MECHANICAL

Made in Germany

MECHANICAL GRAY

Technical manual

PP-RCT Piping System

Polymer pipe system for plant engineering,
air conditioning & refrigeration technology

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General information

The information provided in this technical manual is intended to help you select our products for your application. Text and images were compiled with utmost care. Nevertheless, errors cannot be entirely excluded. POLYMELT does not assume legal liability or any other form of liability for erroneous information and its consequences. POLYMELT is grateful for any suggestions or comments.

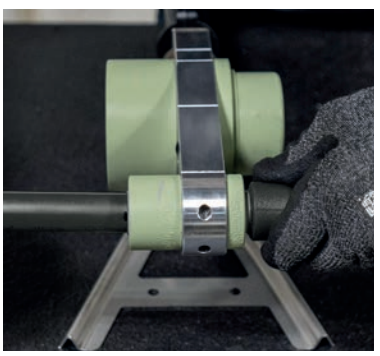
We are happy to provide further information – please contact the POLYMELT sales office on +49 8342 70060, mail@polymelt.com

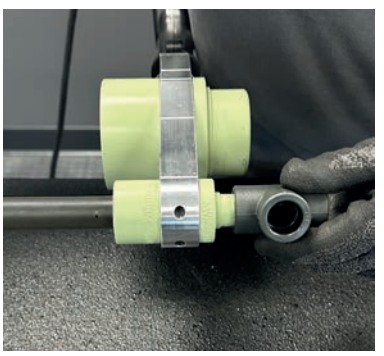
1.1 MECHANICAL – pipe system made of PP-RCT

The MECHANICAL pipe system made of PP-RCT offers a non-corroding and long-standing solution for conveying water in enclosed cooling water systems for residential and commercial buildings, such as hotels and shopping centres, as well as for technological cooling purposes in commercial and industrial buildings.

The well-tried socket welding technology is used for connecting pipes of this system up to 125 mm. Pipes bigger than > 160 mm are connected using the butt welding technology. E-sockets can be applied with the entire product line and thus represent further connecting options.

Socket welding example:





When the pipe and the fitting are welded, their plastic materials fuse together to form a homogeneous, firmly bonded whole. Special tools are used to heat up pipe and fitting, which are then just joined together. This connection is reliable and lastingly leakproof.

Their excellent properties offer many advantages:

- **Reliability**
- **Corrosion resistance**
- **Long service life of the entire system**
- **Homogeneous connection**
- **Low weight**
- **Simple handling and installation**

1.2 Overview pipe system

The MECHANICAL system is available in the following design versions:

	MECHANICAL Fiber pipe			Fusion technology
				
				
Outside diameter in mm				
20	✓			Socket fusion
25	✓			
32		✓		
40		✓		
50		✓		
63		✓		
75		✓		
90		✓		
110		✓		
125		✓	✓	
160		✓	✓	Butt fusion
200		✓	✓	
250		✓	✓	
315		✓	✓	
355		✓	✓	
400		✓	✓	
450		✓	✓	
500			✓	
Pipe series	S 3.2	S 5.0	S 8.3	
Working pressure @50 years *for elevated working pressures see our table on page 13	10°C / 21 bar		10°C / 12 bar	
Thermal expansion factor	0.035 mm/mK			

The calculation of the working pressure assumed a safety factor SF 1.25 for a 50-year service life.

1.3 Pipe structure

The MECHANICAL GRAY fiber pipe produced in the multi-layer technology enhances the good assembly and processing properties. Higher stability due to the fibre reinforced middle layers is one of further benefits compared to standard PP pipes.

- **75 % less linear expansion compared to single layer PP-R pipes**
  This reduces the demands placed upon the allowances for linear expansion
- **Excellent stability**
  It requires less fastening points which is why it can be assembled faster Approx. 30 % less fastening points compared to standard plastics
- **The linear expansion is nearly identical to metal pipes**
  This means the fastening intervalls can be enlarged compared to standard plastic pipes
- **Higher flow rate by thinner walls**
- **Lower weigth**
  compared to steel and copper

Technical Properties

Properties	Measuring method	Unit	Value
Density	ISO 1183	kg/m³	905
Melt flow rate 230 °C/2.16 kg	ISO 1133	g/10 min.	0.3
Modulus of elasticity in tension (1 mm/min.)	ISO 527	MPa	900
Tensile stress at yield (50 mm/min.)	ISO 527	MPa	25
Charpy impact strength, notched (+23 °C)	ISO 179	kJ/m²	40
Material thermal conductivity	DIN 52612	W/mK	0.24
Thermal conductivity tested on the product	ISO22007	W/mK	0,15
Pipe surface roughness k		mm	0.007
Specific heat at 20 °C	Calorimeter	KJ/kg K	2.0

1.4 POLYMELT Pre-insulated pipes

Lightweight, pre-insulated pipes are easy to connect and install. They help minimize energy losses and reduce long-term operating costs. These pipelines are pre-insulated with high efficiency foam and are suitable for both new construction and retrofits of district heating and cooling systems.

POLYMELT pipes are also in Pre-insulated version available. Upon request we can offer you based on your individual demand and application.

Pre insulated construction:
- Pressure pipe made of ECOSAN or MECHANICAL fiber pipe
- Insulation PUR foam
- Outer layer made of PE

Application
- Potable hot and cold water
- District heating and cooling
- Thermal water systems

No corrosion problems in cooling water systems with MECHANICAL

Cooling water systems need insulation so that the energy can be used in the right place, and no condensed water collects on the outer pipe surfaces. Even minor weak spots, such as small holes in the insulating sheath, can cause the formation of condensed water and, as a consequence, corrosion. Corrosion-protective agents could be used to prevent the formation of rust on the pipe inner surfaces, however, this method is expensive and only partly environmentally friendly.

Apart from that, metal pipes need to be drained and cleaned every five years to prevent deposits that might block the control valves. This causes the spiral of costs to turn upwards, if metal pipes are used in cooling and air conditioning systems.

MECHANICAL is made from PP-RCT and is corrosion-resistant; the risk of encrustations and the risk of formation of deposits is extremely low. Thanks to these properties, it requires significantly less maintenance and guarantees the reliability and longevity of the installation.

Main advantages

- corrosion resistant
- increased lifetime
- fibre reinforcement and reduced linear expansion
- easy, fast and safe installation
- safe and homogenous connections
- no costs for corrosion protection

Further properties

- 75 % less linear expansion
- low weight
- higher flow rate due to thinner walls
- excellent sound and thermal insulation properties
- no problems with dew point and corrosion from outside

1.5 Market segments

The POLYMELT Mechanical system can be used in the following areas:

Residential
- Custom single-family
- Commercial multi-family
- Private developments
- Public developments

Commercial
- Hotels
- Office buildings
- Hospitals
- Universities
- Government/D.O.D.
- Municipial schools
- Stadiums
- Shopping centers

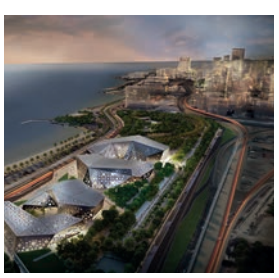
Industrial
- Food processing
- Manufacturing
- Data centers
- Agricultural
- Chemical
- Laboratories
- Pharmaceutical
- Utility
- Landfill
- Mining

The recommended fields of application

Fields of application	POLYMELT MECHANICAL
Cooling technology	✓
Heating technology	✓
Chilled water systems	✓
District cooling system	✓
Connection to cooling towers	✓
Irrigation	✓
Agricultural	✓
Geothermal	✓
Process water cooling	✓
Chemical transport	✓
Compressed air systems	✓

INTERNATIONAL REFERENCES
POLYMELT IN USE AROUND THE WORLD

Proscenium
Makati City, Philippines
Construction period:
2015-2018



Sheikh Jaber Al Ahmad
Cultural Centre, Kuwait
Construction period:
2015-2016

Echelon Tower Singapore
Construction period:
2013-2016

Caprice Gold Hotel
Istanbul, Turkey
Construction period:
2014-2015

2.1 Technical data

2.1.1 Working pressure values

Long term behaviour with a safety factor of 1.25

Temperature	Operating time	MECHANICAL Gray PP-RCT Fiber Pipe			
		SDR11		SDR17,6	
		maximum working pressure			
		bar	(psi)	bar	(psi)
-10° to 10°C	1	22.8	331	13.7	199
	5	22.1	321	13.3	193
	10	21.9	318	13.1	190
	25	21.5	312	12.9	187
	50	21.2	307	12.7	184
15 °C	1	22.1	321	13.2	191
	5	21.4	310	12.5	181
	10	21.0	305	12.0	174
	25	20.2	293	11.9	173
	50	19.5	283	11.5	167
20 °C	1	19.9	289	11.9	173
	5	19.3	280	11.6	168
	10	19.0	276	11.4	165
	25	18.6	270	11.2	162
	50	18.4	267	11.0	160
30 °C	1	17.2	249	10.3	149
	5	16.6	241	10.0	145
	10	16.4	238	9.8	142
	25	16.1	234	9.6	139
	50	15.8	229	9.5	138
40 °C	1	14.8	215	8.9	129
	5	14.3	207	8.6	125
	10	14.1	205	8.4	122
	25	13.8	200	8.3	120
	50	13.6	197	8.1	117
50 °C	1	12.6	183	7.6	110
	5	12.2	177	7.3	106
	10	12.0	174	7.2	104
	25	11.7	170	7.0	102
	50	11.5	167	6.9	100
60 °C	1	10.7	155	6.4	93
	5	10.3	149	6.2	90
	10	10.1	146	6.1	88
	25	9.9	144	5.9	86
	50	9.7	141	5.8	84
70 °C	1	9.0	131	5.4	78
	5	8.6	125	5.2	75
	10	8.5	123	5.1	74
	25	8.3	120	5.0	73
	50	8.1	117	4.9	71
75 °C	1	8.3	120	5.2	75
	5	8.0	116	4.8	70
	10	7.7	112	4.5	65
	25	7.3	106	4.0	58
	50	6.8	99	3.8	55
80 °C	1	7.5	109	4.5	65
	5	7.2	104	4.3	62
	10	7.0	102	4.2	61
	25	6.9	100	4.1	59
90 °C	1	5.6	81	3.4	49
	5	5.3	77	3.2	46
	10	5.2	75	3.1	45

SDR = Standard Dimension Ratio (diameter/wall thickness ratio)

SYSTEM REQUIREMENTS

This table enables you to select the suitable pipe for your application. You should know the requirements made on the system (temperature, pressure).

Example of how to select a pipe:

Field of application: cold water
Temperature of the medium: 10 °C
Maximum working pressure: 10 bar

Selection:
Step 1: select the applicable temperature range > 10 °C
Step 2: select the required service life > 50 years
Step 3: maximum working pressure within the system 10 bar > pressure according to the table > 21.2 bar >
Selection: **MECHANICAL Gray fiber pipe SDR 11**

Temperature	Operating time	MECHANICAL Gray PP-RCT Fiber Pipe	
		maximum working pressure	
		bar	(psi)
-10° to 10°C	1	22.8	331
	5	22.1	321
	10	21.9	318
	25	21.5	312
	50	21.2	307
15 °C	1	22.1	321
	5	21.4	310
	10	21.0	305
	25	20.2	293
	50	19.5	283

2.2 Standards and regulations

The following standards and guidelines are relevant for planning, design and operating water installation systems in Germany and have to be observed.

EnEV	German Energy Saving Regulation
DIN 1988	Technical Regulations on Drinking Water Installations
DIN EN 806	Technical Regulations on Drinking Water Installations
DIN 2000	Guidelines on the Requirements on Drinking Water, Planning, Laying, Operation and Maintenance of Supply Systems
DIN 4109	Sound Protection in Structural Engineering
DIN 4102	Fire Prevention
DVGW W 551	Technical Measures for the Reduction of Legionella Growth in Drinking Water Installations
VDI 6023	Hygiene-conscious planning, laying, operation and maintenance of drinking water plants
POLYMELT	Technical Manual
DVS 2207	Welding of Thermoplastics
DVS 2208	Machinery and Appliances for Welding Thermoplastics

2.2.1 System-specific standards

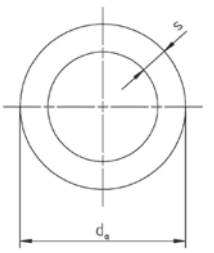
DIN 8077		Polypropylene Pipe Systems, Dimensions
DIN 8078		Polypropylene Pipe Systems General Quality Requirements, Testing
DIN EN ISO 15874	Parts 1–7	Plastic piping systems for hot and cold water installations – polypropylen
	Part 1	General information
	Part 2	Pipes
	Part 3	Fittings
	Part 5	Fitness for purpose of the system
	Part 7 / TS	Conformity Assessment
DIN EN ISO 21003	Parts 1–7	Multilayer Composite Pipe Systems for Hot and Cold Water Installations within Buildings
ASTM F2389		Pressure-rated Polypropylene (PP) Piping System
NSF/ANSI 14		Plastic Piping Systems Components and Related Materials

2.3 Terms used

2.3.1 Standard dimension ratio

SDR is an index in use for the classification of plastic pipes, which describes the ratio between a pipe's outer diameter and its wall thickness.

$$SDR = 2 \cdot S + 1 \qquad SDR \approx \frac{d_a}{s}$$



S = pipe series number
s = wall thickness
da = outer diameter

2.3.2 Pipe series number S

The nominal pipe series number is a dimensionless index, which is used for the calculation of the wall thickness of pipes.

The following equation is used for the calculation of the pipe series number S:

$$S = \frac{SDR - 1}{2}$$

Example: MECHANICAL Gray fiber pipe SDR 11 = S5

2.3.3 Nominal pressure (PN)

The abbreviation PN (nominal pressure) indicates a reference value that is representative for a pipe system. This reference value was used in the first plastic pipe standards (for example, DIN 8077 -1974/1989) and was based on a safety factor of 2.0. The maximum working pressure of 20 bar, 16 bar, 10 bar only refers to a service life of 50 years at a working temperature of 20 °C. However, at elevated temperatures the maximum operating pressure is lower.
This circumstance frequently leads to confusion.

For an exact pipe classification under various operating conditions, newer versions of the respective standards (DIN 8077 – 1999 or EN ISO 15874 – 2003) therefore only state the pipe series S or the diameter-wall thickness ratio SDR.

2.4 Chemical resistance

Thanks to the special properties of its materials, the MECHANICAL pipe system features excellent chemical resistance.
Chemical resistance of the fittings with brass inserts cannot be put on a level with the resistance of those system elements that are only made of PP-RCT.

Metallic copper, manganese or cobalt deteriorate the thermal ageing resistance of PP-RCT, above all, if the plasticized materials come into contact with these metals. Please contact POLYMELT, if the pipe system is likely to come into contact with chemicals and other aggressive media.

Inquiry regarding the chemical resistance of the MECHANICAL pipe system:

Installation company:

Firm

Contact person

Street

Postal code/Place

Telephone

Telefax

Building project

Street

Place

Place, date

Area of application:

Flow medium

°C Service temperature

mbar Service pressure

h/d Running time

Environment

°C Ambient temperature

mbar Ambient pressure

included	not included	Data sheets
☐	☐	flow medium
☐	☐	environment

Send inquiry to: POLYMELT GmbH
Kirnachstraße 17, 87640 Ebenhofen, Germany
Tel. +49 8342 70060
Fax +49 8342 700666
mail@polymelt.com, www.polymelt.com

2.4.1 Chemical disinfection – "shock disinfection"

During the process of chemical disinfection ("shock disinfection") in accordance with Pt. 7.5.2 of the ÖNORM-Standard B 5019, the disinfecting agent can be fed into the cold water circulation or the warm water circulation, respectively. When the disinfecting agent is fed into the warm water circulation, the temperature must first be reduced to below 25 °C. Carrying out "shock disinfections" at higher temperatures is not permissible, as premature material damage cannot be ruled out. In relation to the service life of the installed system, the number of disinfecting procedures must not exceed 5 cycles. No drinking water may be drawn either during the disinfection process or during the subsequent flushing of the system with cold water.

This table lists the concentration and contact times of chemicals for chemical disinfection on the basis of ÖNORM-Standard B 5019.

Active component	Chemical formula	Max. concentration applied	Contact time	Max. water temp. in the system
Chlorine dioxide	ClO_2	6 mg/l as ClO_2	8 to 12 hrs	< 25 °C
Hypochlorite	ClO^-	50 mg/l as $Cl_{2\,(chlorine)}$	8 to 12 hrs	< 25 °C
Permanganate	MnO_4^-	15 mg/l	24 hrs	< 25 °C
Hydrogen peroxide	H_2O_2	150 mg/l	24 hrs	< 25 °C

During the application the applied concentration and application temperature may not be exceeded at any point within the pipe system.

2.4.2 Continuous metered addition of chemicals – "permanent disinfection"

The continuous metered addition of chemicals according to Pt. 9 of the ÖNORM-Standard B 5019 is only permissible in instances when repeated decontamination processes (thermal, chemical, according to section 7 of the ÖNORM-Standard) did not produce the desired results and where the systems in question have low levels of biofilm.
It must be stated that the continuous metered addition of chemicals can in no way replace the structural refurbishment of the pipe system and should be regarded merely as temporary supporting measure until such a time as the refurbishment takes place, and not as prophylactic measure against Legionella.

If the timeframe and the maximum water temperature are exceeded, damage to the component parts of the pipe systems (pipe, seals, o-rings, etc.) cannot be ruled out. This applies to all prevalent materials used in plumbing technology (types of metal, plastics and elastomers).

This table lists the concentration and contact times of chemicals for continuous metered addition on the basis of ÖNORM-Standard B 5019.

Active component	Chemical formula	Max. concentration applied	Max. period of application	Max. water temp. in the system
Chlorine dioxide**	ClO_2	0.4 mg/l als ClO_2	4 months	60 °C
Hypochlorite	ClO^-	0.3 mg/l als $Cl_{2\,(Chlor)}$	4 months	60 °C
Chlorine	Cl_2	0.3 mg/l als $Cl_{2\,(Chlor)}$	4 months	60 °C
Chlorine dioxide**	ClO_2	0.4 mg/l als ClO_2	18 months	< 25 °C
Hypochlorite	ClO^-	0.3 mg/l als $Cl_{2\,(Chlor)}$	18 months	< 25 °C
Chlorine	Cl_2	0.3 mg/l als $Cl_{2\,(Chlor)}$	18 months	< 25 °C

** For the disinfection process using chlorine dioxide (listed as ClO_2) the maximum amount that can be added into the pipe system is 0.4 mg/l ClO_2.

3.1 Safety instructions and intended use

- Carefully read the technical manual and the operating instructions before starting work.
- POLYMELT installation systems may only be planned, assembled and started up as described in the present manual.
- For any deviating fields of application, make sure to obtain POLYMELT's advice.
- All national and international safety regulations and regulations on accident prevention have to be observed.
- Planning, installation and start-up have to be carried out pursuant to the current directives, standards and regulations, as intended and in accordance with the state of the art.
- Only POLYMELT system components are allowed to be used. The use of other components entails loss of guarantee (refer to the letter of guarantee on page 64).
- Observe the general safety regulations when handling assembly tools. Danger of burn.

Handling instructions

- POLYMELT PP-RCT pipes can generally be stored at any ambient temperature.
- Nevertheless, the material must never be subject to impacts or blows, particularly at temperatures below 5 °C.
- Do not drop the pipes when unloading them and protect them from falling objects.
- Select the place of storage so as to make sure that the pipes are always supported over their entire length.
- Before starting assembly, check the pipe and particularly the pipe ends for cracks or damage.
- Observe cleanliness when storing and laying the pipes and fittings. In order to protect the pipes and fittings against contamination, do not remove the packaging material before the material is used.
- Pipes (except UV pipes) and fittings must not be exposed to UV radiation over prolonged periods as this reduces the durability and the special properties of the pipes; provide protection of the pipes from the outside.
- At temperatures below zero, water supply pipes must be protected from frost, and drained, if necessary.
- Cut the pipes using only sharp tools.

Avoid sharp impacts and blows to the pipes, especially at low temperatures. Do not throw when unloading. Protect pipes from falling objects.

Put down pipes or pipe bundles carefully. Cover pipes in areas of falling rocks, etc.

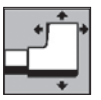
Do not use cracked or damaged pipes.

Only cut pipes with sharp cutters.

Do not expose pipes to UV-radiation for extended periods of time.

Protect stored pipes from sun and rain.

During polyfusion welding, do not twist the pipe or fitting; push the pipe and fitting joint together in a straight manner.



Minor corrections can only be made during joining.

Protect pipes filled with water from freezing.

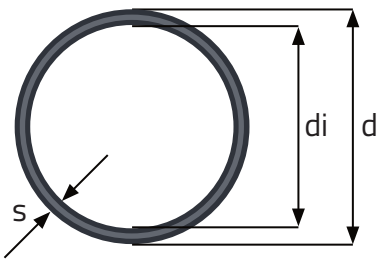
Drain lines in danger of freezing.

