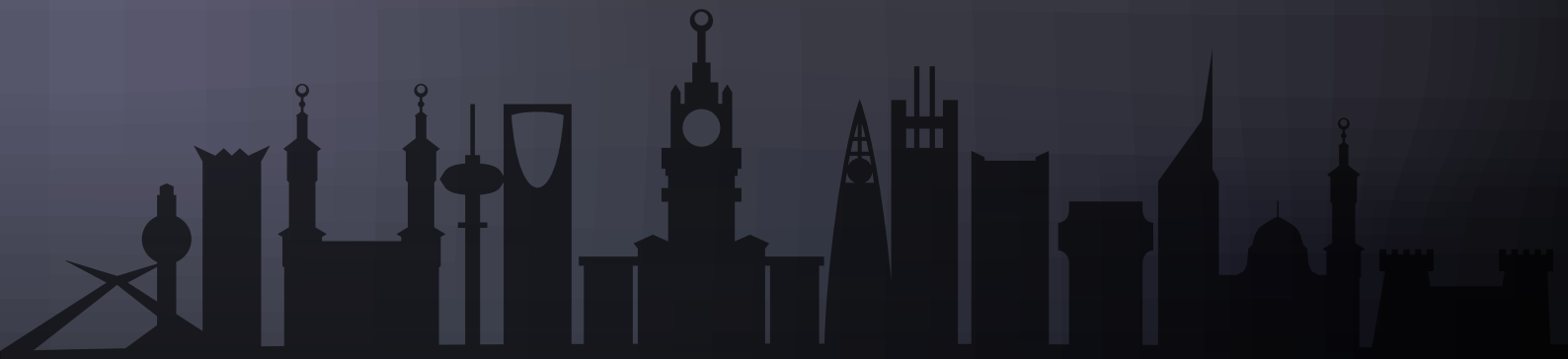
NO.1 PPR PIPES AND FITTINGS MANUFACTURER IN KSA

