 4; S 3,2; S 2,5

placed on the market by the company
PIPELIFE Czech s. r. o.
Kučovaniny 1778, 765 02 Otrokovice, Czech Republic
having company´s registration number: CZ60709391

from the site of manufacture
PIPELIFE Czech s. r. o.
Kučovaniny 1778, 765 02 Otrokovice, Czech Republic

it has reviewed the documents submitted by the applicant, carried out the initial type testing on a sample and assessed the factory production control. The Authorized Body No. 224 ascertained conformity of the product properties with essential requirements of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which are specified by the following technical standards **ČSN EN ISO 15874-2**.
Further, the Authorized Body No. 224 ascertained that the factory production control complies with the submitted technical documentation and ensures that the products placed on the market fulfil the requirements laid down by the above mentioned norms and by the technical documentation pursuant to Section 4, Subsection 3 of the Government Order No. 163/2002, as amended.
This Certificate was issued on the basis the Final Report No. **793501406/2015** dated 31-08-2015 containing conclusions of the assessment, the test results obtained and basic description of the product, as necessary for its identification.

This Certificate remains valid as long as the requirements laid down in the technical documentation and/or norms in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly.
The Authorized Body No. 224 performs at least once per year a surveillance of the factory production control in the production site, takes samples of the product and by the way of testing it finds out, if the product properties comply with the requirements of the norms according to the Section 5,Subsection 4 of the mentioned Government Order. If the Authorized Body finds any shortcomings it has the right to cancel or amend the Certificate it has issued.

Issued in Zlín, on 31-08-2015

RNDr. Radomír Čevelík
Representative of the Authorized Body No. 224

AUTHORIZED BODY No. 224
Institute for Testing and Certification, Inc., T. Bati 299, Louky, 763 02 Zlín, Czech Republic
Authorization granted by the Decision No. 2/2014 dated 10th March 2014

PRODUCT CERTIFICATE
No. 15 0435 V/AO

In compliance with the provision of Section 5, Subsection 2 of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which lays down technical requirements for selected building products, the Authorized Body No. 224 confirms that for the construction product

Pipes with carbon-fibre CARBO^{CRP} from polypropylene PP-RCT/PP-RCT+CF/PP-RCT (Hostalen PP XN125-P, Hostalen PP XN112-I, Borealis RA 7050) for pressure distribution of drinking water, hot service water, low-temperature floor heating and central heating, d 20 mm – d 160 mm; S 5; S 4; S 3,2

placed on the market by the company
Pipelife Czech s.r.o.
Kučovaniny 1778, 765 02 Otrokovice, Czech Republic
having company´s registration number: CZ60709391

from the site of manufacture
PIPELIFE CZECH s. r. o.
Kučovaniny 1778, 765 02 Otrokovice, Czech Republic

it has reviewed the documents submitted by the applicant, carried out the initial type testing on a sample and assessed the factory production control. The Authorized Body No. 224 ascertained conformity of the product properties with essential requirements of the Government Order No. 163/2002, Collection of Laws, as amended by the Government Order No. 312/2005, Collection of Laws, which are specified by the Construction Technical Approval No. **STO – AO 224 – 743/2015**.
Further, the Authorized Body No. 224 ascertained that the factory production control complies with the submitted technical documentation and ensures that the products placed on the market fulfil the requirements laid down by the above mentioned Construction Technical Approval and by the technical documentation pursuant to Section 4, Subsection 3 of the Government Order No. 163/2002, as amended.
The certificate was issued on the basis of the Final Report No. **793501408/2015** dated 2015-09-25 containing conclusions of the assessment, the test results obtained and basic description of the product, as necessary for its identification.
This Certificate remains valid as long as the requirements laid down in the technical documentation and/or Construction Technical Approval in reference or the manufacturing conditions in the factory or the FPC itself are not modified significantly.
The Authorized Body No. 224 performs at least once per year a surveillance of the factory production control in the production site, takes samples of the product and by the way of testing it finds out, if the product properties comply with the requirements of the Construction Technical Approval according to the Section 5, Subsection 4 of the mentioned Government Order. If the Authorized Body finds any shortcomings it has the right to cancel or amend the Certificate it has issued.

Issued in Zlín, on 2015-09-25

RNDr. Radomír Čevelík
Representative of the Authorized Body No. 224

At the end of the service life of the products, we recommend their material or energy recycling by a company with the appropriate authorization.
Our technical advice consists of knowledge of standards, calculations and previous experience. We do not have the opportunity to influence the conditions of use of the products we offer, especially non-standard handling of products or use or installation, therefore all data stated in our catalog are non-binding.
Warranties apply to the quality parameters of our products and goods. In the event of damage, our liability applies to the value of the goods delivered by us.
We reserve the right to deliver goods other than those shown in the catalog. Use our order numbers in your orders.
We regularly update the catalogs and brochures and reserve the right to change the information contained therein.
Therefore, always check the up-to-dateness of a specific catalog or prospectus at www.pipelife.cz. Edition 06/2022

NOTES:

NOTES:

Pipelife Czech s.r.o.

Kučovaniny 1778
765 02 Otrokovice
Czech Republic
tel.: +420 577 111 213
fax: +420 577 111 227
www.pipelife.cz
pipelifeczech@pipelife.com

PIPELIFE
always part of your life