4.1 Product range

4.1.1 Pipe

MECHANICAL Gray pipe SDR 7.4/11/17.6

Material: PP-RCT
Pipe structure: Multi-layer pipe, fibre-reinforced
Colour: Gray
Standards: DIN 8077/78, EN ISO 15874, ASTM 2389, NSF14
Certificate: ICC-ES PMG 1458
Available sizes: 20-500 mm
Pipe lenght : 20-500 mm in 5.8 m length, special length on request

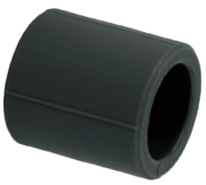


SDR	A. no.	Inch N.D.	Outer Diameter (d) mm	Wall thickness (s) mm	Inner diameter (di) mm	Water content l/m	Weight kg/m	Package qty (m)	Availability
7.4	680322	1/2"	20	2,8	14,4	0,16	0,15	145,0	S
7.4	680323	3/4"	25	3,5	18,0	0,25	0,24	87,0	S
11	680324	1"	32	2,9	26,2	0,53	0,26	58,0	S
11	680325	1 1/4"	40	3,7	32,6	0,83	0,41	29,0	S
11	680326	1 1/2"	50	4,6	40,8	1,31	0,64	29,0	S
11	680327	2"	63	5,8	51,4	2,08	1,01	17,4	S
11	680328	2 1/2"	75	6,8	61,4	2,94	1,41	11,6	S
11	680329	3"	90	8,2	73,6	4,25	2,03	5,8	S
11	680330	3 1/2"	110	10,0	90,0	6,36	3,01	5,8	S
11	680331	4"	125	11,4	102,2	8,20	3,91	5,8	S
11	680333	6"	160	14,6	130,8	13,44	6,41	5,8	S
11	680334	8"	200	18,2	163,6	21,03	10,00	5,8	S
11	680335	10"	250	22,7	204,6	32,87	15,60	5,8	S
11	680346	12"	315	28,6	257,8	52,20	24,60	5,8	MQ
11	680347	14"	355	32,2	290,6	66,33	31,20	5,8	MQ
11	680348	16"	400	36,3	327,4	84,18	39,60	5,8	MQ
11	680349	18	450	40,9	368,2	106,47	50,10	5,8	MQ
17.6	680351	4"	125	7,1	110,8	9,64	2,55	5,8	S
17.6	680353	6"	160	9,1	141,8	15,79	4,17	5,8	S
17.6	680354	8"	200	11,4	177,2	24,66	6,50	5,8	S
17.6	680355	10"	250	14,2	221,6	38,57	10,10	5,8	S
17.6	680366	12"	315	17,9	279,2	61,22	16,00	5,8	MQ
17.6	680367	14"	355	20,1	314,8	77,83	20,30	5,8	MQ
17.6	680368	16"	400	22,7	354,6	98,75	25,70	5,8	MQ
17.6	680369	18"	450	25,5	399,0	125,03	32,50	5,8	MQ
17.6	680370	20"	500	28,4	443,2	154,27	40,20	5,8	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Socket
Material: PP-RCT, Colour: Gray, Product line: Ø 20-125 mm, Processing: Socket welding



A. no.	Dimension		Weight		Supply unit in pcs carton/ package	Availabi-lity
	inch	mm	kg/pcs	ib/pcs		
617002	1/2"	20	0,012	0,027	600 / 10	S
617003	3/4"	25	0,017	0,038	400 / 10	S
617004	1"	32	0,030	0,066	250 / 10	S
617005	1 1/4"	40	0,043	0,095	170 / 10	S
617006	1 1/2"	50	0,070	0,153	100 / 5	S
617007	2"	63	0,160	0,353	50 / 1	S
617008	2 1/2"	75	0,243	0,536	40 / 1	S
617009	3"	90	0,391	0,862	24 / 1	S
617010	3 1/2"	110	0,613	1,352	15 / 1	S
617011	4"	125	0,755	1,664	12 / 1	S

Reducer male/female
Material: PP-RCT, Colour: Gray, Product line: Ø 20-120 mm, Processing: Socket welding

A. no.	Dimension		Weight		Supply unit in pcs carton/ package	Availabi-lity
	inch	mm	kg/pcs	ib/pcs		
617603	3/4" to 1/2"	25 / 20	0,017	0,037	300 / 10	S
617605	1" to 1/2"	32 / 20	0,017	0,037	250 / 10	S
617606	1" to 3/4"	32 / 25	0,019	0,041	200 / 10	S
617608	1 1/4" to 1/2"	40 / 20	0,022	0,049	400 / 5	S
617609	1 1/4" to 3/4"	40 / 25	0,025	0,055	300 / 5	S
617610	1 1/4" to 1"	40 / 32	0,030	0,066	200 / 5	S
617612	1 1/2" to 1/2"	50 / 20	0,037	0,081	250 / 5	S
617613	1 1/2" to 3/4"	50 / 25	0,039	0,087	150 / 5	S
617614	1 1/2" to 1"	50 / 32	0,048	0,106	200 / 5	S
617615	1 1/2" to 1 1/4"	50 / 40	0,050	0,111	150 / 5	S
617618	2" to 3/4"	63 / 25	0,066	0,145	100 / 1	S
617619	2" to 1"	63 / 32	0,072	0,159	120 / 1	S
617620	2" to 1 1/4"	63 / 40	0,079	0,174	100 / 1	S
617621	2" to 1 1/2"	63 / 50	0,103	0,227	75 / 1	S
617627	2 1/2" to 1 1/2"	75 / 50	0,122	0,269	50 / 1	S
617628	2 1/2" to 2"	75 / 63	0,156	0,343	50 / 1	S
617634	3" to 1 1/2"	90 / 50	0,168	0,371	40 / 1	S
617635	3" to 2"	90 / 63	0,196	0,432	40 / 1	S
617636	3" to 2 1/2"	90 / 75	0,239	0,526	30 / 1	S
617643	3 1/2" to 2"	110 / 63	0,327	0,722	30 / 1	S
617644	3 1/2" to 2 1/2"	110 / 75	0,312	0,688	25 / 1	S
617645	3 1/2" to 3"	110 / 90	0,473	1,042	20 / 1	S
617683	4" x 2"	125 / 63	0,612	1,350	15 / 1	S
617684	4" x 2 1/2"	125 / 75	0,658	1,450	15 / 1	S
617685	4" x 3"	125 / 90	0,417	0,920	15 / 1	S
617646	4" x 3 1/2"	125 / 110	0,755	1,664	15 / 1	S

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Reducer male/female
Material: PP-RCT, Colour: Gray, Product line: Ø 125-500 mm, Processing: Butt welding

SDR	A. no.	Dimension		Supply unit in pcs carton/package	Availability
		inch	mm		
11	6017647	6" to 4"	160/125	10/ 1	S
11	6017649	8" to 4"	200/125	1/ 1	S
11	6017650	8" to 6"	200/160	1/ 1	S
11	6017651	10" to 6"	250/160	1/ 1	S
11	6017652	10" to 8"	250/200	1/ 1	S
11	6017653	12" to 6"	315/160	1/ 1	S
11	6017654	12" to 8"	315/200	1/ 1	S
11	6017655	12" to 10"	315/250	1/ 1	S
11	6017657	14" to 10"	355/250	1/ 1	S
11	6017658	14" to 12"	355/315	1/ 1	S
11	6017659	16" to 12"	400/315	1/ 1	MQ
11	6017660	16" to 14"	400/355	1/ 1	MQ
11	6017663	18" to 14"	450/355	1/ 1	MQ
11	6017664	18" to 16"	450/400	1/ 1	MQ
17	5017647	6" to 4"	160/125	10/ 1	S
17	5017649	8" to 4"	200/125	1/1	S
17	5017650	8" to 6"	200/160	1/1	S
17	5017651	10" to 6"	250/160	1/1	S
17	5017652	10" to 8"	250/200	1/1	S
17	5017653	12" to 6"	315/160	1/1	S
17	5017654	12" to 8"	315/200	1/1	S
17	5017655	12" to 10"	315/250	1/1	S
17	5017657	14" to 10"	355/250	1/1	S
17	5017658	14" to 12"	355/315	1/1	S
17	5017659	16" to 12"	400/315	1/1	MQ
17	5017660	16" to 14"	400/355	1/1	MQ
17	5017663	18" to 14"	450/355	1/1	MQ
17	5017664	18" to 16"	450/400	1/1	MQ
17	5017666	20" to 16"	500/400	1/1	MQ
17	5017667	20" to 18"	500/450	1/1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Elbow 90°
for socket welding and butt welding, Material: PP-RCT, Colour: Gray,
Standards: EN ISO 15874, DIN 16962, Processing: Type A: Socket welding, Type C: Butt welding/segmented

Type A (socket fusion)

Type C (butt fusion)

SDR	A. no.	Dimension			Supply unit in pcs carton/package	Availability
		inch	mm			
-	617042	1/2"	20	A	500/ 10	S
-	617043	3/4"	25		300/ 10	S
-	617044	1"	32		150/ 10	S
-	617045	1 1/4"	40		100/ 5	S
-	617046	1 1/2"	50		50/ 5	S
-	617047	2"	63		25/ 1	S
-	617048	2 1/2"	75		15/ 1	S
-	617049	3"	90		12/ 1	S
-	617050	3 1/2"	110		12/ 1	S
-	617051	4"	125		8/ 1	S
11	6517054	6"	160	C	1/ 1	S
11	6517056	8"	200		1/ 1	S
11	6517058	10"	250		1/ 1	S
11	6517070	12"	315		1/ 1	S
11	6517072	14"	355		1/ 1	S
11	6517074	16"	400		1/ 1	MQ
11	6517076	18"	450		1/ 1	MQ
17,6	5517054	6"	160		1/ 1	S
17,6	5517056	8"	200		1/ 1	S
17,6	5517058	10"	250		1/ 1	S
17,6	5517070	12"	315		1/ 1	S
17,6	5517072	14"	355		1/ 1	S
17,6	5517074	16"	400		1/ 1	MQ
17,6	5517076	18"	450		1/ 1	MQ
17,6	5517078	20"	500		1/ 1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Elbow 45°
for socket welding and butt welding, Material: PP-RCT, Colour: Gray,
Processing: Type A: Socket welding, Type C: Butt welding/segmented

Type A (socket fusion)

Type C (butt fusion)

SDR	A. no.	Dimension			Supply unit in pcs carton/package	Availability
		inch	mm			
-	617102	1/2"	20	A	200/ 10	S
-	617103	3/4"	25		150/ 10	S
-	617104	1"	32		100/ 10	S
-	617105	1 1/4"	40		50/ 5	S
-	617106	1 1/2"	50		25/ 5	S
-	617107	2"	63		12/ 1	S
-	617108	2 1/2"	75		20/ 1	S
-	617109	3"	90		15/ 1	S
-	617110	3 1/2"	110		8/ 1	S
-	617111	4"	125		5/ 1	S
11	6517114	6"	160	C	1/ 1	S
11	6517116	8"	200		1/ 1	S
11	6517118	10"	250		1/ 1	S
11	6517120	12"	315		1/ 1	S
11	6517122	14"	355		1/ 1	S
11	6517124	16"	400		1/ 1	MQ
11	6517126	18"	450		1/ 1	MQ
17,6	5517114	6"	160		1/ 1	S
17,6	5517116	8"	200		1/ 1	S
17,6	5517118	10"	250		1/ 1	S
17,6	5517120	12"	315		1/ 1	S
17,6	5517122	14"	355		1/ 1	S
17,6	5517124	16"	400		1/ 1	MQ
17,6	5517126	18"	450		1/ 1	MQ
17,6	5517128	20"	500		1/ 1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Tee
for socket welding and butt welding, Material: PP-RCT, Colour: Gray,
Processing: Type A: Socket welding, Type C: Butt welding/segmented

Type A (socket fusion)

Type C (butt fusion)

SDR	A. no.	Dimension			Supply unit in pcs carton/package	Availability
		inch	mm			
-	617202	1/2"	20	A	300/ 10	S
-	617203	3/4"	25		200/ 10	S
-	617204	1"	32		100/ 10	S
-	617205	1 1/4"	40		30/ 5	S
-	617206	1 1/2"	50		30/ 2	S
-	617207	2"	63		10/ 1	S
-	617208	2 1/2"	75		15/ 1	S
-	617209	3"	90		12/ 1	S
-	617210	3 1/2"	110		6/ 1	S
-	617211	4"	125		5/ 1	S
11	6017214	6"	160	C	1/ 1	S
11	6017216	8"	200		1/ 1	S
11	6017218	10"	250		1/ 1	S
11	6017220	12"	315		1/ 1	S
11	6017222	14"	355		1/ 1	S
11	6017224	16"	400		1/ 1	MQ
11	6017226	18"	450		1/ 1	MQ
17,6	5017214	6"	160		1/ 1	S
17,6	5017216	8"	200		1/ 1	S
17,6	5017218	10"	250		1/ 1	S
17,6	5017220	12"	315		1/ 1	S
17,6	5017222	14"	355		1/ 1	S
17,6	5017224	16"	400		1/ 1	MQ
17,6	5017226	18"	450		1/ 1	MQ
17,6	5017228	20"	500		1/ 1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Tee reduced
for socket welding and butt welding
Material: PP-RCT
Colour: Gray
Product line: Ø 20-500 mm
Processing: Type A: Socket welding; Type C: Butt welding/segmented

Type A
(socket fusion)

A. no.	Dimension			Weight		Supply unit in pcs carton/ package	Availa-bility
	inch	mm		kg/pcs	ib/pcs		
617250	3/4"x1/2"x1/2"	25 x 20 x 20		0,037	0,082	250/ 10	S
617254	3/4"x1/2"x3/4"	25 x 20 x 25		0,034	0,075	250/ 10	S
617256	3/4"x3/4"x1/2"	25 x 25 x 20		0,034	0,075	250/ 10	S
617269	1"x3/4"x3/4"	32 x 25 x 25		0,073	0,160	120/ 5	S
617273	1"x1/2"x1"	32 x 20 x 32		0,064	0,142	120/ 5	S
617275	1"x3/4"x1"	32 x 25 x 32		0,066	0,146	120/ 5	S
617305	1 1/4"x1/2"x1 1/4"	40 x 20 x 40		0,079	0,174	80/ 5	S
617307	1 1/4"x3/4"x1 1/4"	40 x 25 x 40		0,080	0,176	80/ 5	S
617309	1 1/4"x1"x1 1/4"	40 x 32 x 40		0,103	0,228	80/ 5	S
617311	1 1/2"x1/2"x1 1/2"	50 x 20 x 50		0,183	0,404	40/ 2	S
617334	1 1/2"x3/4"x1 1/2"	50 x 25 x 50		0,187	0,412	40/ 2	S
617336	1 1/2"x1"x1 1/2"	50 x 32 x 50		0,191	0,421	40/ 2	S
617338	1 1/2"x1 1/4"x1 1/2"	50 x 40 x 50		0,195	0,429	40/ 2	S
617340	2"x1/2"x2"	63 x 20 x 63		0,393	0,867	25/ 1	S
617352	2"x3/4"x2"	63 x 25 x 63		0,371	0,818	25/ 1	S
617354	2"x1"x2"	63 x 32 x 63	**A**	0,324	0,714	25/ 1	MQ
617356	2"x1 1/4"x2"	63 x 40 x 63		0,366	0,807	25/ 1	MQ
617358	2"x1 1/2"x2"	63 x 50 x 63		0,433	0,954	25/ 1	S
617370	2 1/2"x3/4"x2 1/2"	75 x 25 x 75		0,589	1,297	15/ 1	S
617372	2 1/2"x1"x2 1/2"	75 x 32 x 75		0,595	1,312	15/ 1	S
617374	2 1/2"x1 1/4"x2 1/2"	75 x 40 x 75		0,520	1,145	15/ 1	S
617376	2 1/2"x1 1/2"x2 1/2"	75 x 50 x 75		0,594	1,310	15/ 1	S
617378	2 1/2"x2"x2 1/2"	75 x 63 x 75		0,572	1,261	15/ 1	MQ
617394	3"x1 1/2"x3"	90 x 50 x 90		0,949	2,092	12/ 1	MQ
617396	3"x2"x3"	90 x 63 x 90		0,907	1,998	12/ 1	MQ
617398	3"x2 1/2"x3"	90 x 75 x 90		1,001	2,208	8/ 1	MQ
617414	3 1/2"x2"x3 1/2"	110 x 63 x110		1,206	2,658	14/ 1	MQ
617416	3 1/2"x2 1/2"x3 1/2"	110 x 75 x110		1,228	2,708	6/ 1	MQ
617418	3 1/2"x3"x3 1/2"	110 x 90 x110		1,217	2,684	6/ 1	MQ
617419	4"x3"x4"	125 x90 x125		2,341	5,160	6/ 1	MQ
617420	4"x3 1/2"x4"	125 x110 x125		2,560	5,644	6/ 1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Tee reduced
for socket welding and butt welding
Material: PP-RCT
Colour: Gray
Product line: Ø 20-500 mm
Processing: Type A: Socket welding; Type C: Butt welding/segmented

Type C
(butt fusion)

SDR	A. no.	Dimension			Supply unit in pcs carton/package	Availability
		inch	mm			
11	6017434	6"x3"x6"	160 x 90 x 160	C	1/1	S
11	6017423	6"x3 1/2"x6"	160 x 110 x 160		1/1	S
11	6017438	6"x4"x6"	160 x 125 x 160		1/1	S
11	6017442	8"x6"x8"	200 x 160 x 200		1/1	S
11	6017446	10"x6"x10"	250 x 160 x 250		1/1	S
11	6017450	10"x8"x10"	250 x 200 x 250		1/1	S
11	6017456	12"x10"x12"	315 x 250 x 315		1/1	S
11	6017458	12"x8"x12"	315 x 200 x 315		1/1	S
11	6017464	14"x12"x14"	355 x 315 x 355		1/1	S
11	6017466	14"x10"x14"	355 x 250 x 355		1/1	S
11	6017472	16"x14"x16"	400 x 355 x 400		1/1	MQ
11	6017476	18"x14"x18"	450 x 355 x 450		1/1	MQ
11	6017478	18"x16"x18"	450 x 400 x 450		1/1	MQ
17,6	5017434	6"x3"x6"	160 x 90 x 160		1/1	S
17,6	5017423	6"x3 1/2"x6"	160 x 110 x 160		1/1	S
17,6	5017438	6"x4"x6"	160 x 125 x 160		1/1	S
17,6	5017442	8"x6"x8"	200 x 160 x 200		1/1	S
17,6	5017446	10"x6"x10"	250 x 160 x 250		1/1	S
17,6	5017450	10"x8"x10"	250 x 200 x 250		1/1	S
17,6	5017456	12"x10"x12"	315 x 250 x 315		1/1	S
17,6	5017458	12"x8"x12"	315 x 200 x 315		1/1	S
17,6	5017464	14"x12"x14"	355 x 315 x 355		1/1	S
17,6	5017466	14"x10"x14"	355 x 250 x 355		1/1	S
17,6	5017470	16"x12"x16"	400 x 355 x 400		1/1	MQ
17,6	5017472	16"x14"x16"	450 x 355 x 450		1/1	MQ
17,6	5017476	18"x14"x18"	450 x 355 x 450		1/1	MQ
17,6	5017478	18"x16"x18"	450 x 400 x 450		1/1	MQ
17,6	5017482	20"x16"x20"	500 x 400 x 500		1/1	MQ
17,6	5017484	20"x18"x20"	500 x 450 x 500		1/1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Welding saddle
Material: PP-RCT, Colour: Gray, Product line: Ø 40–355 mm, Processing: Socket welding

A. no.	Dimension		Hole size	Weight		Supply unit in pcs carton/package	Availability
	pipe x fusion outlet in inch	pipe x outlet in mm	mm	kg/pcs	ib/pcs		
617741	1 1/4"x1/2"	40 x 20	25	0,014	0,031	250/ 5	S
617742	1 1/4"x3/4"	40 x 25	25	0,016	0,034	250/ 5	S
617744	1 1/2"x1/2"	50 x 20	25	0,014	0,031	250/ 5	S
617745	1 1/2"x3/4"	50 x 25	25	0,016	0,035	250/ 5	S
617747	2"x1/2"	63 x 20	25	0,014	0,031	200/ 5	S
617748	2"x3/4"	63 x 25	25	0,016	0,035	200/ 5	S
617749	2"x1"	63 x 32	32	0,027	0,060	150/ 5	S
617750	2 1/2"x1/2"	75 x 20	25	0,014	0,031	200/ 5	S
617751	2 1/2"x3/4"	75 x 25	25	0,016	0,036	200/ 5	S
617752	2 1/2"x1"	75 x 32	32	0,027	0,060	120/ 5	S
617754	3"x1/2'	90 x 20	25	0,014	0,031	200/ 5	S
617756	3"x3/4"	90 x 25	25	0,017	0,037	200/ 5	S
617758	3"x1"	90 x 32	32	0,028	0,061	150/ 5	S
617759	3"x1 1/4"	90 x 40	40	0,054	0,118	50/5	S
617760	3 1/2"x1/2"	110 x 20	25	0,015	0,033	200/ 5	S
617761	3 1/2"x3/4"	110 x 25	25	0,017	0,037	150/ 5	S
617762	3 1/2"x1"	110 x 32	32	0,028	0,062	100/ 5	S
617765	4"x1/2"	125 x 20	25	0,015	0,033	200/ 5	S
617766	4"x3/4"	125 x 25	25	0,017	0,037	150/ 5	S
617767	4"x1"	125 x 32	32	0,028	0,062	100/ 5	S
617768	4"x1 1/4"	125 x 40	40	0,058	0,128	60/5	S
617769	4"x1 1/2"	125 x 50	50	0,084	0,185	40/5	S
617780	4"x2"	125 x 63	63	0,161	0,356	60/1	S
617770	6"-10"x1/2"	160-250 x 20	25	0,015	0,032	200/ 5	S
617771	6"-10"x3/4"	160-250 x 25	25	0,017	0,037	200/ 5	S
617772	6"-10"x1"	160-250 x 32	32	0,028	0,061	100/ 5	S
617773	6"-10"x1 1/4	160-250 x 40	40	0,037	0,082	200/5	S
617774	6"-10"x1 1/2"	160-250 x 50	50	0,048	0,106	100/5	S
617775	6"-10"x2"	160-250 x 63	63	0,071	0,157	50/1	S
617786	6"x 2 1/2"	160 x 75	75	0,227	0,500	40/1	S
617787	6"x3"	160 x 90	90	0,357	0,788	25/1	S
617796	8"x2 1/2"	200 x 75	75	0,226	0,499	40/1	S
617797	8"x3"	200 x 90	90	0,355	0,782	25/1	S
617799	8"x4"	200 x 125	125	0,750	1,654	12/1	S
617866	10"x2 1/2"	250 x 75	75	0,231	0,510	40/1	S
617867	10"x3"	250 x 90	90	0,355	0,783	25/1	S
617869	10"x4"	250 x 125	125	0,728	1,604	12/1	S
617875	12-14"x2"	315-355 x 63	63	0,167	0,369	60/1	S
617876	12-14"x2 1/2"	315-355 x 75	75	0,239	0,528	36/1	S
617877	12-14"x3"	315-355 x 90	90	0,363	0,800	25/1	S
617879	12"x4"	315 x 125	125	0,728	1,605	12/1	S
617889	14"x4"	355 x 125	125	0,733	1,616	12/1	S