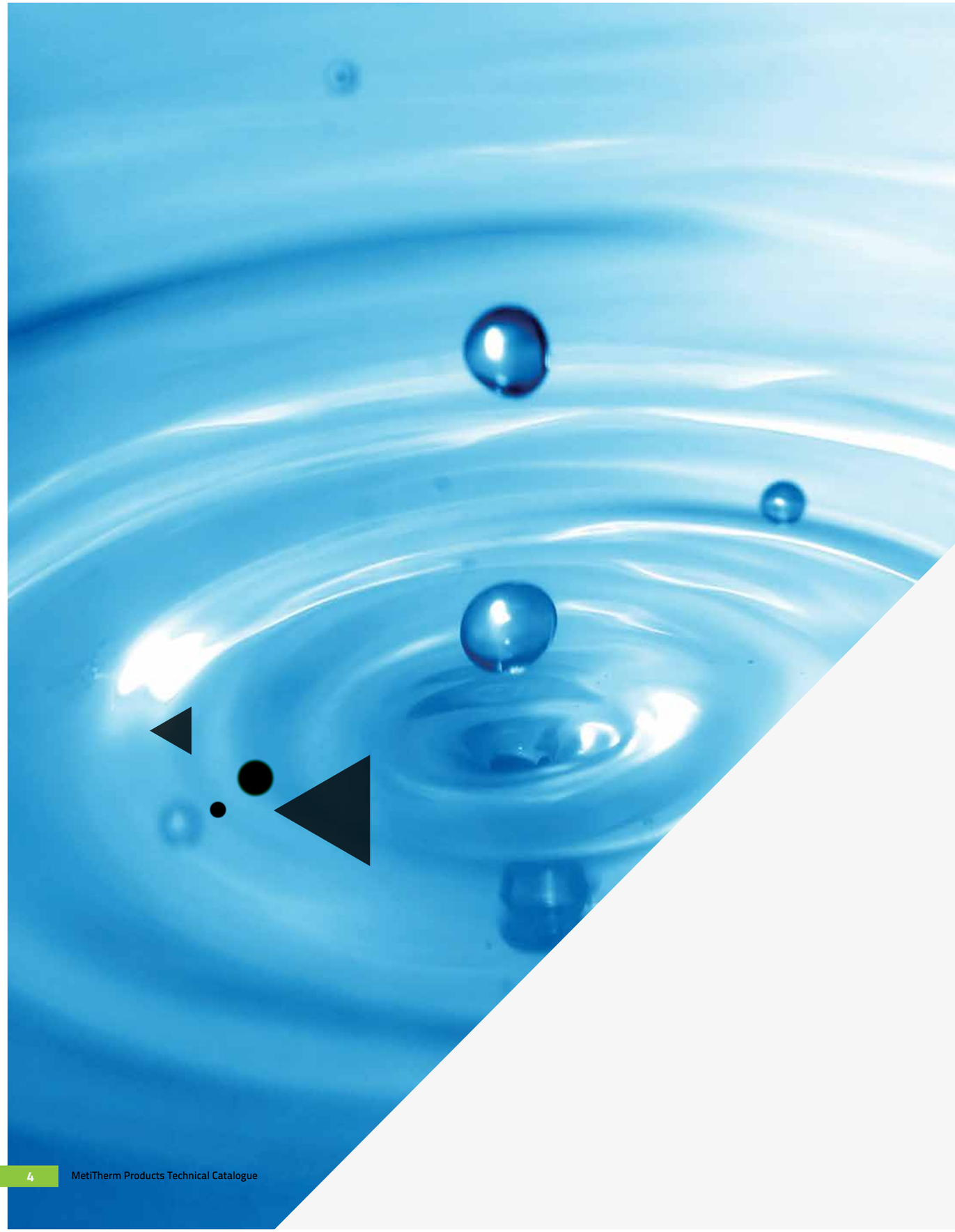


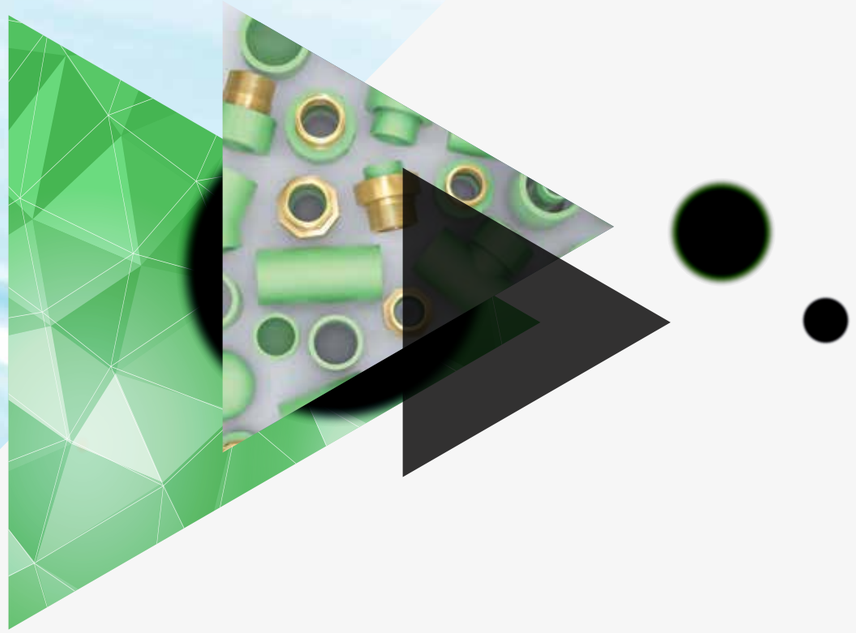
Metitherm
متي ثيرم
PPR PIPES AND FITTINGS

THE ULTIMATE QUALITY.

www.mmppf.com

CONTENT.





INTRODUCTION

MUNIR MUNIF GROUP

We, Munir Abdullah Al-Munif Factory for Plastic Pipes and Fittings Company, are specialized in producing all types of plastic pipes with all its accessories of fittings. Our company was established 30 years ago.

Al-Munif Factories are located in Riyadh where the solid and flexible polyethylene is being produced as high and low density at diameters starting from 10mm to 1600mm with different lengths and pressure ratings as one of the leading factories in the region in producing such big diameters.
Besides producing Polyethylene Pipes; we are also producing PP-R pipes and Fittings for hot water applications with capacity of about 2000 ton yearly with diameters starting from 20mm up to 160mm.

Moreover; we are also producing uPVC and cPVC pipes and fittings for Potable water, drainage and sewerage network, and electrical and telecommunication networks, in addition to GRP pipes and fittings and Rubber products.

Production censorship is done in our laboratories to be sure of specifications compatibility. Our Laboratories has been equipped with all types of necessary systems to do those compatibility tests.

The production capacity is estimated with about 42,000 ton per year which is marketed and sold inside and outside the Kingdom.

VISION

A Region of Healthy People and Productive Businesses Served by our Products. We are the GCC and MENA Regions Leading Most Reliable Manufacturer of Earth Friendly Innovative and High- Quality Products: (UPVC, CPVC Pipes, HDPE, GRP, PP-R and Different kinds of its Fittings: Drainage & Sewerage, High Pressure, CPVC, PE Fittings, Metitherm Fittings, Rubber Rings and Gaskets, GRP Manhole and GRP Tanks.. etc.)

MISSION

To bring life and Energy to the Middle East to be the Safe, Reliable and Earth-Friendly Means by Which Life and Energy is transported in the MENA and GCC region. We provide a Diversified Offering of the Highest Quality Products, at a Reasonable Cost using the most Innovative and Advanced Technologies.

Why PPR?

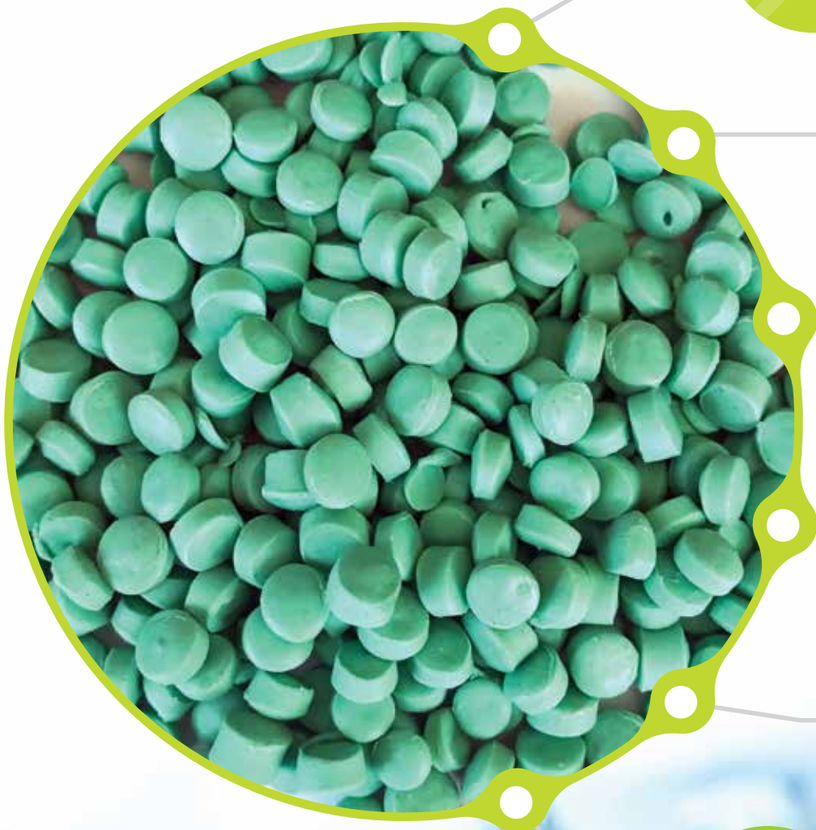
PP comes in three different types: Type 1, Type 2, and Type 3. They have different applications as they are of different specifications. MetiTherm Process Type 3 as it is of a superior quality for the applications meant.

What is the material?

The material is Polypropylene random copolymer usually written as PP-R of high molecular weight, which was developed specially as a material for hot water pipes. Polypropylene is one of the five thermoplastic materials together with Polyvinyl-Chloride, low density Polyethylene, high density Polyethylene, Polystyrene. PP-R has made its name in hot water systems and heating pipelines.