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Welding saddle
Weld-in saddle female thread, Material: PP-RCT/brass, Colour: Gray,
Product line: Ø 40-250 mm, Processing: Socket welding

A. no.	Dimension		Hole size	Weight		Supply unit in pcs carton/package	Availability
	pipe x fusion outlet in inch	pipe x outlet in mm	mm	kg/pcs	ib/pcs		
6918352	1 1/4"x1/2"	40 x 1/2"	25	0,113	0,249	100/ 5	S
6918353	1 1/4"x3/4"	40 x 3/4"	25	0,138	0,303	100/ 5	S
6918354	1 1/2"x1/2"	50 x 1/2"	25	0,028	0,061	100/ 5	S
6918355	1 1/2"x3/4"	50 x 3/4"	25	0,137	0,303	100/ 5	S
6918356	2"x1/2"	63 x 1/2"	25	0,113	0,249	100/ 5	S
6918357	2"x3/4"	63 x 3/4"	25	0,138	0,304	50/ 5	S
6918358	2"x1"	63 x 1"	32	0,218	0,481	50/ 5	S
6918359	2 1/2"x1/2"	75 x 1/2"	25	0,113	0,249	80/ 5	S
6918360	2 1/2"x3/4"	75 x 3/4"	25	0,034	0,076	80/ 5	S
6918361	2 1/2"x1"	75 x 1"	32	0,219	0,483	50/ 5	S
6918362	3"x1/2'	90 x 1/2"	25	0,114	0,251	80/ 5	S
6918363	3"x3/4"	90 x 3/4"	25	0,139	0,306	80/ 5	S
6918364	3"x1"	90 x 1"	32	0,219	0,484	50/ 5	S
6918366	3 1/2"x1/2"	110 x 1/2"	25	0,114	0,251	100/ 5	S
6918367	3 1/2"x3/4"	110 x 3/4"	25	0,139	0,307	80/ 5	S
6918368	3 1/2"x1"	110 x 1"	32	0,221	0,487	50/ 5	S
6918370	4"x1/2"	125 x 1/2"	25	0,113	0,250	50/ 5	S
6918371	4"x3/4"	125 x 3/4"	25	0,139	0,307	50/ 5	S
6918372	4"x1"	125 x 1"	32	0,218	0,480	50/ 5	S
6918375	6"-10"x1/2"	160-250 x 1/2"	25	0,113	0,249	100/ 5	S
6918376	6"-10"x3/4"	160-250 x 3/4"	25	0,140	0,309	50/ 5	S
6918377	6"-10"x1"	160-250 x 1"	32	0,220	0,485	50/ 5	S

Adapter female thread
Adapter female thread, Material: PP-RCT/brass, Colour: Gray,
Product line: Ø 20-75 mm, Processing: Socket welding

Type A

Type B

A. no.	Dimension			Weight		Supply unit in pcs carton/ package	Availability
	inch	mm		kg/pcs	ib/pcs		
6918104	1/2"x1/2"	20 x 1/2"	A	0,071	0,156	130/ 10	S
6918105	1/2"x3/4"	20 x 3/4"		0,101	0,222	100/ 10	S
6918106	3/4"x1/2"	25 x 1/2"		0,072	0,159	130/ 10	S
6918107	3/4"x3/4"	25 x 3/4"		0,101	0,222	100/ 10	S
6918108	1"x3/4"	32 x 3/4"		0,141	0,311	100/ 10	S
6918109	1"x1"	32 x 1"	B	0,224	0,494	50/ 5	S
6918110	1 1/4"x1"	40 x 1"		0,211	0,466	50/ 5	S
6918111	1 1/4"x1 1/4"	40 x 1 1/4"		0,392	0,864	30/ 5	S
6918112	1 1/2"x1 1/4"	50 x 1 1/4"		0,335	0,739	30/ 5	S
6918113	1 1/2"x1 1/2"	50 x 1 1/2"		0,483	1,066	25/ 5	S
6918115	2"x2"	63 x 2"		0,705	1,554	10/ 1	S
6918116	2 1/2"x2"	75 x 2"		0,764	1,683	8/ 1	S
6918117	2 1/2"x2 1/2"	75 x 2 1/2"		1,195	2,635	8/ 1	S

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Adapter male thread
Adapter male thread, Material: PP-RCT/brass, Colour: Gray,
Product line: Ø 20-110 mm, Processing: Socket welding

Type A

Type B

A. no.	Dimension			Weight		Supply unit in pcs carton/ package	Avai-lability
	inch	mm		kg/pcs	ib/pcs		
6918154	1/2"x1/2"	20 x 1/2"	A	0,101	0,224	100/ 10	S
6918155	1/2"x3/4"	20 x 3/4"		0,138	0,305	100/ 10	S
6918156	3/4"x1/2"	25 x 1/2"		0,098	0,216	100/ 10	S
6918157	3/4"x3/4"	25 x 3/4"		0,147	0,323	100/ 10	S
6918158	1"x3/4"	32 x 3/4"		0,151	0,333	80/ 5	S
6918159	1"x1"	32 x 1"	B	0,254	0,560	50/ 5	S
6918160	1 1/4"x1"	40 x 1"		0,259	0,572	50/ 5	S
6918161	1 1/4"x1 1/4"	40 x 1 1/4"		0,326	0,718	30/ 5	S
6918162	1 1/2"x1 1/4"	50 x 1 1/4"		0,439	0,969	20/ 5	S
6918163	1 1/2"x1 1/2"	50 x 1 1/2"		0,436	0,961	20/ 5	S
6918165	2"x2"	63 x 2"		0,752	1,658	20/ 1	S
6918167	2 1/2"x2"	75 x 2 1/2"		0,998	2,201	8/ 1	S
6918169	2 1/2"x3"	90 x 3"		1,622	3,576	6/ 1	S
6918171	3 1/2"x2 1/2"	110 x 2 1/2"		1,061	2,340	4/ 1	S

Transition Tee from 1" for wrench
Material: PP-RCT/brass, Colour: Gray, Product line: Ø 20-50 mm, Processing: Socket welding

A. no.	Dimension		Weight		Supply unit in pcs carton/package	Avai-lability
	inch	mm	kg/pcs	ib/pcs		
6918304	1/2"x1/2"x1/2"	20 x 1/2" x 20	0,092	0,203	100/ 10	S
6918306	3/4"x1/2"x3/4"	25 x 1/2" x 25	0,103	0,227	80/ 10	S
6918307	3/4"x3/4"x3/4"	25 x 3/4" x 25	0,090	0,199	70/ 10	S
6918311	1"x1/2"x1"	32 x 1/2" x 32	0,113	0,250	40/ 5	S
6918310	1"x3/4"x1"	32 x 3/4" x 32	0,133	0,294	40/ 5	S
6918309	1"x1"x1"	32 x 1" x 32	0,268	0,590	30/ 5	S
6918312	1 1/4"x3/4"x1 1/4"	40 x 3/4" x 40	0,113	0,250	30/ 5	S
6918313	1 1/4"x1"x1 1/4"	40 x 1" x 40	0,160	0,353	30/ 5	S
6918314	1 1/2"x1"x1 1/2"	50 x 1" x 50	0,314	0,691	20/ 5	S

Screw coupling, pipe-end/pipe-end
Material: PP-RCT/brass, Colour: Gray, Product line: Ø 20-63 mm, Processing: Socket welding

A. no.	Dimension		Weight		Supply unit in pcs carton/package	Avai-lability
	inch	mm	kg/pcs	ib/pcs		
624182	1/2"	20	0,170	0,375	80/ 1	S
624183	3/4"	25	0,255	0,562	50/ 1	S
624184	1"	32	0,325	0,716	50/ 1	S
624185	1 1/4"	40	0,478	1,054	25/ 1	S
624186	1 1/2"	50	0,620	1,367	20/ 1	S
624187	2"	63	0,910	2,006	15/ 1	S

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Ball valve

Handle: glass fibre reinforced polyamide, ball and stem: brass, PTFE seats, NBR O-ring

A. no.	Dimension		Weight		Supply unit in pcs carton/package	Availa-bility
	inch	mm	kg/pcs	ib/pcs		
20402	1/2"	20	0,114	0,251	50/ 5	S
20403	3/4"	25	0,131	0,289	25/ 5	S
20404	1"	32	0,182	0,401	15/ 1	S
20405	1 1/4"	40	0,346	0,763	10/ 1	S
20412	1 1/2"	50	0,503	1,109	6/ 1	S
20414	2"	63	0,98	2,161	5/ 1	S
20416	2 1/2"	75	1,2	2,646	5/ 1	S

End cap

Material: PP-RCT, Color: Gray,

Product line: Ø 20-500 mm

Type A

Type B

SDR	A. no.	Dimension			Weight		Supply unit in pcs carton/ package	Availa-bility
		inch	mm		kg/pcs	ib/pcs		
-	617702	1/2"	20	A	0,009	0,021	400/ 10	S
-	617703	3/4"	25		0,014	0,031	250/ 10	S
-	617704	1"	32		0,024	0,053	150/ 10	S
-	617705	1 1/4"	40		0,038	0,084	100/ 5	S
-	617706	1 1/2"	50		0,081	0,178	60/ 5	S
-	617707	2"	63		0,180	0,396	30/ 1	S
-	617708	2 1/2"	75		0,255	0,562	20/ 1	S
-	617709	3"	90		0,410	0,905	30/ 1	S
-	617710	3 1/2"	110		0,636	1,402	15/ 1	S
-	617711	4"	125		0,532	1,173	12/ 1	S
11	6017714	6"	160	B	0,900	1,984	1/ 1	S
11	6017716	8"	200		2,030	4,475	1/ 1	S
11	6017718	10"	250		3,171	6,991	1/ 1	S
11	6017720	12"	315		5,919	13,050	1/ 1	S
11	6017722	14"	355		8,387	18,490	1/ 1	S
11	6017724	16"	400		11,698	25,790	1/ 1	MQ
11	6017726	18"	450		16,502	36,380	1/ 1	MQ
17	5017714	6"	160		0,889	1,960	1/ 1	S
17	5017716	8"	200		1,887	4,160	1/ 1	S
17	5017718	10"	250		2,849	6,280	1/ 1	S
17	5017720	12"	315		5,638	12,430	1/ 1	S
17	5017722	14"	355		8,392	18,500	1/ 1	S
17	5017724	16"	400		11,698	25,790	1/ 1	MQ
17	5017726	18"	450		16,502	36,380	1/ 1	MQ
17	5017728	20"	500		23,301	51,370	1/ 1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Flange adapter
Material: PP-RCT, Color: Gray, Product line: Ø 63-500 mm,
Info: Adapter > 160 all with bevel for butterfly valve use

Type A

Type B

SDR	A. no.	Dimension			Weight		Supply unit in pcs carton/ package	Availa-bility
		inch	mm		kg/pcs	ib/pcs		
-	617807	2"	63	A	0,125	0,275	30/ 1	S
-	617808	2 1/2"	75		0,184	0,406	20/ 1	S
-	617809	3"	90		0,239	0,526	15/ 1	S
-	617810	3 1/2"	110		0,327	0,721	12/ 1	S
11	617811	4"	125	B	1,347	2,970	1/ 1	S
11	6017812	6"	160		2,150	4,740	1/ 1	S
11	6017814	8"	200		2,990	6,592	1/ 1	S
11	6017816	10"	250		6,087	13,419	1/ 1	S
11	6017818	12"	315		8,020	17,681	1/ 1	S
11	6017820	14"	355		10,600	23,369	1/ 1	S
11	6017822	16"	400		15,196	33,500	1/ 1	MQ
11	6017824	18"	450		24,399	53,790	1/ 1	MQ
17	5017812	6"	160		1,488	3,280	1/ 1	S
17	5017814	8"	200		2,898	6,390	1/ 1	S
17	5017816	10"	250		4,736	10,440	1/ 1	S
17	5017818	12"	315		7,398	16,310	1/ 1	S
17	5017820	14"	355		10,601	23,370	1/ 1	S
17	5017822	16"	400		15,196	33,500	1/ 1	MQ
17	5017824	18"	450		24,399	53,790	1/ 1	MQ
17	5017826	20"	500		36,002	79,370	1/ 1	MQ

Flange ring
Material: Carbon steel epoxy coated, Colour: Black, Standards: Acc. ANSI 16,5 class 150,
Product line: Ø 63-500 mm

A. no.	Dimension		Supply unit in pcs carton/package	Availability
	inch	mm		
914207	2"	63	1	MQ
914208	2 1/2"	75	1	MQ
914209	3"	90	1	MQ
914210	3 1/2"/ 4"	110/125	1	MQ
914212	6"	160	1	MQ
914214	8"	200	1	MQ
914216	10"	250	1	MQ
914218	12"	315	1	MQ
914220	14"	355	1	MQ
914222	16"	400	1	MQ
914224	18"	450	1	MQ
914226	20"	500	1	MQ

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.2 Fittings

Flange ring
Material: PP fiber-reinforced with steel insert, Colour: Black, Standards: EN 1092,
Product line: Ø 63-500 mm

A. no.	Dimension		Supply unit in pcs carton/package	Availability
	inch	mm		
14207	2"	63	1	S
14208	2 1/2"	75	1	S
14209	3"	90	1	S
14210	3 1/2"/ 4"	110/125	1	S
14212	6"	160	1	S
14214	8"	200	1	S
14216	10"	250	1	S
14218	12"	315	1	S
14220	14"	355	1	S
14222	16"	400	1	MQ
14224	18"	450	1	MQ
14226	20"	500	1	MQ

Electro coupling
Material: PP-RCT, Colour: Green,
Product line: Ø 20-250 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package	Availa-bility
	inch	mm	kg/pcs	ib/pcs		
14802	1/2"	20	0,045	0,099	35/ 1	S
14803	3/4"	25	0,055	0,121	25/ 1	S
14804	1"	32	0,075	0,165	20/ 1	S
14805	1 1/4"	40	0,110	0,243	25/ 1	S
14806	1 1/2"	50	0,155	0,342	20/ 1	S
14807	2"	63	0,225	0,496	25/ 1	S
14808	2 1/2"	75	0,330	0,728	36/ 1	S
14809	3"	90	0,490	1,080	18/ 1	S
14810	3 1/2"	110	0,800	1,764	15/ 1	S
14811	4"	125	1,060	2,337	1/ 1	S
14812	6"	160	1,855	4,090	1/ 1	S
14814	8"	200	4,100	9,039	1/ 1	S
14816	10"	250	6,550	14,440	1/ 1	S

S = Standard range, MQ = Minimum order quantity in pieces or meter

4.1.3 Accessories

Instertion depth gauge
For marking the insertion depth on the pipe. Product line: Ø 20-125 mm.

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15030		20-125	0,0056	0,0123	700/50

Butt fusion machine
Working range max Ø 75-250 mm, Power supply 230 VAC 50/60 Hz, Absorbed Power 3500 W,
Working Temperature 210° C ± 10° C

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15207		160-250	105,000	231,483	1

Welding machine for electric fittings
Working range: 20-315 mm, Power supply: 230 V single phase 50/60 Hz, Universal adapter: 4.0-4.7 mm, Laser scanner,
For fittings from 8–48 V

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15270			25,000	55,115	1

Rotary pipe scraper
Professional rotary scrapers, essential to prepare the plastic pipes and fittings before electrofusion welding,
peeling depth: 0.2 mm (0.15-0.25 mm)

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15167	1/2" - 4"	20-125	1,100	2,42506	1

Rotary pipe scraper – big
Professional rotary scrapers, essential to prepare the plastic pipes and fittings before electrofusion welding,
peeling depth: 0.3 mm (0.25-0.35 mm)

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15167	1/2" - 4"	20-125	1,100	2,42506	1

4.1.3 Accessories

Fusion machine
Working range max Ø 20-40 mm, Power supply 230 V - 50/60 Hz, Absorbed Power 500 W,
with fusion bushings 20-40 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
21310	1/2"-1 1/4"	20-40	12,000	26,455	1

Fusion machine
Working range max Ø 20-63 mm, Power supply 230 V - 50/60 Hz, Absorbed Power 800 W,
with welding tool 20-63 mm with Pipe cutter

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15311	1/2"-2"	20-63	11,300	24,91198	1

Pipe cutter
for pipes from Ø 16 to 40 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15001	3/8"-1 1/4"	16 - 40	0,460	1,014116	1

Pipe cutter – big
for pipes from Ø 16 to 63 mm

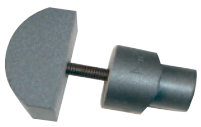
A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15003	3/8" - 2"	16-63	1,240	2,733704	1

Rotational pipe cutter
for pipes from Ø 50 to 110 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15007	1 1/2" - 3 1/2"	50 - 110	2,0	4,4092	1

4.1.3 Accessories

Fusion bushings for saddle
Material: Aluminium, teflon-coated, Product line: Ø 40-250 mm,
Processing: Socket welding



A. no.	Dimension		Hole size mm	Supply unit in pcs carton/package
	inch	mm		
15065	1 1/4"	40	25	1
15066	1 1/2"	50	25	1
15067	2"	63	25	1
15082	2"	63	32	1
15068	2 1/2"	75	25	1
15083	2 1/2"	75	32	1
15102	2 1/2"	75	40	1
15069	3"	90	25	1
15084	3"	90	32	1
15180	3"	90	40	1
15070	3 1/2"	110	25	1
15085	3 1/2"	110	32	1
15071	4"	125	25	1
15086	4"	125	32	1
15186	4"	125	40	1
15187	4"	125	50	1
15188	4"	125	63	1
15087	6"-10"	160-250	25	1
15088	6"-10"	160-250	32	1
15106	6"-10"	160-250	40	1
15107	6"-10"	160-250	50	1
15108	6"-10"	160-250	63	1
15189	6"	160	75	1
15191	6"	160	90	1
15192	8"	200	75	1
15193	8"	200	90	1
15194	8"	200	125	1
15195	10"	250	75	1
15196	10"	250	90	1
15198	10"	250	125	1
15222	12-14"	315-355	63	1
15223	12-14"	315-355	75	1
15224	12"	315	90	1
15225	14"	355	90	1
15226	12"	315	125	1
15227	14"	355	125	1

4.1.3 Accessories

Fusion bushings
Material: Aluminium, teflon-coated, Standards: according to DVS, type A, Product line: Ø 20-125 mm,
Processing: Socket welding

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15042	1/2"	20	0,100	0,220	1
15043	3/4"	25	0,166	0,366	1
15044	1"	32	0,213	0,470	1
15045	1 1/4"	40	0,268	0,591	1
15046	1 1/2"	50	0,268	0,591	1
15047	2"	63	0,430	0,948	1
15048	2 1/2"	75	0,668	1,473	1
15049	3"	90	0,880	1,940	1
15050	3 1/2"	110	1,230	2,712	1
15051	4"	125	1,520	3,351	1

Fusion tool
Assembly tool “Spider”, Universal-purpose welding aid for socket welding from 63-125 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15212	2"-4"	63-125	6,800	14,991	1

Fusion set for repair plug
for repair of holes up to Ø 8 mm, Material: Aluminium, Teflon-coated

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15080	1/16"	8	0,169	0,373	1

Repair plug
for repair of holes up to Ø 8 mm

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
621090	1/16"	8	0,003	0,007	1200/100

4.1.3 Accessories

Hole saw for weld-in saddles
Material: Metal, For installation holes and continuous drilling, A. no. 15094 necessary

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15095	3/4"	25	-	-	1
15096	1"	32	-	-	1
15097	1 1/4"	40	-	-	1
15098	1 1/2"	50	-	-	1
15099	2"	63	-	-	1
15100	2 1/2"	75	-	-	1
15175	3"	90	-	-	1
15176	3 1/2"	110	-	-	1
15178	4"	125	-	-	1