Why PP-R?

PP-R is a modified copolymer with greater resistance to impact. The lower crystalline structure prevents the forming of hair cracks in the internal surface of the pipe. Moreover, PP-R is not subjected to any restrictions for use with foodstuffs, so it may be used for applications involving edible substances. PP-R is characterized by its outstanding chemical resistance, high thermal resistance and good fatigue strength. PP-R is of high molecular weight and is stabilized to high temperature, it corresponds to KTW - recommendation of the German Board of Health.



DENSITY
≈0.895 G/CM3

MOLECULAR WEIGHT
500000

MFI 190/5
0.5 G/10 MIN

MELTING RANGE
140°C - 150°C

E - MODULE
800 N/MM²

COEFFICIENT OF LENGTH EXPANSION
1 .5 X 10^{-4} K^{-1}

The PPR

Propylene Random Copolymer

PPR types come in three different PP Type 1, type 2, type 3. They have different applications as they are of different specification **MetiTherm** Process Type 3 as it is of a superior quality for the applications meant.

Basic Materials

Plastics and its characteristics

Plastics is a class of substance which is hard and tough. Plastics belongs from the large family of polymers. The usage of plastics is widely accepted throughout the world because it is light in weight and has relatively higher strength than most metals and other materials. The use of plastics often reduces overall manufacturing as well as installation costs compared to other conventional materials.

Classification of plastics

Plastics are classified into two types. Thermoplastics and Thermosets.

Thermoplastics

What characterizes thermoplastics is that they get softened under heat and again get hardened when cooled. This process can be repeated several times without any appreciable loss in physical properties. Due to this reason, thermoplastics are not subjected to chemical change by heating.

Thermoplastics

- COMMODITY PLASTICS
- LDPE
- HDPE
- POLYPROPYLENE (PP)
- POLYSTYRENE.
- PVC
- ETC

- Engineering plastics (Performance plastics)
- Polystyrene Co-Acrylonitrile (SAN) Acrylonitrile
- Butadiene Styrene (ABS)
- Poly Methyl Methacrylate (PMMA)
- Polybutylene Terephthalate (PBT) Polyacetal
- Polycarbonate
- Poly Tetra Fluoro Ethylene (PTFE), etc.

Thermosetting Plastics.

This kind of plastics get softened by the application of heat and undergoes an internal change which makes them hard and resistant to any further application of heat.

Polypropylene (PP)

This type of thermoplastic has an increased crystallinity which is stabilized to higher temperature, from the polyolefin group. It has a higher melting point.

Polypropylene is in three different forms.

- Type 1 - Polypropylene homopolymer (PP-H)
- Type 2 - Polypropylene block polymer (PP-B)
- Type 3 - Polypropylene random copolymer (PP-R).

Polypropylene random copolymer (PP-R) - It is a modified copolymer with greater resistance to impact and lower crystallinity that prevents the forming of hair cracks in the internal surface of the pipe.

PP-R is not subjected to any restriction for use with food stuffs, and so it can be used for applications involving edible substances. Because of its outstanding chemical resistance, high residential applications.

The basic material used for the production of MetiTherm is Polypropylene Random Copolymer (PP-R).

Why PP-R is introduced for Potable Hot & Cold water systems?

The compound PP-R has gained major relevance in the world's market due to its remarkable properties of mechanical resistance, inertia to chemical aggression impact strength, corrosion resistance and higher working temperature . PP-R has the general properties of low density, good balance of stiffness to toughness low tendency to stress cracking and is easy to process and installation.

DENSITY
0.895g/cm^3

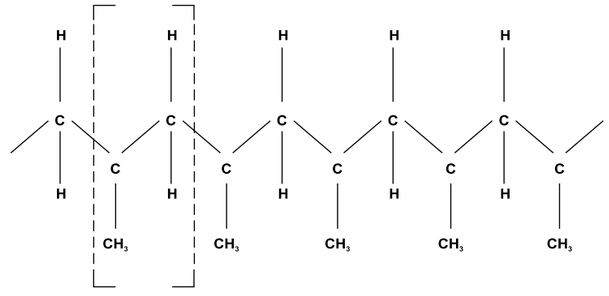
MOLECULAR WEIGHT
500000

MODULUS OF ELASTICITY
800N/ mm2

EXPANSION COEFFICIENT
0.15mm/mK

THERMAL CONDUCTIVITY
0.24W/mK at 20°C

PP-R is one of the thermoplastic materials obtained by the polymerization of ethylene and propylene.



12 REASONS TO CHOOSE METI

1 CORROSION RESISTANCE

MetiTherm pipes will withstand any level of water hardness and contact with chemicals having pH values between 1 and 14 i.e. They withstand acid and alkaline substances within a wide concentration and temperature spectrum. PP-R pipes will safely withstand contact with common building materials such as lime, cement and mortar without any special precautions.

2 EASY INSTALLATION

Polypropylene is light in weight, it also has a wide size range which allow trouble free, quick and a safe pipe laying. The advantages offered by this system are its high crushing resistance, high mechanical flexibility, easy transportation and handling. It is easy to repair, whereby insetions are easily installed.

3 MINIMIZING NOISE EMERGING FROM THE NETWORK

The polypropylene acts as an insulator and could expand to minimize noise and vibration created by the network as a result of accidental or continued water overflow in buildings.

4 KEEPING PRESSURE IN THE NETWORK

Due to smoothness of interior surface and lack of porosity, no accumulations are made in Interior surfaces thus ensuring the required pressure level thereof.

5 ENERGY SAVER

With the polypropylene pipes you could save energy by 15% compared to the applicable energy consumption rates.

6 STRAY CURRENT RESISTANCE

Polypropylene is a very poor electricity conductor, hence pipe puncturing due to stray currents will never occur.

7 ANTI-FREEZING

The polypropylene pipes are anti-freezing and thus, adaptable to the volume of items frozen within these pipes.

8 SAFE ON HEALTH

This material is conforming to the requirements and standards of the World Health Organization (WHO)

9 LOW HEAT LOSS

Like all plastic materials, PP- R is a poor electric conductor, which considerably reduces heat loss in hot water distribution systems and condensation on the outer surface.

10 EXCEEDT LIFE SPAN

50 + YEARS

This duration may exceed 50 years in case recommended temperatures and pressure are maintained.

11 FLEXIBILITY

They are flexible enough to sustain vibration and expected building's fall.

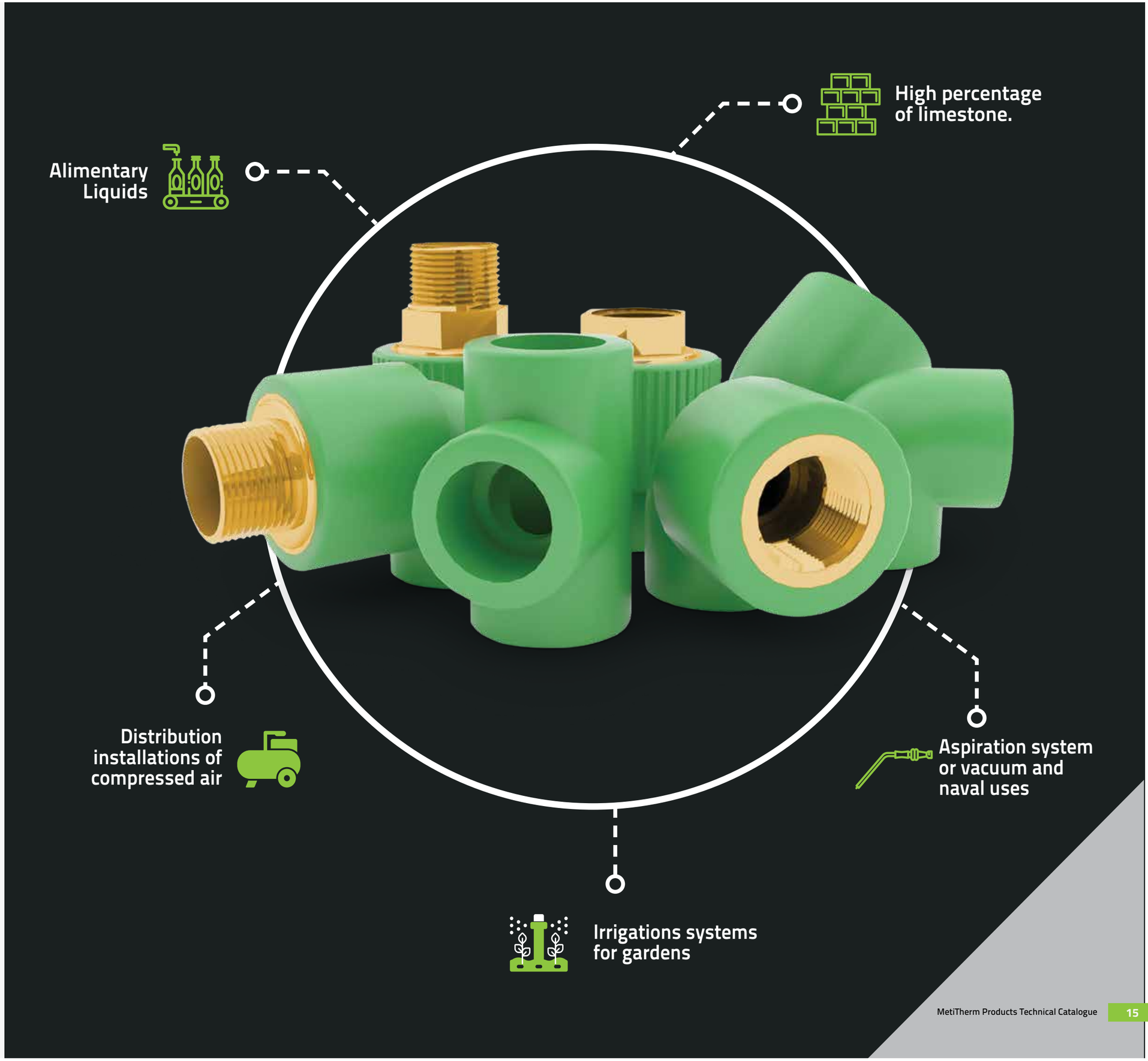
12 NO INCRUSTATION

Due to the spectacular smooth inside of the pipes.

METI SYSTEM

METI PIPES AND FITTINGS

Metitherm Pipes and Fittings are particularly suitable to carry out the distribution of hot and cold water for hydro-sanitary applications. Technical features of the rendered materials are the best solution for the execution of installations for potable water, even with high percentage of limestone, alimentary liquids, and irrigation systems for gardens, distribution installations of compressed air, aspiration systems or vacuum, and naval uses.



WHY METI

Choosing the right piping system is always the challenge while designing networks, as Quality, Safety and Reliability are the prime quests for any designer. What **MetiTherm** offers with its piping solutions are products made of environment friendly PP-R which has its unique physical and chemical properties. **MetiTherm** products stand as one of the safest means for potable water transfer. Its welding properties make it easy for quick installation by the end user in various applications. Hence, **MetiTherm** has been a primary consideration for present day piping solutions for its safety, service and reliability.

ADVANTAGES OF METITHERM PRODUCTS:

1. Environment:

MetiTherm's environment friendly materials contain no toxic wastes which would expose any hazard to the ecosystem we are living in. Polypropylene gives out no pollution when it is being produced or when disposed. **MetiTherm** exerts much care on the fact that its products or the production processes should not pollute our sensitive ecosystem.

- **Recycling**

MetiTherm products are 100% recyclable and can be ground and re-used. Recently, there has been an increasing demand for polypropylene recycling, as it could be recycled many times and used in various applications.

2. Hygienic Suitability:

In this modern era, health and safety have always been under a critical eye.Transfer of potable water has to be through a reliable network system, which ensures the delivered fluid would not be subject to influence by any interactions within the carrier.

- **Non-Toxic**

MetiTherm uses raw materials which are completely non-toxic for its production processes. **MetiTherm** maintains the up-to-date national and international regulations for complying with the same.

- **Smell and Taste Neutrality**

Since **MetiTherm** products do not interact with the fluids within its system, it gives no smell or taste difference to the transferred substance.