Quick change system
With pilot drill for hole saw, bayonet catch, quick change between hole saws of different dimensions

A. no.	Dimension		Weight		Supply unit in pcs carton/package
	inch	mm	kg/pcs	ib/pcs	
15094	for item No. 15095-15099	-	-	-	1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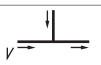
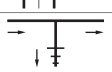
5.1 Single resistance values and pressure loss tables

Coefficient of resistance values for fittings made of PP-RCT

Fitting individual resistance	Graphic symbol	Remark	Resistance coefficient value ζ
Tee		branching, dividing flow	1.3
		passage for dividing flow	0.3
		counter current for dividing flow	1.4
		branching, merging flow	1.3
		passage for merging flow	2.5
		counter current for merging flow	3.0
Elbow 90°			1.2
Elbow 45°			0.7
Socket			0.25
Reducer		by 1 dimension	0.4
		by 2 dimensions	0.6
		by 3 dimensions	0.7
		more than 4 dimensions	0.9
Wall union			1.7
Double wall union			1.5
Short cross over			1.9
Transition with internal thread			0.5
Transition with internal thread, reduced			0.8
Transition with external thread			0.4
Transition with external thread, reduced			0.8
Transition elbow with thread			1.7
Tee with transition, dividing flow			1.6
Slanted seat valve			3.0
Slanted seat valve with back-flow prevention			3.8
Shut off valve			7.0
Ball valve			0.4

Pressure loss due to pipe resistance R and flow speed v depending on flow V

Pipes SDR 7.4/20-25 mm; SDR 11/32-250 mm

Temperature 20 °C Roughness: 0.007 mm Density: 998.29 kg/m³ Kin. viscosity: 1.004E-06 m²/s

		Dimension	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm	200 mm	250 mm
		Wall thickness	2.8 mm	3.5 mm	2.9 mm	3.7 mm	4.6 mm	5.8 mm	6.8 mm	8.2 mm	10.0 mm	11.4 mm	14.6 mm	18.2 mm	22.7 mm
l/s	m³/h														
0.01	0.04	R in mbar/m	0.10	0.04	0.01										
		v in m/s	0.06	0.04	0.02										
0.02	0.07	R	0.30	0.11	0.02	0.01									
		v	0.12	0.08	0.04	0.02									
0.03	0.11	R	0.58	0.21	0.04	0.01									
		v	0.18	0.12	0.06	0.04									
0.04	0.14	R	0.93	0.33	0.06	0.02	0.01								
		v	0.25	0.16	0.07	0.05	0.03								
0.05	0.18	R	1.34	0.47	0.08	0.03	0.01								
		v	0.31	0.20	0.09	0.06	0.04								
0.06	0.22	R	1.82	0.64	0.11	0.04	0.01	0.01							
		v	0.37	0.24	0.11	0.07	0.05	0.03							
0.07	0.25	R	2.36	0.83	0.14	0.05	0.02	0.01							
		v	0.43	0.28	0.13	0.08	0.05	0.03							
0.08	0.29	R	2.96	1.04	0.18	0.06	0.02	0.01							
		v	0.49	0.31	0.15	0.10	0.06	0.04							
0.09	0.32	R	3.61	1.26	0.22	0.08	0.03	0.01							
		v	0.55	0.35	0.17	0.11	0.07	0.04							
0.10	0.36	R	4.32	1.51	0.26	0.09	0.03	0.01	0.01						
		v	0.61	0.39	0.19	0.12	0.08	0.05	0.03						
0.12	0.43	R	5.90	2.05	0.35	0.13	0.04	0.02	0.01						
		v	0.74	0.47	0.22	0.14	0.09	0.06	0.04						
0.14	0.50	R	7.70	2.67	0.46	0.16	0.06	0.02	0.01						
		v	0.86	0.55	0.26	0.17	0.11	0.07	0.05						
0.16	0.58	R	9.70	3.36	0.57	0.20	0.07	0.02	0.01						
		v	0.98	0.63	0.30	0.19	0.12	0.08	0.05						
0.18	0.65	R	11.91	4.11	0.70	0.25	0.09	0.03	0.01	0.01					
		v	1.11	0.71	0.33	0.22	0.14	0.09	0.06	0.04					
0.20	0.72	R	14.32	4.94	0.83	0.30	0.10	0.04	0.02	0.01					
		v	1.23	0.79	0.37	0.24	0.15	0.10	0.07	0.05					
0.30	1.08	R	29.30	10.01	1.67	0.59	0.21	0.07	0.03	0.01	0.01				
		v	1.84	1.18	0.56	0.36	0.23	0.14	0.10	0.07	0.05				
0.40	1.44	R	49.02	16.64	2.75	0.97	0.34	0.11	0.05	0.02	0.01				
		v	2.46	1.57	0.74	0.48	0.31	0.19	0.14	0.09	0.06				
0.50	1.80	R	73.35	24.77	4.07	1.43	0.49	0.17	0.07	0.03	0.01	0.01			
		v	3.07	1.96	0.93	0.60	0.38	0.24	0.17	0.12	0.08	0.06			
0.60	2.16	R	102.21	34.36	5.61	1.97	0.68	0.23	0.10	0.04	0.02	0.01			
		v	3.68	2.36	1.11	0.72	0.46	0.29	0.20	0.14	0.09	0.07			
0.70	2.52	R	135.57	45.40	7.37	2.58	0.89	0.30	0.13	0.05	0.02	0.01			
		v	4.30	2.75	1.30	0.84	0.54	0.34	0.24	0.16	0.11	0.09			
0.80	2.88	R	173.38	57.86	9.34	3.27	1.12	0.37	0.16	0.07	0.03	0.01			
		v	4.91	3.14	1.48	0.96	0.61	0.39	0.27	0.19	0.13	0.10			
0.90	3.24	R	215.63	71.73	11.53	4.02	1.37	0.46	0.20	0.08	0.03	0.02	0.01		
		v	5.53	3.54	1.67	1.08	0.69	0.43	0.30	0.21	0.14	0.11	0.07		
1.00	3.60	R	262.30	87.00	13.93	4.85	1.65	0.55	0.24	0.10	0.04	0.02	0.01		
		v	6.14	3.93	1.85	1.20	0.76	0.48	0.34	0.24	0.16	0.12	0.07		
1.10	3.96	R	313.36	103.67	16.53	5.74	1.96	0.65	0.28	0.12	0.05	0.02	0.01		
		v	6.75	4.32	2.04	1.32	0.84	0.53	0.37	0.26	0.17	0.13	0.08		
1.20	4.32	R	368.81	121.73	19.34	6.71	2.28	0.76	0.32	0.14	0.05	0.03	0.01		
		v	7.37	4.72	2.23	1.44	0.92	0.58	0.41	0.28	0.19	0.15	0.09		
1.30	4.68	R	428.65	141.17	22.36	7.74	2.63	0.87	0.37	0.16	0.06	0.03	0.01		
		v	7.98	5.11	2.41	1.56	0.99	0.63	0.44	0.31	0.20	0.16	0.10		
1.40	5.04	R	492.86	162.00	25.57	8.84	3.00	0.99	0.42	0.18	0.07	0.04	0.01		
		v	8.60	5.50	2.60	1.68	1.07	0.67	0.47	0.33	0.22	0.17	0.10		
1.60	5.76	R	634.39	207.77	32.61	11.25	3.80	1.25	0.54	0.23	0.09	0.05	0.01		
		v	9.82	6.29	2.97	1.92	1.22	0.77	0.54	0.38	0.25	0.20	0.12		
1.80	6.48	R	793.36	259.03	40.45	13.91	4.69	1.54	0.66	0.28	0.11	0.06	0.02	0.01	
		v	11.05	7.07	3.34	2.16	1.38	0.87	0.61	0.42	0.28	0.22	0.13	0.09	
2.00	7.20	R		315.77	49.09	16.84	5.67	1.86	0.79	0.33	0.13	0.07	0.02	0.01	
		v		7.86	3.71	2.40	1.53	0.96	0.68	0.47	0.31	0.24	0.15	0.10	
2.20	7.92	R		377.96	58.51	20.03	6.73	2.21	0.94	0.39	0.15	0.08	0.03	0.01	
		v		8.65	4.08	2.64	1.68	1.06	0.74	0.52	0.35	0.27	0.16	0.10	
2.40	8.64	R		445.60	68.72	23.48	7.87	2.58	1.10	0.46	0.18	0.10	0.03	0.01	
		v		9.43	4.45	2.88	1.84	1.16	0.81	0.56	0.38	0.29	0.18	0.11	
2.60	9.36	R		518.69	79.71	27.18	9.10	2.97	1.26	0.53	0.20	0.11	0.03	0.01	
		v		10.22	4.82	3.11	1.99	1.25	0.88	0.61	0.41	0.32	0.19	0.12	

		Dimension	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm	200 mm	250 mm
		Wall thickness	2.9 mm	3.7 mm	4.6 mm	5.8 mm	6.8 mm	8.2 mm	10.0 mm	11.4 mm	14.6 mm	18.2 mm	22.7 mm
l/s	m³/h												
2.80	10.08	R	91.49	31.14	10.40	3.40	1.44	0.60	0.23	0.13	0.04	0.01	
		v	5.19	3.35	2.14	1.35	0.95	0.66	0.44	0.34	0.21	0.13	
3.00	10.80	R	104.04	35.35	11.79	3.84	1.63	0.68	0.26	0.14	0.04	0.02	0.01
		v	5.56	3.59	2.29	1.45	1.01	0.71	0.47	0.37	0.22	0.14	0.09
3.50	12.60	R	138.82	47.00	15.62	5.07	2.15	0.90	0.34	0.19	0.06	0.02	0.01
		v	6.49	4.19	2.68	1.69	1.18	0.82	0.55	0.43	0.26	0.17	0.11
4.00	14.40	R	178.44	60.21	19.95	6.46	2.73	1.14	0.43	0.24	0.07	0.03	0.01
		v	7.42	4.79	3.06	1.93	1.35	0.94	0.63	0.49	0.30	0.19	0.12
4.50	16.20	R	222.89	74.99	24.77	8.01	3.38	1.41	0.53	0.29	0.09	0.03	0.01
		v	8.35	5.39	3.44	2.17	1.52	1.06	0.71	0.55	0.33	0.21	0.14
5.00	18.00	R	272.15	91.32	30.09	9.70	4.08	1.70	0.64	0.35	0.11	0.04	0.01
		v	9.27	5.99	3.82	2.41	1.69	1.18	0.79	0.61	0.37	0.24	0.15
5.50	19.80	R	326.21	109.21	35.90	11.55	4.85	2.02	0.76	0.41	0.13	0.04	0.02
		v	10.20	6.59	4.21	2.65	1.86	1.29	0.86	0.67	0.41	0.26	0.17
6.00	21.60	R		128.65	42.20	13.55	5.69	2.36	0.89	0.48	0.15	0.05	0.02
		v		7.19	4.59	2.89	2.03	1.41	0.94	0.73	0.45	0.29	0.18
6.50	23.40	R		149.64	48.99	15.70	6.58	2.73	1.03	0.56	0.17	0.06	0.02
		v		7.79	4.97	3.13	2.20	1.53	1.02	0.79	0.48	0.31	0.20
7.00	25.20	R		172.17	56.26	17.99	7.53	3.12	1.18	0.64	0.20	0.07	0.02
		v		8.39	5.35	3.37	2.36	1.65	1.10	0.85	0.52	0.33	0.21
7.50	27.00	R		196.24	64.02	20.44	8.55	3.53	1.33	0.72	0.22	0.08	0.03
		v		8.99	5.74	3.61	2.53	1.76	1.18	0.91	0.56	0.36	0.23
8.00	28.80	R		221.85	72.27	23.03	9.62	3.97	1.50	0.81	0.25	0.08	0.03
		v		9.58	6.12	3.86	2.70	1.88	1.26	0.98	0.60	0.38	0.24
8.50	30.60	R		249.01	80.99	25.78	10.76	4.44	1.67	0.90	0.28	0.09	0.03
		v		10.18	6.50	4.10	2.87	2.00	1.34	1.04	0.63	0.40	0.26
9.00	32.40	R			90.20	28.67	11.95	4.93	1.85	1.00	0.31	0.10	0.04
		v			6.88	4.34	3.04	2.12	1.41	1.10	0.67	0.43	0.27
9.50	34.20	R			99.89	31.70	13.20	5.44	2.04	1.10	0.34	0.11	0.04
		v			7.27	4.58	3.21	2.23	1.49	1.16	0.71	0.45	0.29
10.00	36.00	R			110.06	34.89	14.52	5.97	2.24	1.21	0.37	0.13	0.04
		v			7.65	4.82	3.38	2.35	1.57	1.22	0.74	0.48	0.30
10.50	37.80	R			120.71	38.22	15.89	6.53	2.45	1.32	0.40	0.14	0.05
		v			8.03	5.06	3.55	2.47	1.65	1.28	0.78	0.50	0.32
11.00	39.60	R			131.84	41.69	17.32	7.12	2.67	1.44	0.44	0.15	0.05
		v			8.41	5.30	3.72	2.59	1.73	1.34	0.82	0.52	0.33
11.50	41.40	R			143.45	45.32	18.81	7.72	2.89	1.56	0.47	0.16	0.06
		v			8.80	5.54	3.88	2.70	1.81	1.40	0.86	0.55	0.35
12.00	43.20	R			155.54	49.08	20.36	8.35	3.13	1.69	0.51	0.17	0.06
		v			9.18	5.78	4.05	2.82	1.89	1.46	0.89	0.57	0.36
12.50	45.00	R			168.11	53.00	21.96	9.00	3.37	1.82	0.55	0.19	0.06
		v			9.56	6.02	4.22	2.94	1.96	1.52	0.93	0.59	0.38
13.00	46.80	R			181.16	57.06	23.63	9.68	3.62	1.95	0.59	0.20	0.07
		v			9.94	6.27	4.39	3.06	2.04	1.58	0.97	0.62	0.40
13.50	48.60	R			194.69	61.26	25.35	10.38	3.88	2.09	0.63	0.22	0.07
		v			10.33	6.51	4.56	3.17	2.12	1.65	1.00	0.64	0.41
14.00	50.40	R				65.61	27.13	11.10	4.14	2.23	0.68	0.23	0.08
		v				6.75	4.73	3.29	2.20	1.71	1.04	0.67	0.43
14.50	52.20	R				70.10	28.97	11.84	4.42	2.38	0.72	0.24	0.08
		v				6.99	4.90	3.41	2.28	1.77	1.08	0.69	0.44
15.00	54.00	R				74.74	30.87	12.61	4.70	2.53	0.76	0.26	0.09
		v				7.23	5.07	3.53	2.36	1.83	1.12	0.71	0.46
16.00	57.60	R				84.46	34.84	14.22	5.30	2.85	0.86	0.29	0.10
		v				7.71	5.40	3.76	2.52	1.95	1.19	0.76	0.49
17.00	61.20	R				94.75	39.04	15.91	5.92	3.18	0.96	0.33	0.11
		v				8.19	5.74	4.00	2.67	2.07	1.27	0.81	0.52
18.00	64.80	R				105.62	43.47	17.70	6.58	3.53	1.06	0.36	0.12
		v				8.67	6.08	4.23	2.83	2.19	1.34	0.86	0.55
19.00	68.40	R				117.06	48.13	19.58	7.27	3.90	1.17	0.40	0.14
		v				9.16	6.42	4.47	2.99	2.32	1.41	0.90	0.58
20.00	72.00	R				129.09	53.03	21.55	7.99	4.29	1.29	0.44	0.15
		v				9.64	6.75	4.70	3.14	2.44	1.49	0.95	0.61
21.00	75.60	R				141.69	58.15	23.61	8.75	4.69	1.41	0.48	0.16
		v				10.12	7.09	4.94	3.30	2.56	1.56	1.00	0.64
22.00	79.20	R					63.51	25.77	9.54	5.11	1.53	0.52	0.18
		v					7.43	5.17	3.46	2.68	1.64	1.05	0.67
23.00	82.80	R					69.09	28.01	10.36	5.55	1.66	0.56	0.19
		v					7.77	5.41	3.62	2.80	1.71	1.09	0.70
24.00	86.40	R					74.90	30.34	11.21	6.00	1.80	0.61	0.21
		v					8.11	5.64	3.77	2.93	1.79	1.14	0.73
25.00	90.00	R					80.95	32.76	12.10	6.47	1.94	0.65	0.22
		v					8.44	5.88	3.93	3.05	1.86	1.19	0.76
26.00	93.60	R					87.22	35.28	13.02	6.96	2.08	0.70	0.24
		v					8.78	6.11	4.09	3.17	1.93	1.24	0.79

		Dimension	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm	200 mm	250 mm
		Wall thickness	2.9 mm	3.7 mm	4.6 mm	5.8 mm	6.8 mm	8.2 mm	10.0 mm	11.4 mm	14.6 mm	18.2 mm	22.7 mm
l/s	m³/h												
27.00	97.20	R					93.72	37.88	13.97	7.46	2.23	0.75	0.25
		v					9.12	6.35	4.24	3.29	2.01	1.28	0.82
28.00	100.80	R					100.46	40.57	14.95	7.99	2.38	0.80	0.27
		v					9.46	6.58	4.40	3.41	2.08	1.33	0.85
29.00	104.40	R					107.42	43.36	15.96	8.52	2.54	0.86	0.29
		v					9.79	6.82	4.56	3.54	2.16	1.38	0.88
30.00	108.00	R					114.61	46.23	17.01	9.08	2.71	0.91	0.31
		v					10.13	7.05	4.72	3.66	2.23	1.43	0.91
32.00	115.20	R						52.25	19.20	10.24	3.05	1.02	0.35
		v						7.52	5.03	3.90	2.38	1.52	0.97
34.00	122.40	R						58.62	21.51	11.46	3.41	1.14	0.39
		v						7.99	5.34	4.14	2.53	1.62	1.03
36.00	129.60	R						65.36	23.96	12.76	3.79	1.27	0.43
		v						8.46	5.66	4.39	2.68	1.71	1.09
38.00	136.80	R						72.45	26.53	14.12	4.19	1.40	0.47
		v						8.93	5.97	4.63	2.83	1.81	1.16
40.00	144.00	R						79.90	29.22	15.54	4.60	1.54	0.52
		v						9.40	6.29	4.88	2.98	1.90	1.22
42.00	151.20	R						87.71	32.05	17.03	5.04	1.68	0.57
		v						9.87	6.60	5.12	3.13	2.00	1.28
44.00	158.40	R						95.87	35.00	18.59	5.49	1.84	0.62
		v						10.34	6.92	5.36	3.27	2.09	1.34
46.00	165.60	R							38.08	20.21	5.97	1.99	0.67
		v							7.23	5.61	3.42	2.19	1.40
48.00	172.80	R							41.28	21.90	6.46	2.15	0.72
		v							7.55	5.85	3.57	2.28	1.46
50.00	180.00	R							44.61	23.66	6.97	2.32	0.78
		v							7.86	6.10	3.72	2.38	1.52
52.00	187.20	R							48.07	25.48	7.50	2.50	0.84
		v							8.17	6.34	3.87	2.47	1.58
54.00	194.40	R							51.65	27.37	8.05	2.68	0.90
		v							8.49	6.58	4.02	2.57	1.64
56.00	201.60	R							55.36	29.32	8.61	2.86	0.96
		v							8.80	6.83	4.17	2.66	1.70
58.00	208.80	R							59.20	31.34	9.20	3.06	1.02
		v							9.12	7.07	4.32	2.76	1.76
60.00	216.00	R							63.16	33.42	9.80	3.25	1.09
		v							9.43	7.31	4.47	2.85	1.82
62.00	223.20	R							67.24	35.57	10.42	3.46	1.16
		v							9.75	7.56	4.61	2.95	1.89
64.00	230.40	R							71.46	37.78	11.06	3.67	1.23
		v							10.06	7.80	4.76	3.04	1.95
66.00	237.60	R								40.06	11.72	3.88	1.30
		v								8.05	4.91	3.14	2.01
68.00	244.80	R								42.40	12.40	4.11	1.37
		v								8.29	5.06	3.23	2.07
70.00	252.00	R								44.81	13.10	4.33	1.45
		v								8.53	5.21	3.33	2.13
75.00	270.00	R								51.12	14.91	4.93	1.64
		v								9.14	5.58	3.57	2.28
80.00	288.00	R								57.84	16.85	5.56	1.85
		v								9.75	5.95	3.81	2.43
85.00	306.00	R								64.96	18.90	6.23	2.07
		v								10.36	6.33	4.04	2.59
90.00	324.00	R									21.06	6.93	2.30
		v									6.70	4.28	2.74
95.00	342.00	R									23.33	7.67	2.55
		v									7.07	4.52	2.89
100.00	360.00	R									25.72	8.45	2.80
		v									7.44	4.76	3.04
110.00	396.00	R									30.85	10.11	3.35
		v									8.19	5.23	3.35
120.00	432.00	R									36.42	11.92	3.94
		v									8.93	5.71	3.65
130.00	468.00	R									42.45	13.87	4.58
		v									9.67	6.18	3.95
140.00	504.00	R									48.94	15.96	5.26
		v									10.42	6.66	4.26
150.00	540.00	R									55.87	18.20	5.99
		v									11.16	7.14	4.56
160.00	576.00	R									63.26	20.58	6.76
		v									11.91	7.61	4.87
170.00	612.00	R									71.10	23.10	7.58
		v									12.65	8.09	5.17