- **Opaqueness**

MetiTherm products,which are opaque, would prevent sun light penetration in its piping system and thus resisting bacterial and fungal growth.

- **Corrosion resistance**

Compared to the old metallic pipes, **MetiTherm** piping systems are corrosion free due to its material properties and thus, lesser exposed to contamination. Also, the joints are connected through a weld-fusion process which eliminates not only the chances of corrosion within the piping system, but also gives **MetiTherm** a longer service life. Moreover, the metal parts of the system are made of dezincification resistance brass, complying with WHO regulations.

3. Chemical resistance:

Polypropylene by nature is highly chemical resistant at a wide range of temperature and pressure. Due to its higher molecular weight, it resists most of the acids, lime and cement.

4. Mechanical Properties:

When it is designed to replace the conventional metal piping solutions, **MetiTherm** offers a better alternative to what has been offered in the past. The mechanical properties of **MetiTherm** products are,

- High Impact Resistance.
- Low Thermal conductivity.
- Resistance to current strays.
- High durability.
- Light Weight.

5. Sound Insulation:

In comparison to the metallic pipes, the sound insulation qualities of **MetiTherm** pipe system related to water flow and hydraulic shock within a building reduces the noise transmission to a larger scope. This is due to the elasticity of **MetiTherm** products which makes it more workable to absorb and reduce almost all vibrations which would appear in conventional piping systems.

6. Flow Performance:

- **Low Pressure Loss**

The inner surface finishing of **MetiTherm** products is sleek, smooth and with very low irregularities which conveys a significant reduction in pressure loss. Thus, limestone build up is prevented inside the pipe.

7. Ease of Installation:

One of the major attractions of **MetiTherm** products is its capability to be welded by fusion. **MetiTherm** pipes and fittings are comparatively lighter in weight to the metallic pipes, consequently this would require a shorter time to establish a permanent connection/ joint in the piping system.

8. Long Service Life:

MetiTherm piping systems are designed for a theoretical long service life of 50 years in application, subject to specific conditions. Though peak temperatures of 100 °C arising within the system for shorter period are harmless, permanent temperature from 70 °C up to 90 °C might marginally reduce the service life of the pipe.

STANDARDS

DIN 1988 Pipes for drinking water in buildings
- Technical standards for drinking water installations

DIN 4725 Underfloor heating with hot water
- Concepts
- Thermal testing
- Heat potential and design

DIN 4726 Plastic pipes for hot water underfloor heating, required Properties

DIN 4728 Polypropylene pipes for hot water underfloor heating, special

DIN 8076 Pressure pipes in thermoplastics
- Joining to metal fittings
- Screw joints for polyethylene pipes

DIN 8077 Polypropylene pipes: Dimensions

DIN 8078 Polypropylene pipes, Type 1, 2, & 3: general quality requirements and testing

DIN 16962 Pipe joints and their elements for Polypropylene pipes under pressure: Manufacture and test

DIN 16960 Welding of thermoplastic materials: principles

DIN 19560 Flame retardant pipes for sewage applications

DVS 2207 Welding thermoplastic materials, Polypropylene Type 1 & 2, pipes and pipe fittings

DVS 2208 Tools and equipment for welding thermoplastic materials, welding thermal elements

DVS 2203 Testing welded thermoplastic joints

FIELDS OF APPLICATION

The **Metitherm** System is commonly used in houses and large condominiums, hotels, hospitals, shopping malls, gyms, cruise and cargo ships for several different types of installation including:

- PLUMBING SYSTEM
- RISERS BRANCHING TO SANITY
- HEATING SYSTEM
- MAX TEMPERATURE 70°
- AIR CONDITIONING SYSTEMS
- SPA WATER SYSTEM
- WATER SUPPLY SYSTEM TO POOLS

THE SYSTEM IS ALSO USED IN INDUSTRIAL INSTALLATIONS:

IN GENERAL

- COMPRESSED AIR INSTALLATIONS
- THERMAL POWER PLANTS
- PLANT ENGINEERING IN GENERAL

Such extheme application veratitity is only possible thanks to the superior technology used in metitherm system.

WORKING PRESSURE

MetiTherm permissible working pressure for potable water installations fluid transported: water acc. to DIN 2000

Temperature	Service life	MetiTherm Pipe SDR 11		MetiTherm Pipe SDR 7,4		MetiTherm pipe SDR 6 / MetiTherm stabi composite pipe		MetiTherm faser composite pipe SDR 7.4	
		Permissible working pressure in bar and (psi)							
		bar	(psi)	bar	(psi)	bar	(psi)	bar	(psi)
20 °C	1	15,0	(218)	23,8	(345)	30,0	(435)	28,6	(415)
	5	14,1	(205)	22,3	(324)	28,1	(408)	26,8	(389)
	10	13,7	(199)	21,7	(315)	27,3	(396)	26,1	(379)
	25	13,3	(193)	21,1	(306)	26,5	(385)	25,3	(367)
	50	12,9	(187)	20,4	(296)	25,7	(373)	24,5	(356)
30 °C	1	12,8	(186)	20,2	(293)	25,5	(370)	24,3	(353)
	5	12,0	(174)	19,0	(276)	23,9	(347)	22,8	(331)
	10	11,6	(168)	18,3	(266)	23,1	(335)	22,0	(319)
	25	11,2	(163)	17,7	(257)	22,3	(324)	21,3	(309)
	50	10,9	(158)	17,3	(251)	21,8	(316)	20,7	(300)
40 °C	1	10,8	(157)	17,1	(248)	21,5	(312)	20,5	(298)
	5	10,1	(147)	16,0	(232)	20,2	(293)	19,2	(279)
	10	9,8	(142)	15,6	(226)	19,6	(284)	18,7	(271)
	25	9,4	(136)	15,0	(218)	18,8	(273)	18,0	(261)
	50	9,2	(134)	14,5	(210)	18,3	(266)	17,5	(254)
50 °C	1	9,2	(134)	14,5	(210)	18,3	(266)	17,5	(254)
	5	8,5	(123)	13,5	(196)	17,0	(247)	16,2	(235)
	10	8,2	(119)	13,1	(190)	16,5	(239)	15,7	(228)
	25	8,0	(116)	12,6	(183)	15,9	(231)	15,2	(221)
	50	7,7	(112)	12,2	(177)	15,4	(224)	14,7	(213)
60 °C	1	7,7	(112)	12,2	(177)	15,4	(224)	14,7	(213)
	5	7,2	(104)	11,4	(165)	14,3	(208)	13,7	(199)
	10	6,9	(100)	11,0	(160)	13,8	(200)	13,2	(192)
	25	6,7	(97)	10,5	(152)	13,3	(193)	12,6	(183)
	50	6,4	(93)	10,1	(147)	12,7	(184)	12,1	(176)
65 °C	1			11,6	(168)	14,6	(212)	13,9	(202)
	5			10,8	(157)	13,6	(197)	12,9	(187)
	10			10,4	(151)	13,1	(190)	12,5	(181)
	25			10,0	(145)	12,6	(183)	12,0	(174)
	50			8,8	(128)	11,1	(161)	10,6	(154)
70 °C	1			10,3	(149)	13,0	(189)	12,4	(180)
	5			9,5	(138)	11,9	(173)	11,4	(165)
	10			9,3	(135)	11,7	(170)	11,1	(161)
	25			8,0	(116)	10,1	(147)	9,6	(139)
	30			7,0	(102)	8,8	(128)	9,3	(135)
	50			6,7	(97)	8,5	(123)	8,1	(118)
75 °C	1			9,8	(142)	12,3	(179)	11,7	(170)
	5			9,0	(131)	11,4	(165)	10,8	(157)
	10			8,3	(120)	10,5	(152)	10,0	(145)
	25			6,7	(97)	8,4	(122)	8,0	(116)