Pressure loss due to pipe resistance R and flow speed v depending on flow V

SDR 11/315–450 mm

Temperature 20 °C Roughness: 0.007 mm Density: 998.29 kg/m³ Kin. viscosity: 1.004E-06 m²/s

		Dimension	315 mm	355 mm	400 mm	450 mm
		Wall thick-ness	28.6 mm	32.2 mm	36.3 mm	40.9 mm
l/s	m³/h					
6,50	23,40	R in mbar/m v in m/s	0,00 0,12			
7,00	25,20	R v	0,00 0,13			
7,50	27,00	R v	0,00 0,14			
8,00	28,80	R v	0,00 0,15			
8,50	30,60	R v	0,01 0,16			
9,00	32,40	R v	0,01 0,17			
9,50	34,20	R v	0,01 0,18			
10,00	36,00	R v	0,01 0,19			
10,50	37,80	R v	0,01 0,20			
11,00	39,60	R v	0,01 0,21	0,00 0,17		
11,50	41,40	R v	0,01 0,22	0,01 0,17		
12,00	43,20	R v	0,01 0,23	0,01 0,18		
12,50	45,00	R v	0,01 0,24	0,01 0,19		
13,00	46,80	R v	0,01 0,25	0,01 0,20		
13,50	48,60	R v	0,01 0,26	0,01 0,20		
14,00	50,40	R v	0,01 0,27	0,01 0,21		
14,50	52,20	R v	0,01 0,28	0,01 0,22		
15,00	54,00	R v	0,02 0,29	0,01 0,23	0,00 0,18	
16,00	57,60	R v	0,02 0,31	0,01 0,24	0,01 0,19	
17,00	61,20	R v	0,02 0,33	0,01 0,26	0,01 0,20	
18,00	64,80	R v	0,02 0,34	0,01 0,27	0,01 0,21	
19,00	68,40	R v	0,03 0,36	0,01 0,29	0,01 0,23	
20,00	72,00	R v	0,03 0,38	0,02 0,30	0,01 0,24	
21,00	75,60	R v	0,03 0,40	0,02 0,32	0,01 0,25	0,00 0,20
22,00	79,20	R v	0,03 0,42	0,02 0,33	0,01 0,26	0,01 0,21
23,00	82,80	R v	0,04 0,44	0,02 0,35	0,01 0,27	0,01 0,22
24,00	86,40	R v	0,04 0,46	0,02 0,36	0,01 0,29	0,01 0,23
25,00	90,00	R v	0,04 0,48	0,02 0,38	0,01 0,30	0,01 0,23
26,00	93,60	R v	0,05 0,50	0,03 0,39	0,01 0,31	0,01 0,24
27,00	97,20	R v	0,05 0,52	0,03 0,41	0,01 0,32	0,01 0,25
28,00	100,80	R v	0,05 0,54	0,03 0,42	0,02 0,33	0,01 0,26
29,00	104,40	R v	0,06 0,56	0,03 0,44	0,02 0,34	0,01 0,27
30,00	108,00	R v	0,06 0,57	0,03 0,45	0,02 0,36	0,01 0,28

		Dimension	315 mm	355 mm	400 mm	450 mm
		Wall thick-ness	28.6 mm	32.2 mm	36.3 mm	40.9 mm
l/s	m³/h					
32,00	115,20	R in mbar/m	0,07	0,04	0,02	0,01
		v in m/s	0,61	0,48	0,38	0,30
34,00	122,40	R	0,08	0,04	0,02	0,01
		v	0,65	0,51	0,40	0,32
36,00	129,60	R	0,09	0,05	0,03	0,01
		v	0,69	0,54	0,43	0,34
38,00	136,80	R	0,10	0,05	0,03	0,02
		v	0,73	0,57	0,45	0,36
40,00	144,00	R	0,11	0,06	0,03	0,02
		v	0,77	0,60	0,48	0,38
42,00	151,20	R	0,12	0,07	0,04	0,02
		v	0,80	0,63	0,50	0,39
44,00	158,40	R	0,13	0,07	0,04	0,02
		v	0,84	0,66	0,52	0,41
46,00	165,60	R	0,14	0,08	0,04	0,02
		v	0,88	0,69	0,55	0,43
48,00	172,80	R	0,16	0,08	0,05	0,03
		v	0,92	0,72	0,57	0,45
50,00	180,00	R	0,17	0,09	0,05	0,03
		v	0,96	0,75	0,59	0,47
52,00	187,20	R	0,18	0,10	0,05	0,03
		v	1,00	0,78	0,62	0,49
54,00	194,40	R	0,20	0,11	0,06	0,03
		v	1,03	0,81	0,64	0,51
56,00	201,60	R	0,21	0,12	0,06	0,03
		v	1,07	0,84	0,67	0,53
58,00	208,80	R	0,23	0,12	0,07	0,04
		v	1,11	0,87	0,69	0,54
60,00	216,00	R	0,25	0,13	0,07	0,04
		v	1,15	0,90	0,71	0,56
62,00	223,20	R	0,26	0,14	0,08	0,04
		v	1,19	0,93	0,74	0,58
64,00	230,40	R	0,28	0,15	0,08	0,04
		v	1,23	0,96	0,76	0,60
66,00	237,60	R	0,30	0,16	0,09	0,05
		v	1,26	1,00	0,78	0,62
68,00	244,80	R	0,31	0,17	0,09	0,05
		v	1,30	1,03	0,81	0,64
70,00	252,00	R	0,33	0,18	0,10	0,05
		v	1,34	1,06	0,83	0,66
75,00	270,00	R	0,38	0,21	0,11	0,06
		v	1,44	1,13	0,89	0,70
80,00	288,00	R	0,43	0,23	0,13	0,07
		v	1,53	1,21	0,95	0,75
85,00	306,00	R	0,49	0,26	0,14	0,08
		v	1,63	1,28	1,01	0,80
90,00	324,00	R	0,55	0,30	0,16	0,09
		v	1,72	1,36	1,07	0,85
95,00	342,00	R	0,61	0,33	0,18	0,10
		v	1,82	1,43	1,13	0,89
100,00	360,00	R	0,68	0,37	0,20	0,11
		v	1,92	1,51	1,19	0,94
110,00	396,00	R	0,82	0,44	0,24	0,13
		v	2,11	1,66	1,31	1,03
120,00	432,00	R	0,98	0,53	0,28	0,16
		v	2,30	1,81	1,43	1,13
130,00	468,00	R	1,14	0,62	0,33	0,18
		v	2,49	1,96	1,54	1,22
140,00	504,00	R	1,33	0,72	0,39	0,21
		v	2,68	2,11	1,66	1,31
150,00	540,00	R	1,52	0,82	0,44	0,24
		v	2,87	2,26	1,78	1,41
160,00	576,00	R	1,73	0,93	0,50	0,28
		v	3,07	2,41	1,90	1,50
170,00	612,00	R	1,95	1,05	0,57	0,31
		v	3,26	2,56	2,02	1,60
180,00	648,00	R	2,19	1,18	0,64	0,35
		v	3,45	2,71	2,14	1,69
190,00	684,00	R	2,44	1,32	0,71	0,39
		v	3,64	2,86	2,26	1,78
200,00	720,00	R	2,70	1,46	0,79	0,43
		v	3,83	3,02	2,38	1,88
210,00	756,00	R	2,98	1,61	0,87	0,47
		v	4,02	3,17	2,49	1,97

		Dimension	315 mm	355 mm	400 mm	450 mm
		Wall thick-ness	28.6 mm	32.2 mm	36.3 mm	40.9 mm
l/s	m³/h					
220,00	792,00	R in mbar/m v in m/s	3,27 4,21	1,76 3,32	0,95 2,61	0,52 2,07
230,00	828,00	R v	3,57 4,41	1,93 3,47	1,04 2,73	0,57 2,16
240,00	864,00	R v	3,89 4,60	2,10 3,62	1,13 2,85	0,62 2,25
250,00	900,00	R v	4,22 4,79	2,27 3,77	1,23 2,97	0,67 2,35
260,00	936,00	R v	4,56 4,98	2,46 3,92	1,33 3,09	0,73 2,44
270,00	972,00	R v	4,92 5,17	2,65 4,07	1,43 3,21	0,78 2,54
280,00	1008,00	R v	5,29 5,36	2,85 4,22	1,54 3,33	0,84 2,63
290,00	1044,00	R v	5,68 5,56	3,06 4,37	1,65 3,44	0,90 2,72
300,00	1080,00	R v	6,08 5,75	3,27 4,52	1,77 3,56	0,97 2,82
310,00	1116,00	R v	6,49 5,94	3,49 4,67	1,89 3,68	1,03 2,91
320,00	1152,00	R v	6,91 6,13	3,72 4,82	2,01 3,80	1,10 3,01
330,00	1188,00	R v	7,35 6,32	3,96 4,98	2,14 3,92	1,17 3,10
340,00	1224,00	R v	7,80 6,51	4,20 5,13	2,27 4,04	1,24 3,19
350,00	1260,00	R v	8,27 6,71	4,45 5,28	2,41 4,16	1,31 3,29
360,00	1296,00	R v	8,75 6,90	4,71 5,43	2,55 4,28	1,39 3,38
370,00	1332,00	R v	9,24 7,09	4,98 5,58	2,69 4,39	1,47 3,47
380,00	1368,00	R v	9,74 7,28	5,25 5,73	2,84 4,51	1,55 3,57
390,00	1404,00	R v	10,26 7,47	5,53 5,88	2,99 4,63	1,63 3,66
400,00	1440,00	R v	10,79 7,66	5,82 6,03	3,14 4,75	1,71 3,76
410,00	1476,00	R v		6,11 6,18	3,30 4,87	1,80 3,85
420,00	1512,00	R v		6,41 6,33	3,46 4,99	1,89 3,94
430,00	1548,00	R v		6,72 6,48	3,63 5,11	1,98 4,04
440,00	1584,00	R v		7,04 6,63	3,80 5,23	2,07 4,13
450,00	1620,00	R v		7,36 6,78	3,98 5,35	2,17 4,23
460,00	1656,00	R v		7,69 6,94	4,15 5,46	2,27 4,32
470,00	1692,00	R v		8,03 7,09	4,34 5,58	2,37 4,41
480,00	1728,00	R v		8,37 7,24	4,52 5,70	2,47 4,51
490,00	1764,00	R v		8,72 7,39	4,71 5,82	2,57 4,60
500,00	1800,00	R v		9,08 7,54	4,91 5,94	2,68 4,70
510,00	1836,00	R v		9,45 7,69	5,11 6,06	2,79 4,79
520,00	1872,00	R v		9,82 7,84	5,31 6,18	2,90 4,88
530,00	1908,00	R v		10,20 7,99	5,51 6,30	3,01 4,98
540,00	1944,00	R v			5,72 6,41	3,12 5,07
550,00	1980,00	R v			5,94 6,53	3,24 5,17
600,00	2160,00	R v			7,06 7,13	3,85 5,63
650,00	2340,00	R v			8,29 7,72	4,52 6,10
700,00	2520,00	R v			9,61 8,31	5,24 6,57

		Dimension	315 mm	355 mm	400 mm	450 mm
		Wall thick-ness	28.6 mm	32.2 mm	36.3 mm	40.9 mm
l/s	m³/h					
750,00	2700,00				11,03 8,91	6,02 7,04
800,00	2880,00				12,55 9,50	6,85 7,51
850,00	3060,00				14,17 10,10	7,73 7,98
900,00	3240,00				15,89 10,69	8,66 8,45
950,00	3420,00					9,65 8,92
1000,00	3600,00					10,69 9,39

Pressure loss due to pipe resistance R and flow speed v depending on flow V

SDR 17.6/125–500 mm

Temperature 20 °C Roughness: 0.007 mm Density: 998.29 kg/m³ Kin. viscosity: 1.004E-06 m²/s

		Dimension	125 mm	160 mm	200 mm	250 mm	315 mm	355 mm	400 mm	450 mm	500 mm
		Wall thick-ness	7.1 mm	9.1 mm	11.4 mm	14.2 mm	17.9 mm	20.1 mm	22.7 mm	25.5 mm	28.4 mm
l/s	m³/h										
0,50	1,80	R v	0,00 0,05								
0,60	2,16	R v	0,01 0,06								
0,70	2,52	R v	0,01 0,07								
0,80	2,88	R v	0,01 0,08								
0,90	3,24	R v	0,01 0,09	0,00 0,06							
1,00	3,60	R v	0,01 0,10	0,00 0,06							
1,10	3,96	R v	0,02 0,11	0,01 0,07							
1,20	4,32	R v	0,02 0,12	0,01 0,08							
1,30	4,68	R v	0,02 0,13	0,01 0,08							
1,40	5,04	R v	0,03 0,15	0,01 0,09							
1,60	5,76	R v	0,03 0,17	0,01 0,10	0,00 0,06						
1,80	6,48	R v	0,04 0,19	0,01 0,11	0,00 0,07						
2,00	7,20	R v	0,05 0,21	0,01 0,13	0,01 0,08						
2,20	7,92	R v	0,06 0,23	0,02 0,14	0,01 0,09						
2,40	8,64	R v	0,07 0,25	0,02 0,15	0,01 0,10						
2,60	9,36	R v	0,08 0,27	0,02 0,16	0,01 0,11	0,00 0,07					
2,80	10,08	R v	0,09 0,29	0,03 0,18	0,01 0,11	0,00 0,07					
3,00	10,80	R v	0,10 0,31	0,03 0,19	0,01 0,12	0,00 0,08					
3,50	12,60	R v	0,13 0,36	0,04 0,22	0,01 0,14	0,00 0,09					
4,00	14,40	R v	0,16 0,41	0,05 0,25	0,02 0,16	0,01 0,10					
4,50	16,20	R v	0,20 0,47	0,06 0,28	0,02 0,18	0,01 0,12	0,00 0,07				
5,00	18,00	R v	0,24 0,52	0,07 0,32	0,03 0,20	0,01 0,13	0,00 0,08				
5,50	19,80	R v	0,28 0,57	0,09 0,35	0,03 0,22	0,01 0,14	0,00 0,09				

		Dimension	125 mm	160 mm	200 mm	250 mm	315 mm	355 mm	400 mm	450 mm	500 mm
		Wall thick-ness	7.1 mm	9.1 mm	11.4 mm	14.2 mm	17.9 mm	20.1 mm	22.7 mm	25.5 mm	28.4 mm
l/s	m³/h										
6,00	21,60	R	0,33	0,10	0,03	0,01	0,00				
		v	0,62	0,38	0,24	0,16	0,10				
6,50	23,40	R	0,38	0,12	0,04	0,01	0,00				
		v	0,67	0,41	0,26	0,17	0,11				
7,00	25,20	R	0,43	0,13	0,05	0,02	0,01				
		v	0,73	0,44	0,28	0,18	0,11				
7,50	27,00	R	0,49	0,15	0,05	0,02	0,01	0,00			
		v	0,78	0,47	0,30	0,19	0,12	0,10			
8,00	28,80	R	0,55	0,17	0,06	0,02	0,01	0,00			
		v	0,83	0,51	0,32	0,21	0,13	0,10			
8,50	30,60	R	0,61	0,19	0,06	0,02	0,01	0,00			
		v	0,88	0,54	0,34	0,22	0,14	0,11			
9,00	32,40	R	0,68	0,21	0,07	0,02	0,01	0,00			
		v	0,93	0,57	0,36	0,23	0,15	0,12			
9,50	34,20	R	0,75	0,23	0,08	0,03	0,01	0,01			
		v	0,99	0,60	0,39	0,25	0,16	0,12			
10,00	36,00	R	0,82	0,25	0,09	0,03	0,01	0,01			
		v	1,04	0,63	0,41	0,26	0,16	0,13			
10,50	37,80	R	0,90	0,27	0,09	0,03	0,01	0,01	0,00		
		v	1,09	0,66	0,43	0,27	0,17	0,13	0,11		
11,00	39,60	R	0,97	0,30	0,10	0,03	0,01	0,01	0,00		
		v	1,14	0,70	0,45	0,29	0,18	0,14	0,11		
11,50	41,40	R	1,06	0,32	0,11	0,04	0,01	0,01	0,00		
		v	1,19	0,73	0,47	0,30	0,19	0,15	0,12		
12,00	43,20	R	1,14	0,35	0,12	0,04	0,01	0,01	0,00		
		v	1,24	0,76	0,49	0,31	0,20	0,15	0,12		
12,50	45,00	R	1,23	0,37	0,13	0,04	0,01	0,01	0,00		
		v	1,30	0,79	0,51	0,32	0,20	0,16	0,13		
13,00	46,80	R	1,32	0,40	0,14	0,05	0,02	0,01	0,00		
		v	1,35	0,82	0,53	0,34	0,21	0,17	0,13		
13,50	48,60	R	1,41	0,43	0,15	0,05	0,02	0,01	0,01		
		v	1,40	0,85	0,55	0,35	0,22	0,17	0,14		
14,00	50,40	R	1,51	0,46	0,16	0,05	0,02	0,01	0,01	0,00	
		v	1,45	0,89	0,57	0,36	0,23	0,18	0,14	0,11	
14,50	52,20	R	1,61	0,49	0,17	0,06	0,02	0,01	0,01	0,00	
		v	1,50	0,92	0,59	0,38	0,24	0,19	0,15	0,12	
15,00	54,00	R	1,71	0,52	0,18	0,06	0,02	0,01	0,01	0,00	
		v	1,56	0,95	0,61	0,39	0,25	0,19	0,15	0,12	
16,00	57,60	R	1,92	0,58	0,20	0,07	0,02	0,01	0,01	0,00	
		v	1,66	1,01	0,65	0,41	0,26	0,21	0,16	0,13	
17,00	61,20	R	2,15	0,65	0,22	0,08	0,03	0,01	0,01	0,00	
		v	1,76	1,08	0,69	0,44	0,28	0,22	0,17	0,14	
18,00	64,80	R	2,38	0,72	0,25	0,08	0,03	0,02	0,01	0,01	
		v	1,87	1,14	0,73	0,47	0,29	0,23	0,18	0,14	
19,00	68,40	R	2,63	0,79	0,27	0,09	0,03	0,02	0,01	0,01	
		v	1,97	1,20	0,77	0,49	0,31	0,24	0,19	0,15	
20,00	72,00	R	2,89	0,87	0,30	0,10	0,03	0,02	0,01	0,01	
		v	2,07	1,27	0,81	0,52	0,33	0,26	0,20	0,16	
21,00	75,60	R	3,16	0,95	0,32	0,11	0,04	0,02	0,01	0,01	
		v	2,18	1,33	0,85	0,54	0,34	0,27	0,21	0,17	
22,00	79,20	R	3,44	1,04	0,35	0,12	0,04	0,02	0,01	0,01	0,00
		v	2,28	1,39	0,89	0,57	0,36	0,28	0,22	0,18	0,14
23,00	82,80	R	3,73	1,12	0,38	0,13	0,04	0,02	0,01	0,01	0,00
		v	2,39	1,46	0,93	0,60	0,38	0,30	0,23	0,18	0,15
24,00	86,40	R	4,04	1,21	0,41	0,14	0,05	0,03	0,01	0,01	0,01
		v	2,49	1,52	0,97	0,62	0,39	0,31	0,24	0,19	0,16
25,00	90,00	R	4,35	1,31	0,44	0,15	0,05	0,03	0,02	0,01	0,01
		v	2,59	1,58	1,01	0,65	0,41	0,32	0,25	0,20	0,16
26,00	93,60	R	4,68	1,40	0,48	0,16	0,05	0,03	0,02	0,01	0,01
		v	2,70	1,65	1,05	0,67	0,42	0,33	0,26	0,21	0,17
27,00	97,20	R	5,02	1,50	0,51	0,17	0,06	0,03	0,02	0,01	0,01
		v	2,80	1,71	1,09	0,70	0,44	0,35	0,27	0,22	0,18
28,00	100,80	R	5,37	1,61	0,55	0,19	0,06	0,03	0,02	0,01	0,01
		v	2,90	1,77	1,14	0,73	0,46	0,36	0,28	0,22	0,18
29,00	104,40	R	5,73	1,71	0,58	0,20	0,06	0,04	0,02	0,01	0,01
		v	3,01	1,84	1,18	0,75	0,47	0,37	0,29	0,23	0,19
30,00	108,00	R	6,10	1,82	0,62	0,21	0,07	0,04	0,02	0,01	0,01
		v	3,11	1,90	1,22	0,78	0,49	0,39	0,30	0,24	0,19
32,00	115,20	R	6,88	2,05	0,69	0,24	0,08	0,04	0,02	0,01	0,01
		v	3,32	2,03	1,30	0,83	0,52	0,41	0,32	0,26	0,21
34,00	122,40	R	7,70	2,30	0,78	0,26	0,09	0,05	0,03	0,02	0,01
		v	3,53	2,15	1,38	0,88	0,56	0,44	0,34	0,27	0,22
36,00	129,60	R	8,56	2,55	0,86	0,29	0,10	0,05	0,03	0,02	0,01
		v	3,73	2,28	1,46	0,93	0,59	0,46	0,36	0,29	0,23