Potable water (cold)

Potable water (warm)

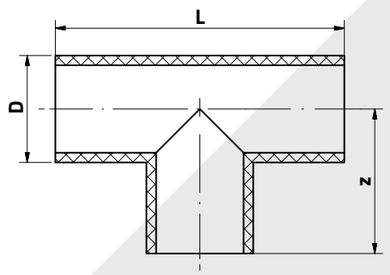
Faser and Stabi composite pipe: high working stress at lower wall thickness and higher flow rate

SDR = Standard Dimension Ratio
(diameter / wall thickness ratio)
SDR = 2 x S + 1 ≈ d / s (S = Pipe series index from ISO 4065)
* Only for non-potable water

Heating systems or closed systems

Heating period	Temperature	Service life	MetiTherm faser composite pipe SDR 7.4 / MetiTherm stabi composite pipe	
			Permissible working pressure in bar and (psi)	
			bar	(psi)
constant operating temperature 70 °C / 158 °F incl. 30 days per year at	75 °C	5	14,3	(208)
		10	13,8	(200)
		25	11,7	(170)
		45	10,2	(148)
	80 °C	5	13,5	(196)
		10	12,8	(186)
		25	11,1	(161)
		42,5	9,8	(142)
	85 °C	5	12,4	(180)
		10	11,9	(173)
		25	10,1	(147)
		37,5	9,2	(134)
	90 °C	5	11,4	(165)
		10	10,9	(158)
		25	8,9	(129)
		35	8,2	(119)
constant operating temperature 70 °C / 158 °F incl. 60 days per year at	75 °C	5	14,1	(205)
		10	13,6	(197)
		25	11,6	(168)
		45	10,1	(147)
	80 °C	5	13,1	(190)
		10	12,5	(181)
		25	10,6	(154)
		40	9,4	(136)
	85 °C	5	12,0	(174)
		10	11,5	(167)
		25	9,2	(134)
		35	8,5	(123)
	90 °C	5	11,0	(160)
		10	9,8	(142)
		25	7,8	(113)
		30	7,5	(109)
constant operating temperature 70 °C / 158 °F incl. 90 days per year at	75 °C	5	14,0	(203)
		10	13,4	(194)
		25	11,3	(164)
		45	9,8	(142)
	80 °C	5	12,9	(187)
		10	12,4	(180)
		25	10,1	(147)
		37,5	9,1	(132)
	85 °C	5	11,8	(171)
		10	10,7	(155)
		25	8,6	(125)
		32,5	8,0	(116)
	90 °C	5	10,6	(154)
		10	9,0	(131)
		25	7,2	(104)

SDR = Standard Dimension Ratio
(diameter /wall thickness ratio)
SDR = 2 x S + 1 ≈ d / s (S = Pipe series index from ISO 4065)

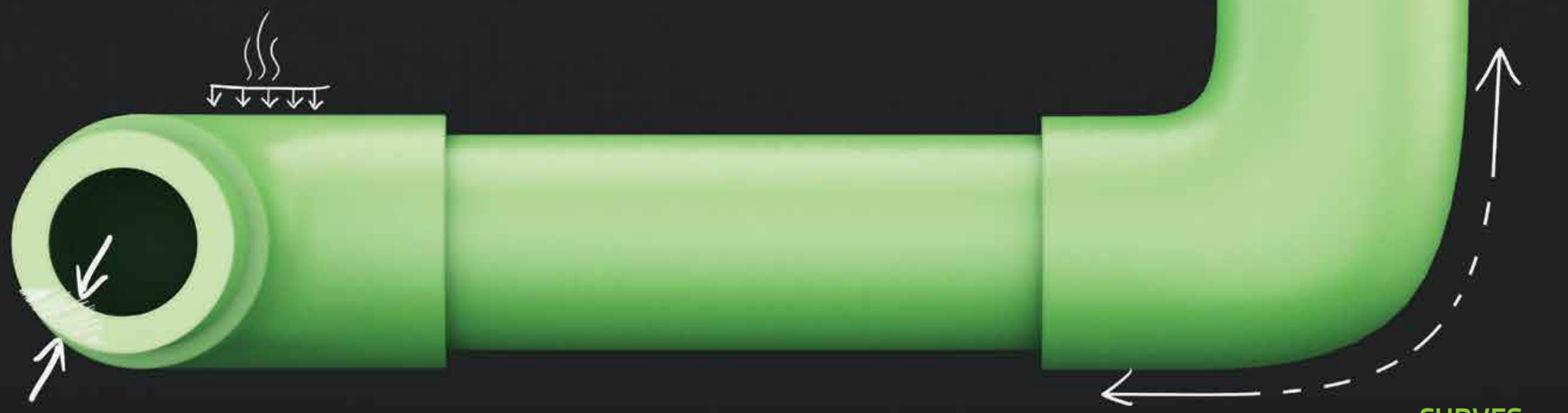


TEMPRATURE

Calculation of admitted working pressure for pipes depends on different parameters such as temperature and working period.