		Dimension	125 mm	160 mm	200 mm	250 mm	315 mm	355 mm	400 mm	450 mm	500 mm
		Wall thick-ness	7.1 mm	9.1 mm	11.4 mm	14.2 mm	17.9 mm	20.1 mm	22.7 mm	25.5 mm	28.4 mm
l/s	m³/h										
38,00	136,80	R	9,47	2,82	0,95	0,32	0,11	0,06	0,03	0,02	0,01
		v	3,94	2,41	1,54	0,99	0,62	0,49	0,38	0,30	0,25
40,00	144,00	R	10,42	3,10	1,04	0,35	0,12	0,06	0,04	0,02	0,01
		v	4,15	2,53	1,62	1,04	0,65	0,51	0,41	0,32	0,26
42,00	151,20	R	11,42	3,39	1,14	0,39	0,13	0,07	0,04	0,02	0,01
		v	4,36	2,66	1,70	1,09	0,69	0,54	0,43	0,34	0,27
44,00	158,40	R	12,46	3,69	1,24	0,42	0,14	0,08	0,04	0,02	0,01
		v	4,56	2,79	1,78	1,14	0,72	0,57	0,45	0,35	0,29
46,00	165,60	R	13,54	4,01	1,35	0,45	0,15	0,08	0,05	0,03	0,02
		v	4,77	2,91	1,87	1,19	0,75	0,59	0,47	0,37	0,30
48,00	172,80	R	14,67	4,34	1,46	0,49	0,16	0,09	0,05	0,03	0,02
		v	4,98	3,04	1,95	1,24	0,78	0,62	0,49	0,38	0,31
50,00	180,00	R	15,84	4,68	1,57	0,53	0,17	0,10	0,05	0,03	0,02
		v	5,19	3,17	2,03	1,30	0,82	0,64	0,51	0,40	0,32
52,00	187,20	R	17,05	5,04	1,69	0,57	0,19	0,10	0,06	0,03	0,02
		v	5,39	3,29	2,11	1,35	0,85	0,67	0,53	0,42	0,34
54,00	194,40	R	18,31	5,40	1,81	0,61	0,20	0,11	0,06	0,04	0,02
		v	5,60	3,42	2,19	1,40	0,88	0,69	0,55	0,43	0,35
56,00	201,60	R	19,61	5,78	1,94	0,65	0,21	0,12	0,07	0,04	0,02
		v	5,81	3,55	2,27	1,45	0,91	0,72	0,57	0,45	0,36
58,00	208,80	R	20,95	6,17	2,07	0,69	0,23	0,13	0,07	0,04	0,02
		v	6,02	3,67	2,35	1,50	0,95	0,75	0,59	0,46	0,38
60,00	216,00	R	22,34	6,58	2,20	0,74	0,24	0,13	0,08	0,04	0,03
		v	6,22	3,80	2,43	1,56	0,98	0,77	0,61	0,48	0,39
62,00	223,20	R	23,77	6,99	2,34	0,78	0,26	0,14	0,08	0,05	0,03
		v	6,43	3,93	2,51	1,61	1,01	0,80	0,63	0,50	0,40
64,00	230,40	R	25,24	7,42	2,48	0,83	0,27	0,15	0,09	0,05	0,03
		v	6,64	4,05	2,60	1,66	1,05	0,82	0,65	0,51	0,41
66,00	237,60	R	26,75	7,86	2,62	0,88	0,29	0,16	0,09	0,05	0,03
		v	6,85	4,18	2,68	1,71	1,08	0,85	0,67	0,53	0,43
68,00	244,80	R	28,31	8,31	2,77	0,93	0,30	0,17	0,10	0,05	0,03
		v	7,05	4,31	2,76	1,76	1,11	0,87	0,69	0,54	0,44
70,00	252,00	R	29,91	8,78	2,93	0,98	0,32	0,18	0,10	0,06	0,03
		v	7,26	4,43	2,84	1,81	1,14	0,90	0,71	0,56	0,45
75,00	270,00	R	34,11	9,99	3,33	1,11	0,36	0,20	0,11	0,06	0,04
		v	7,78	4,75	3,04	1,94	1,23	0,96	0,76	0,60	0,49
80,00	288,00	R	38,57	11,28	3,75	1,25	0,41	0,23	0,13	0,07	0,04
		v	8,30	5,07	3,24	2,07	1,31	1,03	0,81	0,64	0,52
85,00	306,00	R	43,30	12,65	4,20	1,40	0,45	0,25	0,14	0,08	0,05
		v	8,82	5,38	3,45	2,20	1,39	1,09	0,86	0,68	0,55
90,00	324,00	R	48,30	14,09	4,67	1,56	0,50	0,28	0,16	0,09	0,05
		v	9,33	5,70	3,65	2,33	1,47	1,16	0,91	0,72	0,58
95,00	342,00	R	53,57	15,60	5,17	1,72	0,56	0,31	0,17	0,10	0,06
		v	9,85	6,02	3,85	2,46	1,55	1,22	0,96	0,76	0,62
100,00	360,00	R	59,10	17,20	5,69	1,89	0,61	0,34	0,19	0,11	0,07
		v	10,37	6,33	4,05	2,59	1,63	1,28	1,01	0,80	0,65
110,00	396,00	R		20,60	6,81	2,26	0,73	0,41	0,23	0,13	0,08
		v		6,97	4,46	2,85	1,80	1,41	1,11	0,88	0,71
120,00	432,00	R		24,31	8,02	2,66	0,86	0,48	0,27	0,15	0,09
		v		7,60	4,87	3,11	1,96	1,54	1,22	0,96	0,78
130,00	468,00	R		28,32	9,32	3,09	0,99	0,55	0,31	0,17	0,10
		v		8,23	5,27	3,37	2,12	1,67	1,32	1,04	0,84
140,00	504,00	R		32,63	10,72	3,54	1,14	0,63	0,35	0,20	0,12
		v		8,87	5,68	3,63	2,29	1,80	1,42	1,12	0,91
150,00	540,00	R		37,23	12,22	4,03	1,29	0,72	0,40	0,23	0,14
		v		9,50	6,08	3,89	2,45	1,93	1,52	1,20	0,97
160,00	576,00	R		42,14	13,81	4,55	1,46	0,81	0,45	0,26	0,15
		v		10,13	6,49	4,15	2,61	2,06	1,62	1,28	1,04
170,00	612,00	R		47,34	15,50	5,10	1,63	0,91	0,51	0,29	0,17
		v		10,76	6,89	4,41	2,78	2,18	1,72	1,36	1,10
180,00	648,00	R			17,28	5,68	1,82	1,01	0,56	0,32	0,19
		v			7,30	4,67	2,94	2,31	1,82	1,44	1,17
190,00	684,00	R			19,15	6,29	2,01	1,11	0,62	0,35	0,21
		v			7,70	4,93	3,10	2,44	1,92	1,52	1,23
200,00	720,00	R			21,12	6,93	2,21	1,23	0,68	0,38	0,23
		v			8,11	5,19	3,27	2,57	2,03	1,60	1,30
210,00	756,00	R			23,19	7,60	2,42	1,34	0,75	0,42	0,25
		v			8,52	5,44	3,43	2,70	2,13	1,68	1,36
220,00	792,00	R			25,35	8,30	2,64	1,46	0,82	0,46	0,27
		v			8,92	5,70	3,59	2,83	2,23	1,76	1,43
230,00	828,00	R			27,60	9,03	2,87	1,59	0,89	0,50	0,30
		v			9,33	5,96	3,76	2,96	2,33	1,84	1,49
240,00	864,00	R			29,95	9,79	3,11	1,72	0,96	0,54	0,32
		v			9,73	6,22	3,92	3,08	2,43	1,92	1,56

		Dimension	125 mm	160 mm	200 mm	250 mm	315 mm	355 mm	400 mm	450 mm	500 mm
		Wall thick-ness	7.1 mm	9.1 mm	11.4 mm	14.2 mm	17.9 mm	20.1 mm	22.7 mm	25.5 mm	28.4 mm
l/s	m³/h										
250,00	900,00	R			32,39	10,58	3,36	1,86	1,04	0,58	0,35
		v			10,14	6,48	4,08	3,21	2,53	2,00	1,62
260,00	936,00	R			34,92	11,40	3,62	2,00	1,11	0,62	0,37
		v			10,54	6,74	4,25	3,34	2,63	2,08	1,69
270,00	972,00	R			37,55	12,25	3,88	2,15	1,19	0,67	0,40
		v			10,95	7,00	4,41	3,47	2,73	2,16	1,75
280,00	1008,00	R				13,12	4,16	2,30	1,28	0,72	0,43
		v				7,26	4,57	3,60	2,84	2,24	1,81
290,00	1044,00	R				14,03	4,44	2,45	1,37	0,77	0,46
		v				7,52	4,74	3,73	2,94	2,32	1,88
300,00	1080,00	R				14,97	4,74	2,62	1,45	0,81	0,49
		v				7,78	4,90	3,85	3,04	2,40	1,94
310,00	1116,00	R				15,94	5,04	2,78	1,55	0,87	0,52
		v				8,04	5,06	3,98	3,14	2,48	2,01
320,00	1152,00	R				16,93	5,35	2,95	1,64	0,92	0,55
		v				8,30	5,23	4,11	3,24	2,56	2,07
330,00	1188,00	R				17,96	5,67	3,13	1,74	0,97	0,58
		v				8,56	5,39	4,24	3,34	2,64	2,14
340,00	1224,00	R				19,02	6,00	3,31	1,84	1,03	0,61
		v				8,82	5,55	4,37	3,44	2,72	2,20
350,00	1260,00	R				20,10	6,34	3,50	1,94	1,09	0,65
		v				9,07	5,72	4,50	3,54	2,80	2,27
360,00	1296,00	R				21,22	6,69	3,69	2,05	1,14	0,68
		v				9,33	5,88	4,63	3,65	2,88	2,33
370,00	1332,00	R				22,37	7,05	3,88	2,15	1,20	0,72
		v				9,59	6,04	4,75	3,75	2,96	2,40
380,00	1368,00	R				23,54	7,41	4,08	2,26	1,27	0,76
		v				9,85	6,21	4,88	3,85	3,04	2,46
390,00	1404,00	R				24,75	7,79	4,29	2,38	1,33	0,79
		v				10,11	6,37	5,01	3,95	3,12	2,53
400,00	1440,00	R				25,98	8,17	4,50	2,49	1,39	0,83
		v				10,37	6,53	5,14	4,05	3,20	2,59
410,00	1476,00	R				27,24	8,57	4,71	2,61	1,46	0,87
		v				10,63	6,70	5,27	4,15	3,28	2,66
420,00	1512,00	R				28,54	8,97	4,93	2,73	1,53	0,91
		v				10,89	6,86	5,40	4,25	3,36	2,72
430,00	1548,00	R					9,38	5,16	2,86	1,60	0,95
		v					7,02	5,52	4,35	3,44	2,79
440,00	1584,00	R					9,80	5,39	2,98	1,67	0,99
		v					7,19	5,65	4,46	3,52	2,85
450,00	1620,00	R					10,23	5,62	3,11	1,74	1,04
		v					7,35	5,78	4,56	3,60	2,92
460,00	1656,00	R					10,67	5,86	3,25	1,81	1,08
		v					7,51	5,91	4,66	3,68	2,98
470,00	1692,00	R					11,11	6,11	3,38	1,89	1,12
		v					7,68	6,04	4,76	3,76	3,05
480,00	1728,00	R					11,57	6,36	3,52	1,96	1,17
		v					7,84	6,17	4,86	3,84	3,11
490,00	1764,00	R					12,04	6,61	3,66	2,04	1,21
		v					8,00	6,30	4,96	3,92	3,18
500,00	1800,00	R					12,51	6,87	3,80	2,12	1,26
		v					8,17	6,42	5,06	4,00	3,24
510,00	1836,00	R					12,99	7,13	3,95	2,20	1,31
		v					8,33	6,55	5,16	4,08	3,31
520,00	1872,00	R					13,49	7,40	4,09	2,28	1,36
		v					8,49	6,68	5,27	4,16	3,37
530,00	1908,00	R					13,99	7,68	4,24	2,36	1,41
		v					8,66	6,81	5,37	4,24	3,44
540,00	1944,00	R					14,50	7,95	4,40	2,45	1,46
		v					8,82	6,94	5,47	4,32	3,50
550,00	1980,00	R					15,02	8,24	4,55	2,54	1,51
		v					8,98	7,07	5,57	4,40	3,57
560,00	2016,00	R					15,54	8,53	4,71	2,62	1,56
		v					9,15	7,19	5,67	4,48	3,63
570,00	2052,00	R					16,08	8,82	4,87	2,71	1,61
		v					9,31	7,32	5,77	4,56	3,69
580,00	2088,00	R					16,63	9,12	5,04	2,80	1,67
		v					9,47	7,45	5,87	4,64	3,76
590,00	2124,00	R					17,18	9,42	5,20	2,89	1,72
		v					9,64	7,58	5,97	4,72	3,82
600,00	2160,00	R					17,75	9,73	5,37	2,99	1,78
		v					9,80	7,71	6,08	4,80	3,89
610,00	2196,00	R					18,32	10,04	5,54	3,08	1,83
		v					9,96	7,84	6,18	4,88	3,95

		Dimension	125 mm	160 mm	200 mm	250 mm	315 mm	355 mm	400 mm	450 mm	500 mm
		Wall thick-ness	7.1 mm	9.1 mm	11.4 mm	14.2 mm	17.9 mm	20.1 mm	22.7 mm	25.5 mm	28.4 mm
l/s	m³/h										
620,00	2232,00	R					18,90	10,36	5,72	3,18	1,89
		v					10,13	7,97	6,28	4,96	4,02
630,00	2268,00	R					19,49	10,68	5,89	3,28	1,95
		v					10,29	8,09	6,38	5,04	4,08
640,00	2304,00	R					20,09	11,01	6,07	3,38	2,01
		v					10,45	8,22	6,48	5,12	4,15
650,00	2340,00	R					20,70	11,34	6,25	3,48	2,07
		v					10,62	8,35	6,58	5,20	4,21
660,00	2376,00	R					21,32	11,67	6,44	3,58	2,13
		v					10,78	8,48	6,68	5,28	4,28
670,00	2412,00	R					21,95	12,01	6,63	3,68	2,19
		v					10,94	8,61	6,78	5,36	4,34
680,00	2448,00	R						12,36	6,82	3,79	2,25
		v						8,74	6,89	5,44	4,41
690,00	2484,00	R						12,71	7,01	3,89	2,31
		v						8,87	6,99	5,52	4,47
700,00	2520,00	R						13,07	7,20	4,00	2,38
		v						8,99	7,09	5,60	4,54
710,00	2556,00	R						13,43	7,40	4,11	2,44
		v						9,12	7,19	5,68	4,60
720,00	2592,00	R						13,79	7,60	4,22	2,51
		v						9,25	7,29	5,76	4,67
730,00	2628,00	R						14,16	7,80	4,33	2,57
		v						9,38	7,39	5,84	4,73
740,00	2664,00	R						14,54	8,01	4,45	2,64
		v						9,51	7,49	5,92	4,80
750,00	2700,00	R						14,92	8,22	4,56	2,71
		v						9,64	7,59	6,00	4,86
760,00	2736,00	R						15,30	8,43	4,68	2,78
		v						9,76	7,70	6,08	4,93
770,00	2772,00	R						15,69	8,64	4,80	2,85
		v						9,89	7,80	6,16	4,99
780,00	2808,00	R						16,09	8,86	4,92	2,92
		v						10,02	7,90	6,24	5,06
790,00	2844,00	R						16,49	9,08	5,04	2,99
		v						10,15	8,00	6,32	5,12
800,00	2880,00	R						16,89	9,30	5,16	3,06
		v						10,28	8,10	6,40	5,19
850,00	3060,00	R						18,98	10,44	5,79	3,43
		v						10,92	8,61	6,80	5,51
860,00	3096,00	R						19,42	10,68	5,92	3,51
		v						11,05	8,71	6,88	5,57
870,00	3132,00	R							10,92	6,05	3,59
		v							8,81	6,96	5,64
880,00	3168,00	R							11,16	6,19	3,67
		v							8,91	7,04	5,70
890,00	3204,00	R							11,41	6,32	3,74
		v							9,01	7,12	5,77
900,00	3240,00	R							11,65	6,46	3,83
		v							9,11	7,20	5,83
950,00	3420,00	R							12,93	7,16	4,24
		v							9,62	7,60	6,16
1000,00	3600,00	R							14,27	7,90	4,67
		v							10,13	8,00	6,48
1050,00	3780,00	R							15,68	8,67	5,13
		v							10,63	8,40	6,81
1100,00	3960,00	R								9,48	5,61
		v								8,80	7,13
1150,00	4140,00	R								10,33	6,10
		v								9,20	7,45
1200,00	4320,00	R								11,21	6,62
		v								9,60	7,78
1250,00	4500,00	R								12,13	7,16
		v								10,00	8,10
1300,00	4680,00	R								13,08	7,72
		v								10,40	8,43
1400,00	5040,00	R									8,90
		v									9,07
1500,00	5400,00	R									10,16
		v									9,72
1600,00	5760,00	R									11,51
		v									10,37

6.1 Basic information

6.1.1 Socket welding using a heated tool

Before starting the work, make sure that the welding tools lie flat against the heated rod. Do not use pliers or other unsuitable tools for the assembly, to avoid damage to the coating of the welding tools.

The required welding temperature for processing the MECHANICAL installation system is 250–270 °C.

Warning:
- **Danger of burns from hot welding equipment**
- **The first welding should not be carried out until five minutes after the welding temperature has been reached!**

MECHANICAL welding equipment and welding tools must be protected against impurities. Burned-on particles can lead to faulty welding connections. Tools may be cleaned with non-fibrous, coarse paper towels. The welding tools must be kept dry at all times.

Damaged and soiled welding tools must be replaced, since only impeccable processing tools can ensure impeccable connections.

Connect the components during the welding process without twisting the parts. Minor corrections can only be made immediately after the parts are connected.

6.1.2 Guidelines

General work protection and accident prevention guidelines are to be observed when using welding equipment.

The Guidelines of the Industrial Trade Associations of the Chemical Industry for Machines for the Processing and Employment of Plastics, Chapter: Welding Machines and Equipment, apply.

For the handling of MECHANICAL welding equipment, machines and tools, the General Guidelines DVS 2208, Section 1 apply. In order to establish a connection between the MECHANICAL Gray fiber pipe and the fitted part, the welding tools used must correspond to the measurements as stipulated by procedure A.

In accordance with DVS Guidelines, control of the necessary application temperature using quick-display surface temperature thermometers is permissible.

6.2 Processing information for welding

Parameters for socket welding with a heated tool

Outer pipe diameter	Insertion depth	Heating period for SDR 11, SDR 7.4	Processing period (maximum period)	Cooling period	
				fixed	total
mm	mm	at 20°	s	s	min
20	14	5	4	6	2
25	15	7	4	10	2
32	16.5	8	6	10	4
40	18	12	6	20	4
50	20	18	6	20	4
63	24	24	8	30	6
75	26	30	8	30	6
90	29	40	8	40	6
110	32.5	50	10	50	8
125	35	60	10	60	8

Note: heating element temperature 250 to 270 °C

Instructions for socket welding can be found in DVS brochure no. 2207, Section 11, “Socket welding with a heated tool – welding of thermoplastic plastics and pipelines made of polypropylene (PP)”. MECHANICAL socket welding is performed according to these guidelines.
In this process, pipes and fittings are welded overlapping. The end of the pipes and fittings are heated using a welding device and are subsequently connected.

6.2.1 Socket welding with a hand-held welding device, from 20 mm

The following points should be observed:

1. The welding device should be equipped with the appropriate welding tools. Welding bushes and core rods have a Teflon coating. In order to avoid damaging the Teflon coating, never use pliers or similar tools for assembly. Please use a suitable hexagon socket wrench.

2. Switch on the welding device.

3. Using a thermometer or a temperature control pin, check welding temperature before starting to weld.

4. The ends of the pipes must be cut straight. Use appropriate pipe scissors or cutters. Pipe, fittings and welding tools must be clean.
   If necessary, clean them with a lint-free cloth.

5. Fitting and pipe must be inserted quickly and axially, without twisting, into the corresponding welding tools. The parts to be welded are then heated without pressure according to the table.

6. After the required heating time, fitting and pipe are to be removed quickly from the heating element and connected immediately by pushing together without twisting until insertion depth or markings have been reached. A double roll provides a visual guide to determine the correct welding (see DVS brochure 2207, Section 11).
   The line markings on the fittings and the pipe ensure the proper alignment of the pipes.

7. Pressure due to subsequent installation works must not be exerted upon the welded connection until after the end of the cooling period.

8. If necessary, clean the welding tools after each use.

6.2.2 Socket welding with a stationary welding machine, from 40 mm

6.2.2.1 Area of use

We recommend the use of a stationary welding machine for the welding of larger pipe diameters and for the pre-assembly of installation elements. The general guidelines provided by DVS brochure no. 2207, Section 11, "Socket welding with a heated tool. Detailed information on welding times." apply here.

6.2.2.2 Processing steps

1. Check the machine: Establish welding insertion depth by setting the dimension; make sure the welding temperature is reached.

2. Fix the moulded part with the clamp, taking care not to wind it too tightly, as this can lead to ovality, with a negative impact on the resulting weld. Make sure the moulded part is correctly positioned; use counter-tension to prevent the possibility of slipping.

3. Place the pipe loosely into the jaw chuck.

4. Adjust the dimension using the rotary button, which sets the precise welding insertion depth.

5. Push both tools together until they reach the stop.

6. Push the pipe as far as the fitting, then tighten. Make sure that the welding partners are accurately aligned. Open the welding tool.