PRESSURE

Due to smoothness of interior surface and lack of porosity, no accumulations are made ininterior surfaces thus ensuring the required pressure level thereof.

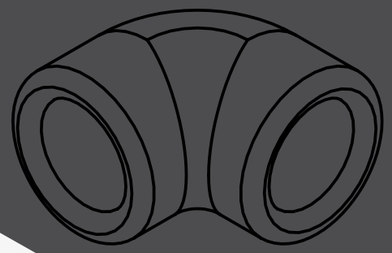


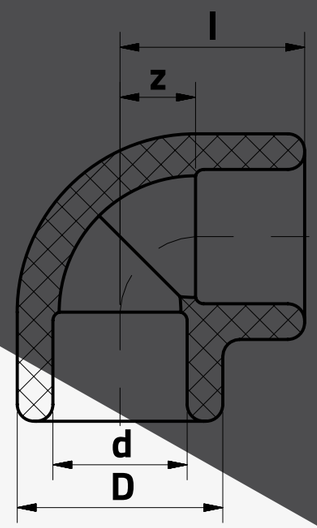
THICKNESS

Thickness of MetiTherm pipes and fitting is designed in accordance with certain values, able to guarantee reliability and long life.

CURVES

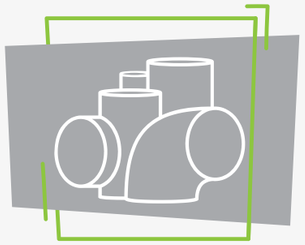
Duration of continuous working condition for MetiTherm components is based on regression curves, which strictly links duration in hours to pressure and temperature of the fluid.





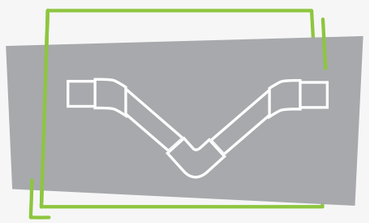
PHYSICAL BEHAVIOUR

MetiTherm products are in accordance with KTW specifications (Germany).

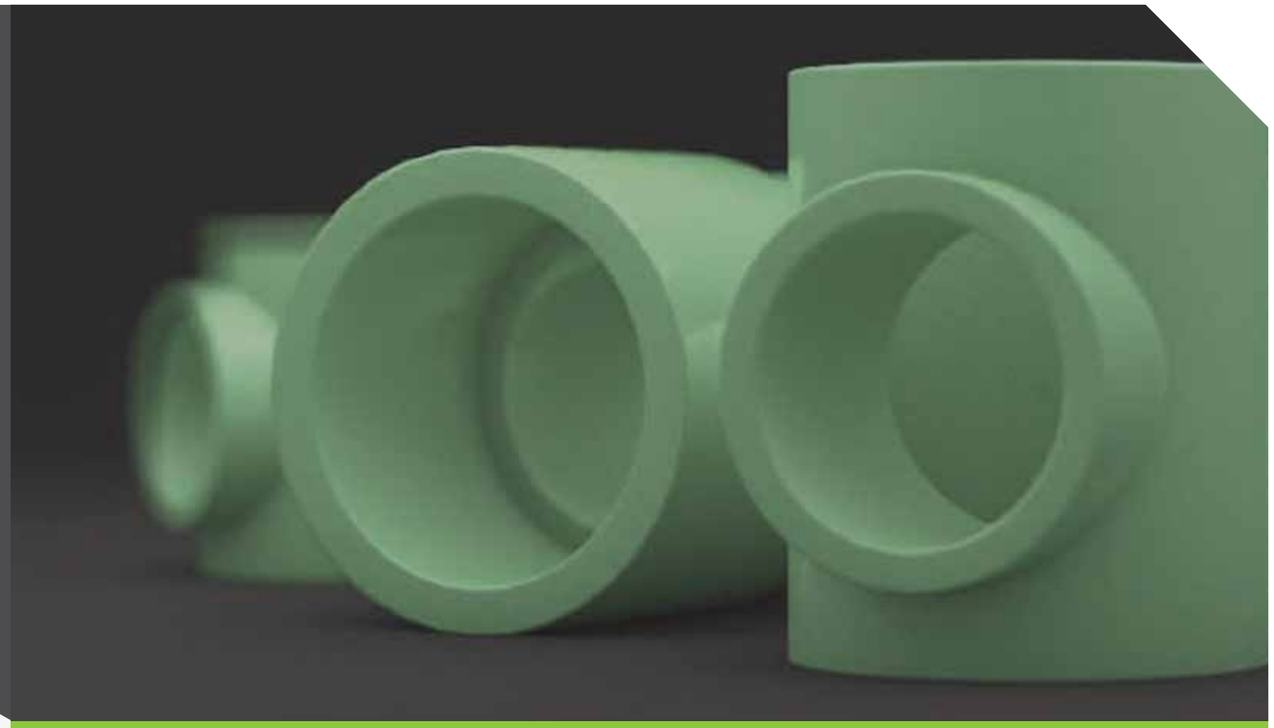


Calculation of admitted working pressure for pipes depends on different parameters such as temperature and working period.

Thickness of **MetiTherm** pipes and fitting is designed in accordance with certain security values, able to guarantee reliability and long life.



Duration of continuous working condition for **MetiTherm** components is based on regression curves, which strictly links duration in hours to pressure and temperature of the fluid.