7. Insert the welding device. Using the crank, gradually push the fitting and the pipe into the tool until the stop is reached. Pay attention to the welding time.

8. The welding period begins when the pipe and the fitting have been fitted together closely. Allow them to heat up without exerting any further pressure. Once the heating time has elapsed, move the tools apart, remove the welding device, and fit together the fitting and the pipe.

9. Observe the required cooling time.

6.2.3 Welding saddle for 40–250 mm

6.2.3.1 Area of use

- **Subsequent extension of existing pipe systems**
- **Alternative use instead of tees**
- **Direct branching of a service line to a supply line**
- **Simple assembly of sensor sleeves**

6.2.3.2 Processing steps

1. Before you start the work, prepare material and tools.
   Ensure that the welding saddle, the drill and the welding tool have the same diameters.

2. Uncover the pipe at the exact location where the welding saddle is supposed to be welded, and mark the welding area. Drain existing pipes and vent the pressure.

3. Prepare the welding device and the saddle welding tools for the polyfusion welding and heat to operating temperature (250-270 °C).

4. Drill through the marked pipe wall with the POLYMELT plastic drill and clear any cuttings from the drill hole.

5. The parts and areas to be welded must be clean and dry.

6. Push the welding plate into the hole in the wall of the pipe using a suitable and aligned saddle tool, until the tool reaches its stop position. At the same time the weld-in saddle must be pushed in, until the saddle surface reaches the camber of the tool.

7. The heating time for pipe and saddle is depending on the bead formation but at least 25 seconds. Please check our training guide.

8. Once the heating time has elapsed, remove the welding device, push the heated weld-in saddle straight into the heated hole as far as it will go without turning it, and hold the pipe in position for at least 20 seconds applying the necessary pressure.

9. After a cooling period of at least 10 minutes, the connection can withstand a full load.

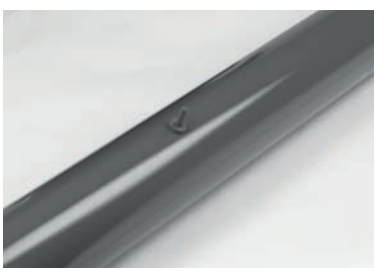
6.2.4 Repair plugs

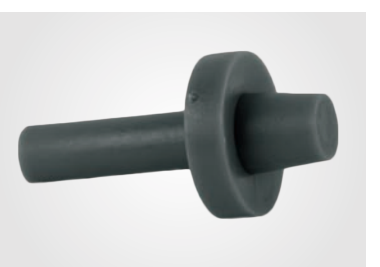
6.2.4.1 Area of use

- **the repair of damaged pipes up to hoile size of 8 mm pipes**

6.2.4.2 Processing steps

1. Drain pipes.
2. Uncover damaged pipe.
3. Drill damaged area of pipe out to a diameter of 8 mm at a right angle to the pipe.
4. Heat up drill hole and repair plug with MECHANICAL hole welding tool for 15 seconds.
5. Insert repair plug immediately.
6. Cut off protruding end of repair plug.
7. The repaired area of pipe has reached full strength after approx. 5 minutes.





6.2.5 Use of electric welding sockets

6.2.5.1 Area of use

- **Welding in constrained positions and in areas with restricted space**
- **Repair welding**
- **Alternative processing option for large pipe dimensions**

6.2.5.2 Preparation

1. General information and controls

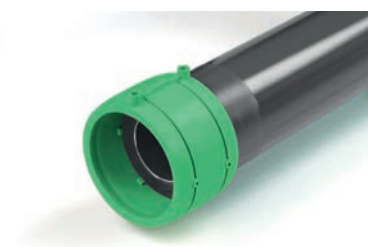
Cleanliness – besides the correct operation – is the most important requirement for achieving good welding results! For the sockets to stay thoroughly clean, they need to be left in the original packaging until they are used. Furthermore, the surface of the pipe must be clean and undamaged. Incorrectly collapsed pipe ends must be cut off. We recommend PP-cleaner or cloths with ethyl alcohol for cleaning.

The pipe elements to be welded as well as the electric socket and the welding equipment must show precisely the same temperature level within the permitted temperature range (i.e. +5 °C to 40 °C according to DVS 2207). (UV radiation or improper storage, to name two examples, can cause significant differences in temperature, which will result in faulty welding.)

2. Preparatory work

It is absolutely mandatory to maintain the order of the working steps!

1. Cut pipe ends at a right angle and burr them (control carved ends).
2. Remove any dirt from the pipe ends at the required length and dry them.
3. Mark the insertion depth of the electro-welded sockets at the pipe end.
4. Remove the oxide film with a pipe scraper on the pipe surface along the length of the insertion depth. Use the peeler intended for the respective diameter of the pipe.
5. Clean thoroughly using ethyl alcohol. A homogeneous and impermeable welded connection can only be established, if the surface in the welding range is peeled and cleaned comprehensively.



Do not touch peeled pipe ends again and protect them from new contamination – e.g. put a clean plastic bag over them. Weld within 30 minutes after the peeling process.

3. Assembly of the electric welding socket

1. Carefully clean the inner surface of the socket using lint-free cloth. Mount the socket within 30 minutes after opening the packaging.
2. Slide the electric welding socket onto the clean and dry pipe end until you reach the marked insertion depth.
3. Completely remove the protective foil and slide the peeled and clean second pipe end into the electric welding socket.

Contaminations are to be avoided diligently and all parts must be securely fastened. Pipes must be free of flexural strain or self-weight when they are inserted into the electric welding socket. The socket should still be able move on the pipe ends after the mounting process. The air gap must be evenly distributed around the circumference. A joint that is not free of tension or that has shifted can result in undesired molten mass or in an inadequate connection. The pipe ends and welded sockets must be dry when mounted.

4. Welding process

1. Position the socket so that the air gap is evenly distributed around the circumference.
2. Set the welding equipment to the diameter of the welding socket.
3. Compare the data on the welding equipment's display screen with the details on the label and enter the requested code by scanner or manual (see barcode label on the electric welding socket).
4. Start the welding process and monitor it closely.

The joint must not be moved or put under external pressure during the entire welding process, until it has completely cooled off!
Once the welded connection has been successfully established, two pins remain visible as an outward sign (see picture).

5. Cooling-off time and pressure test

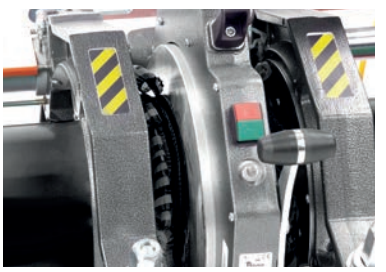
The welded pipe joint may only be put under pressure or moved, and the fastening may only be loosened once the cooling-off period has elapsed!
The minimum required cooling-off time is marked on the electric welding sockets. In case of ambient temperatures above 25 °C or when there is strong solar radiation, the cooling-off time must be extended accordingly!

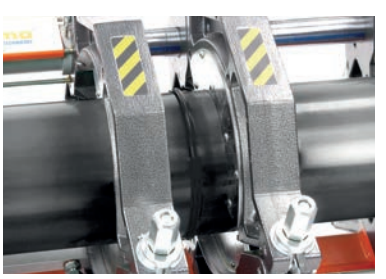
In order to achieve an ideal and stable welding result, both pipe ends must be plane-parallel within the electric welding socket! It is imperative to mark the socket insertion depth on the pipe, and to adhere to it!

Type of strain	Compression strain	Minimum waiting period
Tension, bending, torsion of unpressurised pipelines		20 minutes
Testing or working pressure of pressurised pipelines	up to 0.1 bar	20 minutes
	0.1 bar to 1 bar	60 minutes
	over 1 bar	120 minutes
Repetition of welding process		60 minutes

6.2.6 Butt welding process for 160 mm and above

Please also refer to the operating instructions for your welding equipment, which will provide the precise welding parameters.





6.2.6.1 Processing steps

1. Protect the workplace against the effects of weather and against contamination by dirt.
2. Heat up the welding machine and check for proper function.
3. Cut the pipes at a right angle to the required length.
4. Align the pipes and tighten the clamping elements.
5. Using a milling machine, plane the front of the pipes at a uniform level and evenly.
6. Remove shavings and clean the front side with ethyl alcohol.
7. Maintain pipe offset (at most 0.1 × wall thickness).
8. Combine the pipes and check for a seamless connection (maximum tolerance 0.5 mm).
9. Set the joining pressure (refer to relevant table in the operating instructions of the welding machine).
10. Check welding temperature (210 °C).
11. Examine cleanliness of heated element before every operation.
12. Initiate welding process by swivelling the heated element and press the pipes onto the heating element using joining pressure.
13. After reaching the bead height, the pressure is reduced. This is the start of the warm-up time, which brings the pipe ends to the required welding temperature.
14. Once the warm-up time has elapsed, remove the heated element swiftly, and combine the pipes using the necessary pressure.
15. The pipes are now welded and will cool down under pressure.
16. Do not release or remove the welded joint from the clamps until the stipulated cooling-off period has elapsed.

7.1 Fastening techniques

A pipe fastening system that complies with regulations is subject to the following requirements:

- **The fastening system must absorb any forces that may occur.**
- **The external impact upon pipes and fittings, caused e.g. by sagging, changes in length, mechanical load, must be prevented by applying appropriate fastening techniques.**
- **The pipework must be held firmly in the intended position.**

The fastening mechanism must be selected in accordance with the outside diameter of the pipe due to be fixed into position. Take appropriate measures to ensure that the pipe surface cannot be damaged by any of the pipe fastening elements.

Experience has shown that pipe clamps with rubber inserts represent the ideal fastening mechanism for POLYMELT installation systems. In the selection of suitable fastening materials, we generally differentiate between fixed bearings and slide or guide bearings.

7.1.1 Fixed bearings

- **Fixed points are determined to divide the pipe line into individual sections, which helps to avoid uncontrolled pipe movement.**
- **These fixed points need to be designed so as to compensate for the expansion forces arising from the pipe and possibly existing additional loads.**
- **Short distances in the ceiling should be chosen as the clamp and the fastening element need to be fastened tightly because of the forces that arise here.**

7.1.2 Slide bearings

- **They have to compensate for the axial pipe movement without causing any damage.**
- **When positioning the slide bearings, care must be taken that no fittings or fixtures obstruct the pipeline movement.**

7.2 Mounting distances

Tables for the determination of the distance between clamps, depending on temperature and outside diameter. The values specified are POLYMELT recommendations, and are valid for horizontal and vertical installations.

MECHANICAL Gray fiber pipes SDR 7.4, SDR 11

Dimension in mm	Media temperature [°C]						
	10	20	30	40	50	60	70
	Mounting distances [cm]						
20	110	95	90	85	85	80	70
25	120	105	105	95	95	90	80
32	140	120	120	110	110	105	95
40	160	140	135	125	125	120	110
50	185	155	155	145	145	135	130
63	200	175	175	165	165	155	145
75	215	190	190	175	175	165	155
90	230	210	210	195	195	180	180
110	250	220	220	210	200	200	190
125	250	240	225	215	195	185	170
160	280	270	245	235	205	195	180
200	285	275	250	240	210	205	185
250	290	280	255	245	215	200	190
315	300	290	270	260	230	220	200
355	310	300	290	270	250	240	220
400	320	310	300	280	260	250	230
450	330	320	310	300	280	270	250

With MECHANICAL Gray fiber pipes you need around 30 % less clamps compared to an installation with standard plastics without fibre reinforcement.

MECHANICAL Gray fiber pipes SDR 17.6

Dimension in mm	Media temperature [°C]						
	10	20	30	40	50	60	70
	Mounting distances [cm]						
125	200	190	180	170	160	150	140
160	220	215	200	190	170	160	150
200	230	220	210	200	170	170	160
250	240	230	220	200	180	170	160
315	240	240	220	210	190	180	160
355	250	240	230	220	200	190	170
400	260	250	240	230	210	200	190
450	270	260	250	240	230	220	200
500	280	270	260	250	240	230	220

Example:
MECHANICAL Gray fiber pipe 50 mm, medium temperature 10 °C
mounting distance = 1,85 m

MECHANICAL PP-RCT pipe

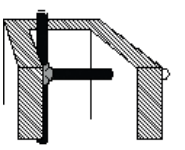
Standard plastic pipes 50 mm, medium temperature 10 °C
mounting distance = 1,2 m

Standard plastic pipe

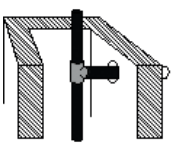
7.3 Laying the pipes

In the case of pipes laid in walls and ceilings, the friction forces that occur prevent the expansion of the pipes, and therefore no compensation is necessary. The resulting tension is absorbed by the pipe materials.

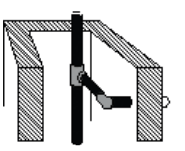
Due to the low expansion forces, the masonry or the plaster are not damaged.



Installing pipes in a shaft
- Changes in length can be disregarded if pipes are laid in a vertical shaft.
- It will be sufficient to mount a fixed-point clamp ahead of every branching; in a rising pipe, all clamps are fixed points.
- Rising pipes can be laid without expansion elbows.
- The distance between two fixed points must not be greater than 3 m.



Open laying of pipes
- Such pipes need to be laid using fixed and slide bearings. This will ensure sufficient space for the pipe to expand.
- If the line length equals or exceeds 40 m, expansion must be compensated for using bending legs and angles.



Concealed laying
- No precautions required.

7.4 Length variation

Changes in the length of pipes are dependent on the increasing temperature of the pipe material. This temperature change can be caused by different installation and operating temperatures, as well as varying media temperatures. The potential variation in length must be taken into account at the time of installation.

If the operating temperature is higher than the installation temperature, the pipe will elongate. If the media temperature (e.g. cold water) is lower than the installation temperature, the calculation will result in a reduction in length.

The following factors must be considered in the calculation of the variation in length:
- Installation temperature
- Operating temperatures (media temperatures)
- Temperature difference between installation and operating temperatures
- Coefficient of linear expansion
- Pipe length

The coefficient of linear expansion α are:

- MECHANICAL GRAY PP-RCT pipe $\alpha = 0.035$ mm/mK

The formula for the calculation of the variation in length is:

$\Delta L = \alpha \times l_0 \times \Delta T$		
ΔL	variation in length	mm
l_0	pipe length prior to temperature change	m
α	length variation coefficient	$\frac{mm}{m \times K}$
ΔT	maximum occurring temperature difference between installation and operating temperature	K

Example:
MECHANICAL Gray fiber pipe
Length = 10 m
Assembly temperature: 20 °C
Working temperature: 40 °C

Calculation:
$\Delta L = 0.035$ mm/mK × 10 m × 20 K
$\Delta L = 7.0$ mm

MECHANICAL Gray fiber pipe								
Pipe length in meters (m)	Difference in temperature ΔT (K)							
	10	20	30	40	50	60	70	80
1	0,4	0,8	1,1	1,5	1,9	2,3	2,7	3,0
2	0,8	1,5	2,3	3,0	3,8	4,6	5,3	6,1
3	1,1	2,3	3,4	4,6	5,7	6,8	8,0	9,1
4	1,5	3,0	4,6	6,1	7,6	9,1	10,6	12,2
5	1,9	3,8	5,7	7,6	9,5	11,4	13,3	15,2
6	2,3	4,6	6,8	9,1	11,4	13,7	16,0	18,2
7	2,7	5,3	8,0	10,6	13,3	16,0	18,6	21,3
8	3,0	6,1	9,1	12,2	15,2	18,2	21,3	24,3
9	3,4	6,8	10,3	13,7	17,1	20,5	23,9	27,4
10	3,8	7,6	11,4	15,2	19,0	22,8	26,6	30,4
15	5,7	11,4	17,1	22,8	28,5	34,2	39,9	45,6
20	7,6	15,2	22,8	30,4	38,0	45,6	53,2	60,8
25	9,5	19,0	28,5	38,0	47,5	57,0	66,5	76,0
30	11,4	22,8	34,2	45,6	57,0	68,4	79,8	91,2
35	13,3	26,6	39,9	53,2	66,5	79,8	93,1	106,4
40	15,2	30,4	45,6	60,8	76,0	91,2	106,4	121,6
45	17,1	34,2	51,3	68,4	85,5	102,6	119,7	136,8
50	19,0	38,0	57,0	76,0	95,0	114,0	133,0	152,0
	Linear expansion ΔL in mm							

7.5 Thermal expansion force

The following formula can be used to calculate the thermal expansion force:

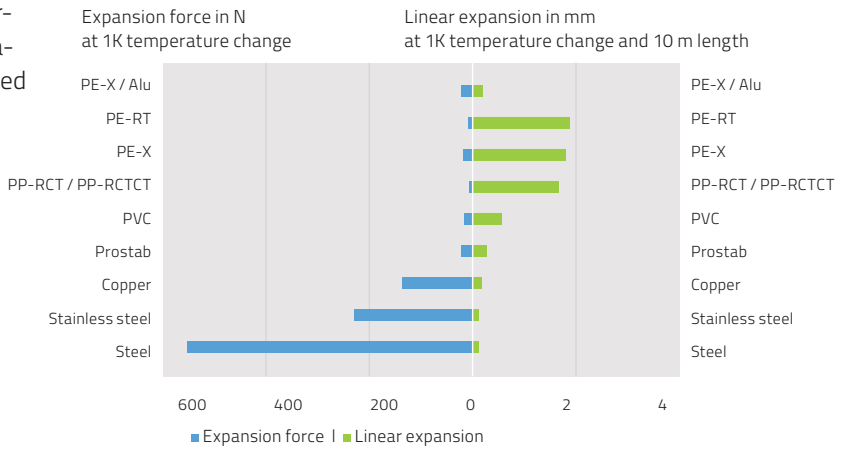
$$F_t = \frac{E \times A \times \alpha \times \Delta T}{1000}$$

F_t = thermal expansion force [N]
E = modulus of elasticity (modulus of rigidity) [MPa = N/mm²]
A = cross-sectional area of the pipe in [mm²]
α = specific thermal expansion coefficient [mm/(mK)]
ΔT = temperature difference resulting from media temperature minus laying temperature [K]

Material	Pipe dimension	Modulus of elasticity	Coefficient of linear expansion	Thermal expansion force
Steel	26,9 × 2,65	220.000	0,012	533
High-grade steel	22,0 × 1,2	200.000	0,015	235
Copper	22,0 × 1,0	130.000	0,016	137
Prostab	25,0 × 3,5	3.500	0,035	29
PVC	25,0 × 3,2	1.100	0,08	19
PP-RCT / PP RCT	25,0 × 4,2	900	0,150	12
PE-X	25,0 × 3,5	540	0,175	22
PE-RT	25,0 × 3,5	250	0,180	10
PE-X / Alu	26,0 × 3,0	3.500	0,030	22

This comparison shows that the thermal expansion forces occurring in plastic pipes are extremely low, compared to pipes made of metallic materials

If the thermal expansion force is countered by a corresponding retention force, the expansion can be neutralised effectively.



7.6 Expansion compensation

Variations in length caused by temperature differences must be taken into account during the planning stage to prevent subsequent damage to pipelines, fastening elements and the building structure. In order to keep the occurring stress impacts within acceptable ranges, the variation in length must be compensated appropriately. There are two options available to achieve this compensation:

- Expansion compensation using bending legs and a U-pipe bends (“natural” expansion compensation)
- Expansion compensation using compensators (“artificial” expansion compensation)

In most cases, directional changes in the pipe routeing can be utilised to absorb the variation in length. Should the directional changes not be sufficient, a U-pipe bend must be used.

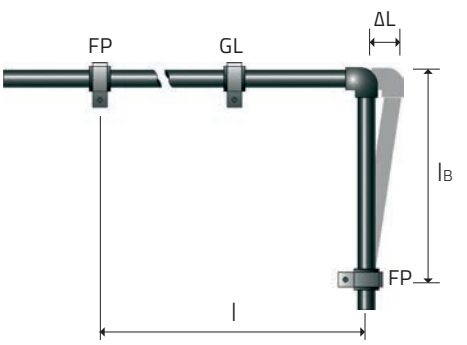
It is important to bear in mind that the outlets distributed throughout the line system can also influence the variation in length, or may be negatively affected themselves by the variation in length.

Please refer to the manufacturers of the compensators for more information on the expansion compensation provided by compensators.

7.6.1 Bending legs

In order to determine the specific direction in which the expansion compensation is steered, the directional change is installed between two fixed points. Generally, the pipes are arranged in right angles at the points where the direction changes. A variation in the length of one leg produces bending in the other leg. Provided that all legs are of a sufficient length to prevent the resulting flexural strain from becoming too great, the system can flexibly absorb the variation in length.

$l_B = K \times \sqrt{d \times \Delta L}$		
l_B	length of the bending leg	mm
K	material-dependent constant (15.0 for PP)	
d	outside pipe diameter	mm
ΔL	variation in length	mm



Sample calculation:
Pipe outside diameter 75 mm
Variation in length 84 mm

$l_B = 15 \times \sqrt{75\ mm\ 84\ mm}$
$l_B = 1191\ mm$

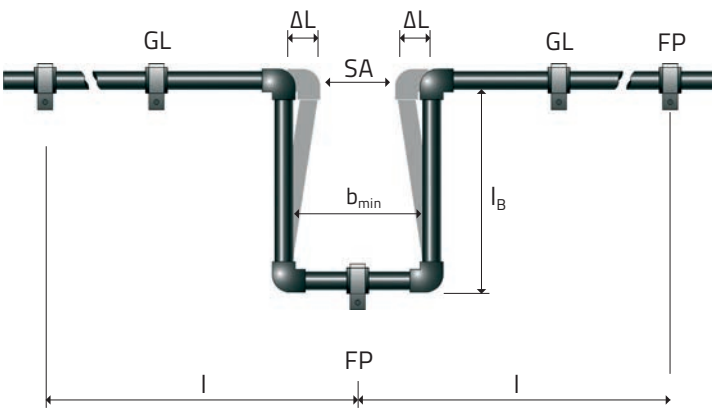
7.6.2 Expansion loop

If it is not possible to compensate for the variation in length by introducing directional changes into the pipe routeing, an expansion loop must be used instead.
For the implementation of the expansion bend, the length l_B of the bending leg and the width b_{min} of the expansion bend must be considered. It is advisable to position the expansion bend in such a way that the lengths l_1 and l_2 are equal.

$b_{min} = 2 \times \Delta L + SA$		
b_{min}	minimum width of the expansion	mm
ΔL	variation in length	mm
SA	safety clearance = 150	mm

Sample calculation:
Variation in length $\Delta L = 84$ mm

$b_{min} = 2 \times 84 \text{ mm} + 150 \text{ mm}$
$b_{min} = 318 \text{ mm}$



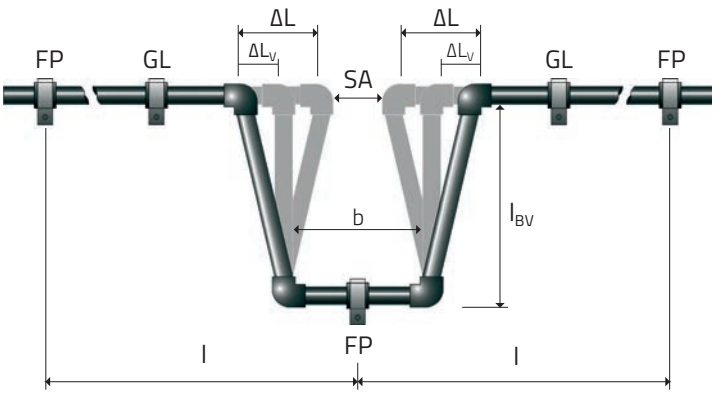
7.6.3 Pre-tensioning

If, during installation, an expansion loop is already pre-stretched by the length ΔL_V against the subsequent length variation and is thus "pre-tensioned", the length of the bending leg l_{BV} can be reduced.

$l_{BV} = l_B \times \sqrt{1 - \frac{\Delta L_V}{\Delta L}}$		
ΔL_V	variation in length with pre-tensioning	mm
ΔL	variation in length	mm
l_{BV}	length of bending leg with pre-tensioning	mm
l_B	length of bending leg	mm

Sample calculation:
Variation in length $\Delta L = 84$ mm
Pre-tensioning $\Delta L_V = 42$ mm

$l_{BV} = 1191 \text{ mm} \sqrt{\times 1 - \frac{42}{84}} \text{ mm}$
$l_{BV} = 842 \text{ mm}$



7.7 Insulation

The EnEV (German Energy Saving Regulation) standard regulates the thermal insulation of pipelines and fittings within the Federal Republic of Germany. The tasks of a pipe insulation are:

- Protect the pipes against condensation
- Protect the cold water pipes against exposure to heat
- Minimize heat losses
- Reduce the transfer of heat to structural components
- Reduce sound transmission
- Protect against UV radiation
- Absorb variations in length caused by temperature
- Protect against mechanical stresses
- Protect against corrosion

Requirements according to EnEV
Thermal insulation of heat distribution and hot water pipelines as well as fittings:

Line	Type of pipeline / valves and fittings	Minimum thickness of the insulation layer, based on a thermal conductivity of 0.035 W/(m k)
1	inner diameter up to 22 mm	20 mm
2	inner diameter above 22 mm up to 35 mm	30 mm
3	inner diameter above 35 mm up to 100 mm	equal to inner diameter
4	inner diameter above 100 mm	100 mm
5	pipes, valves and fittings acc. to lines 1 to 4 in wall and ceiling breaks, at the intersection of lines, at line connection points, at central mains system switches	½ of the requirements listed in lines 1 to 4
6	central heating pipes acc. to lines 1 to 4, that have been installed in buildings between heated rooms of various users since January 31, 2002	½ of the requirements listed in lines 1 to 4
7	pipes acc. to line 6 installed in floor constructions	6 mm
8	cold distribution and cold water pipes as well fittings for ventilation and cooling systems	6 mm

When using materials with thermal conductivity values other than 0.035 W/(m K), the minimum thickness values of the insulation layers must be converted accordingly. The calculation methods and values contained within accepted engineering standards must be employed for the conversion and the thermal conductivity of the insulation material.

In the case of heat distribution and hot water pipes, as well as cold distribution and cold water pipes, the minimum thickness values of the insulation layers listed in the table above may be reduced to the extent of the equivalent limitation of heat absorption or loss, and the insulating effect of the pipe walls must be taken into account.

MECHANICAL system: Thermal Insulation from heat and cool distribution, hot and cold water lines acc. to EnEV2009

Minimum thickness of the insulating layer related to a thermal conductivity of 0.035 W/mK

Pipe diameter	50 % acc. EnEV	100 % acc. EnEV
20 mm	10 mm	20 mm
25 mm	10 mm	20 mm
32 mm	15 mm	30 mm
40 mm	15 mm	30 mm
50 mm	20 mm	40 mm
63 mm	25 mm	50 mm
75 mm	30 mm	60 mm
90 mm	35 mm	70 mm
110 mm	45 mm	90 mm
125 mm	50 mm	100 mm
160 mm	50 mm	100 mm
200 mm	50 mm	100 mm
250 mm	50 mm	100 mm

7.7.1 Dew point

Condensation occurs when the temperature of a surface falls below the saturation temperature of the surrounding air.
The saturation temperature of the air is determined from the current temperature and the relative humidity. The temperature of the surface is determined by the heat transfer from the material to the pipe surface, from the air to the pipe surface, and the heat transfer through the pipe wall.

Data required in order to determine the dew point:

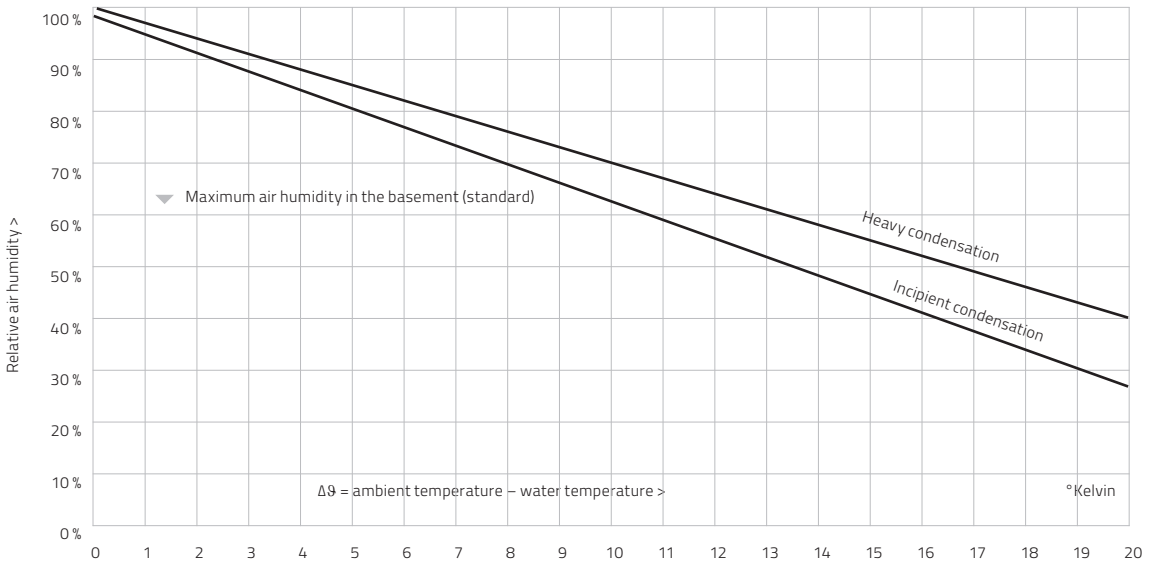
- **Relative air humidity**
- **Room temperature**
- **Water temperature**
- **Temperature difference $\Delta\vartheta$ in K (room temperature – water temperature)**

Sample calculation:

At a room temperature of 27 °C, 60 % relative humidity and 12 °C water temperature the pipe begins to sweat.

- **For SDR 11 pipes the maximum temperature difference is 11 K.**

Diagram for the determination of the dew point for MECHANICAL Gray fiber pipe SDR 11



7.8 Fire protection

The MECHANICAL pipe system is classified as follows:

Standard	Classification
EN 13501	E
DIN 4102	B2

EN 13501 and DIN 4102
These standards define the classification of those materials, which are used as products or as product components in building construction. The fire behaviour of the products used is tested and classified by testing the behaviour in the case of fire, e.g. the development and spread of fire and smoke.

The behaviour of PP-RCT in the case of fire
Pipes and fittings made of PP-RCT and with fibres, do not exhibit an increased conflagration gas toxicity.
In construction objects with a greater need for fire protection measures, pipe ducts through walls and ceilings must be protected against fire in such a way that, as a general principle, all pipe ducts have the same classification as the structural components through which the ducts lead.

For example: In the case of a wall, which features a fire resistance period of 90 minutes (F90), the pipe ducting must also have a fire resistance period of 90 minutes (R 90).

One possible solution is the fire protection measure using fire protection collars or special mineral insulation with a melting temperature of > 1,000 °C.

Fire load

The resulting combustion heat V(kWh/m) of MECHANICAL Gray fiber pipes is dependent on the pipe dimension. The basis for the calculation of the combustion heat V for MECHANICAL Gray fiber pipes made of PP-RCT is given by the lower calorific value Hu = 12.2 kWh/kg (acc. to DIN 18230 Section 1), as well as the material mass m (kg/m).

Combustion values V (kWh/m) of MECHANICAL Gray fiber pipes.

Outer diameter mm	SDR 7,4 kWh/m	SDR 11 kWh/m
20	1,82	-
25	2,88	-
32	-	3,18
40	-	5,03
50	-	7,78
63	-	12,32
75	-	17,20
90	-	24,77
110	-	36,72
125	-	47,70
160	-	77,84
200	-	121,93
250	-	189,10

8.1 Pressure tests

Upon completion of the installation work, water installations inside buildings must be subjected to hydraulic pressure testing. This must be carried out while the pipe system is fully accessible. In accordance with DIN EN 806, the test can be carried out using water or, if national regulations permit, with oil-free clean air at low pressure or inert gases.
The choice of method to be applied must take into account the factors relating to hygiene and corrosion, and must be determined in relation to the design of the system and the time schedule of the construction project.

In order to pressure test using water, the completed pipelines must be gradually filled with drinking water that does not contain particles ≥ 150 µm, and must then be vented. The drinking water system must be put into operation immediately after the pressure test with water and the subsequent flushing of the system. If this is not possible, the flushing process must be repeated regularly, with no more than 7 days between repetitions. If the system is due to be put into operation at a later stage, in the interest of hygiene, the pressure test should be conducted with air or inert gas as a testing medium.

Due to the characteristic properties of the materials used, plastic pipes expand for a limited period of time when they are subjected to pressure. This has an impact on the test result. A change in the temperature in a pipe system can lead to a change in pressure in the case of pipes made of plastic.
Consequently, pressure testing should follow the protocols provided below (page 61 and following).

Once the pressure tests have been completed, the responsible technician must produce a formal record, which includes an assessment of the test. The impermeability of the system must be evident, and must be confirmed in writing.

Pressure testing with water

DIN EN 806-4 stipulates that there are three possible pressure tests, depending on the different material properties. Due to issues concerning the practical feasibility on site, and following practical experiments, a modified method was selected, which is suitable for all materials and all material combinations.
The duration of the test was extended beyond the period stipulated in the standard, to ensure that even the smallest possible leaks can be detected during the leak test.

Pressure Testing Protocol – Water

Construction project: .....

Construction stage: .....

Client represented by:.....

Contractor represented by:.....

Admissible operating pressure = ... bar

Test pressure = ... bar (Corresponds to 1.1 times the system operating pressure)

Water temperature ..... °C Ambient temperature ..... °C

System inspection as ☐ complete system ☐ in ..... sections

Preliminary arrangements:
- ☐ The pipe system is made of PP-RCT
- ☐ The pipe system is made of PP-RCT and/or with combined installations made of metal and multi-layer composite pipelines.
- ☐ All pipes have been sealed with metal plugs, caps, blanking plates or blank flanges
- ☐ Equipment, pressure tanks or drinking water heaters have been disconnected from the system.
- ☐ A visual inspection ensuring the professional execution of all pipe connections has been carried out.
- ☐ Filling water has been filtered. Filter size < 150 µm
- ☐ The drinking water system has been filled, flushed and de-aerated.

Leak Test

1. Establish testing pressure ..... bar [1] (minimum 1.1 x admissible operating pressure)
2. In the case of large temperature differences (> 10 °) between ambient temperature and the filling water, a 30-minute waiting period must be observed after testing pressure has been reached in order to achieve temperature equalization.
3. Testing period: 30 minutes
4. Use visual inspection of all connections and pressure gauge to check for obvious leaks.
5. Reduce pressure to 0.5 of testing pressure (e.g. from 15 bar to 7.5 bar)
6. Additional testing period: 30 minutes
7. Assessment:
   No drop in pressure (= 0) occurred during this period.

- ☐ Visual inspection of pipe system has been carried out
- ☐ No leaks were determined during the testing period.
- ☐ The pipe system is leak-proof

Place ..... Date .....

Client ..... Contractor .....

1) The pressure gauges used must allow a precise reading of a 0.1 bar change in pressure.

9.1 Quality assurance

All incoming goods that are intended for use as raw and auxiliary materials for further processing, are checked for their suitability by POLYMELT quality assurance.

The manufacture of quality-controlled pipeline systems requires all necessary procedural steps:
- Monitoring
- Control
- Inspection

Furthermore, all results and procedures are documented.

The minimum requirements for independent company quality control are derived from the corresponding regulations for the quality control of sanitary pipeline systems, in that compliance must also include inspection by a neutral testing institution within the framework of external control.

External control, in addition to external testing of products, includes
- testing of the manufacturer's own required control measures
- examination of the technical equipment requirements
- hygienic and toxicological testing

External control of the POLYMELT pipe systems in Germany is conducted by the
- Süddeutsches Kunststoffzentrum (Southern German Plastics Centre) (SKZ)
- Hygiene Institut (Hygiene Institute of) Karlsruhe (TZW),

which are authorised as testing centres by DVGW (German Association of Gas and Water Facilities), among others.

External control of approvals for foreign usage is conducted in a similar manner.

The suitability of the POLYMELT pipe systems for drinking water has been established by the Technology Water Centre (TWZ) according to the "Guideline for Hygienic Assessment of Organic Materials in Contact with Drinking Water" (KTW Guideline) provided by the German Federal Environmental Agency, and is subject to permanent external control.

Summary of key points:
- The entire production process is defined, monitored, documented
- Quality management according to DIN EN ISO 9001
- Complies with all applicable standards, laws and regulations
- Monitoring by external institutes
- Certified system

QUALITY MANAGEMENT

Quality assurance

The entire production process for POLYMELT pipe systems and fittings is monitored and controlled by POLYMELT quality assurance. All results and procedures are documented. The monitoring is carried out by external institutes and by self-monitoring.

Self-monitoring

↓

Tasks

↓

- Comply with all applicable standards, laws and regulations
- Laboratory testing of pipes and fittings
- Inspection of incoming goods
- Quality assurance in production processes

External monitoring

↓

By authorised testing institutes of the DVGW:
- Süddeutsches Kunststoffzentrum (Southern German Plastics Centre) (SKZ)
- Technologiezentrum Wasser (Technology Centre Water) in Karlsruhe

↓

Tasks

↓

- Testing of the manufacturer's self-monitoring
- Product testing
- Examination of the technical equipment requirements
- Hygienic and toxicological testing acc. to KTW guidelines

POLYMELT organisation is certified in accordance with ISO 9001 and our MECHANICAL pipe system complies to EN ISO 15874, ASTM F2389, NSF14

Das Kunststoff-Zentrum

SKZ

Certificate

The SKZ - Cert GmbH certifies to the company

POLYMELT

Polymelt GmbH
Kirnachstraße 17
87640 Ebenhofen

the introduction and application of a management system according to
ISO 9001:2015

Scope:
Development, production and sales of plastic pipe systems and components.

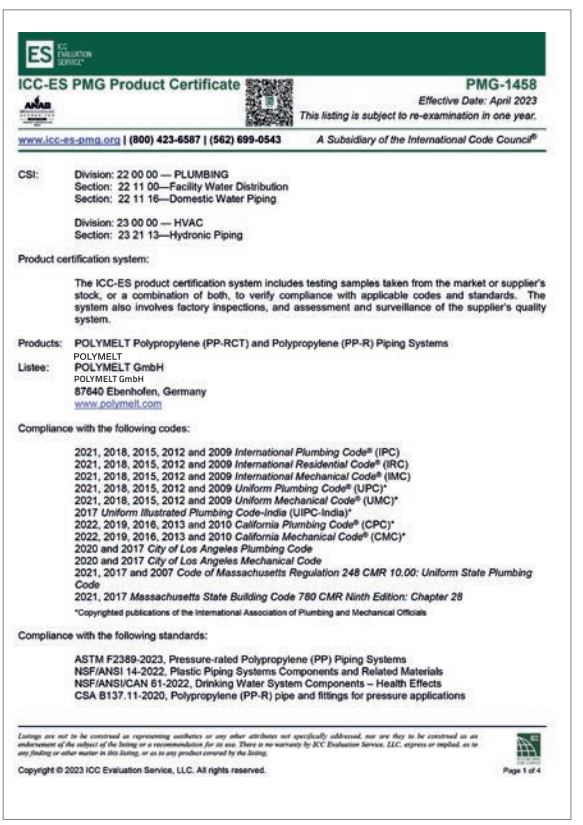
The proof has been furnished by an audit.

This certificate is valid from: **05.08.2024** to: **04.08.2027**
Certificate No.: **000878.Q/24.R**

Würzburg, 05.07.2024
Benjamin Kirchgeßner
Certification Body

DAkkS

SKZ - Cert GmbH
Friedrich-Bergius-Ring 22 · 97076 Würzburg · Tel. +49 931 4104-310 · cert@skz.de · www.skz.de



ICC-ES PMG Product Certificate

PMG-1458

Effective Date: April 2023

This listing is subject to re-examination in one year.

www.icc-es-pmg.org | (800) 423-6587 | (562) 699-0543 A Subsidiary of the International Code Council®

CSI: Division: 22 00 00 — PLUMBING
Section: 22 11 00—Facility Water Distribution
Section: 22 11 16—Domestic Water Piping

Division: 23 00 00 — HVAC
Section: 23 21 13—Hydronic Piping

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: POLYMELT Polypropylene (PP-RCT) and Polypropylene (PP-R) Piping Systems

Listee: POLYMELT
POLYMELT GmbH
POLYMELT GmbH
87640 Ebenhofen, Germany
www.polymelt.com

Compliance with the following codes:

2021, 2018, 2015, 2012 and 2009 *International Plumbing Code®* (IPC)
2021, 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)
2021, 2018, 2015, 2012 and 2009 *International Mechanical Code®* (IMC)
2021, 2018, 2015, 2012 and 2009 *Uniform Plumbing Code®* (UPC)*
2021, 2018, 2015, 2012 and 2009 *Uniform Mechanical Code®* (UMC)*
2017 *Uniform Illustrated Plumbing Code-India* (UIPC-India)*
2022, 2019, 2016, 2013 and 2010 *California Plumbing Code®* (CPC)*
2022, 2019, 2016, 2013 and 2010 *California Mechanical Code®* (CMC)*
2020 and 2017 *City of Los Angeles Plumbing Code*
2020 and 2017 *City of Los Angeles Mechanical Code*
2021, 2017 and 2007 *Code of Massachusetts Regulation 248 CMR 10.00: Uniform State Plumbing Code*
2021, 2017 *Massachusetts State Building Code 780 CMR Ninth Edition: Chapter 28*
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Compliance with the following standards:

ASTM F2389-2023, Pressure-rated Polypropylene (PP) Piping Systems
NSF/ANSI 14-2022, Plastic Piping Systems Components and Related Materials
NSF/ANSI/CAN 61-2022, Drinking Water System Components – Health Effects
CSA B137.11-2020, Polypropylene (PP-R) pipe and fittings for pressure applications

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9.2 Sustainability

In the development of its products and their production, POLYMELT places emphasis on the sustainable, environmentally friendly and resource-conserving implementation. The raw material polypropylene PP-RCT can be recycled to 100 %. Any residues from the production can be reused.

Thanks to this advantage it can be processed further for the industry in many different ways. Compared to other materials, the energy expenditure required for the production of POLYMELT products is significantly lower. Furthermore, the process does not produce any environmentally hazardous substances, leading to an excellent environmental performance evaluation overall.

Advantages PP-RCT:

- **Can be recycled**
- **Free of halogen**
- **Free of plasticisers**
- **Hygienically safe**
- **Environmentally friendly**

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