CURVES TEMPERATURE PRESSURE THICKNESS

For example:

A **MetiTherm** pipe of PN20, after 50 years of continuous working to a temperature of 20 C is still able to withstand a pressure of 20 bar. Evaluation od admitted working pressure can be carried out by the following formula diagram.

$$P = \frac{20 \cdot sp \cdot \sigma}{DN - sp} \qquad P_{max} = \frac{P}{sf}$$

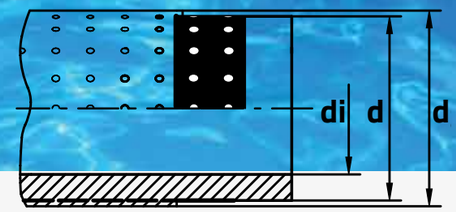
Where:

P = pressure in bar
Sp = thickness of pipes
Pmax = max. working pressure in bar

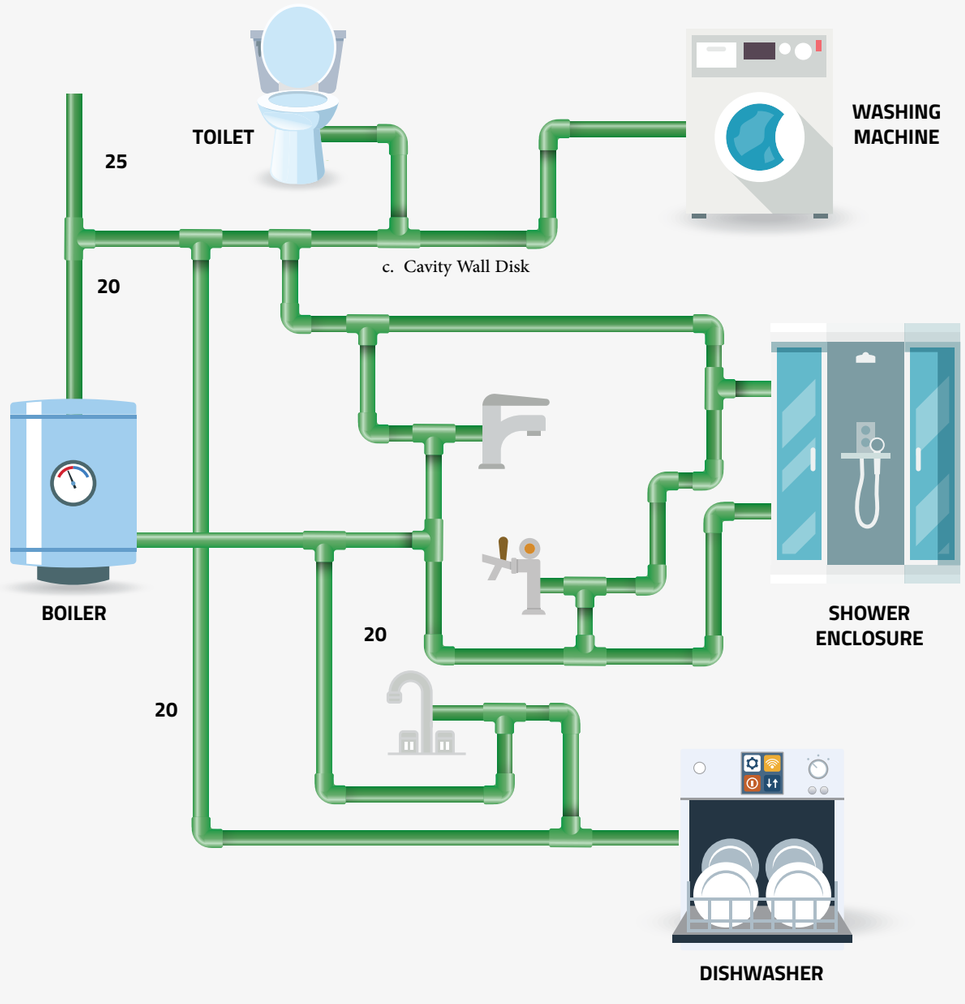
DN = outside diameter of the pipe in mm
σ = Hydrostatic stress by the Mpa diagram
Sf = security coefficient

PHYSICAL BEHAVIOUR

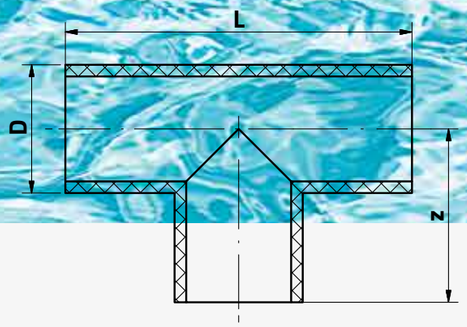
PROPERTIES	TEST METHOD	UNITS	VALUE
Viscosity J Average molecular -weight	ISO 1191 Solution viscosity C=0.001 g/cm³	cm³/g	420 500.00
Melt Flow index MFI 190/5 MFI 230/5	ISO/R 1133 Condition 18 Condition 20 Condition 12	g/10min g/10min g/10min	0.5 1.5 0.25
Density	ISO/R 1183	g/cm³	0.895
Melting zone	Polarizing microscope	°C	140-150
Ultimate strength Resistance to tensile stress Ultimate elongation	ISO/R 527 Forward speed D Test Specimen fig. 2	N/mm² N/mm² %	21 40 800
Resistance under spheric pressure	ISO 2039 (H358/30)	N/mm²	40
Bending stress at 3,5% Elongation of edge fibers	ISO 178 Specimen 5.1	N/mm²	20
Modulus of elasticity	ISO 178	N/mm²	800
Shear modulus -10 °C 0 °C 10 °C 20 °C 30 °C 40 °C 50 °C 60 °C 80 °C	ISO 573 Method A	ISO/R 573 N/mm² N/mm² N/mm² N/mm² N/mm² N/mm² N/mm² N/mm² N/mm²	 1100 770 500 370 300 240 180 140 100
Mechanical resistance after the impact bending test	DIN 8078		No Failure
CHARPY impact strength RT 0°C -10°C	ISO/R 179 Test Specimen fig.2	KJ/mm² KJ/mm² KJ/mm²	No Failure No Failure No Failure
CHARPY impact strength RT 0°C -20°C	ISO/R 179 Test Specimen	KJ/mm² KJ/mm² KJ/mm²	25 7 3
Linear expansion	VDE 0304 part 1&4	K^{-1}	$1.5x10^{-4}$
Thermal conductivity at 20°C	DIN 52612	W/mK	0.24
Specific heat at 20°C	Adiabatic Calorimeter	KJ/KgK	2.0

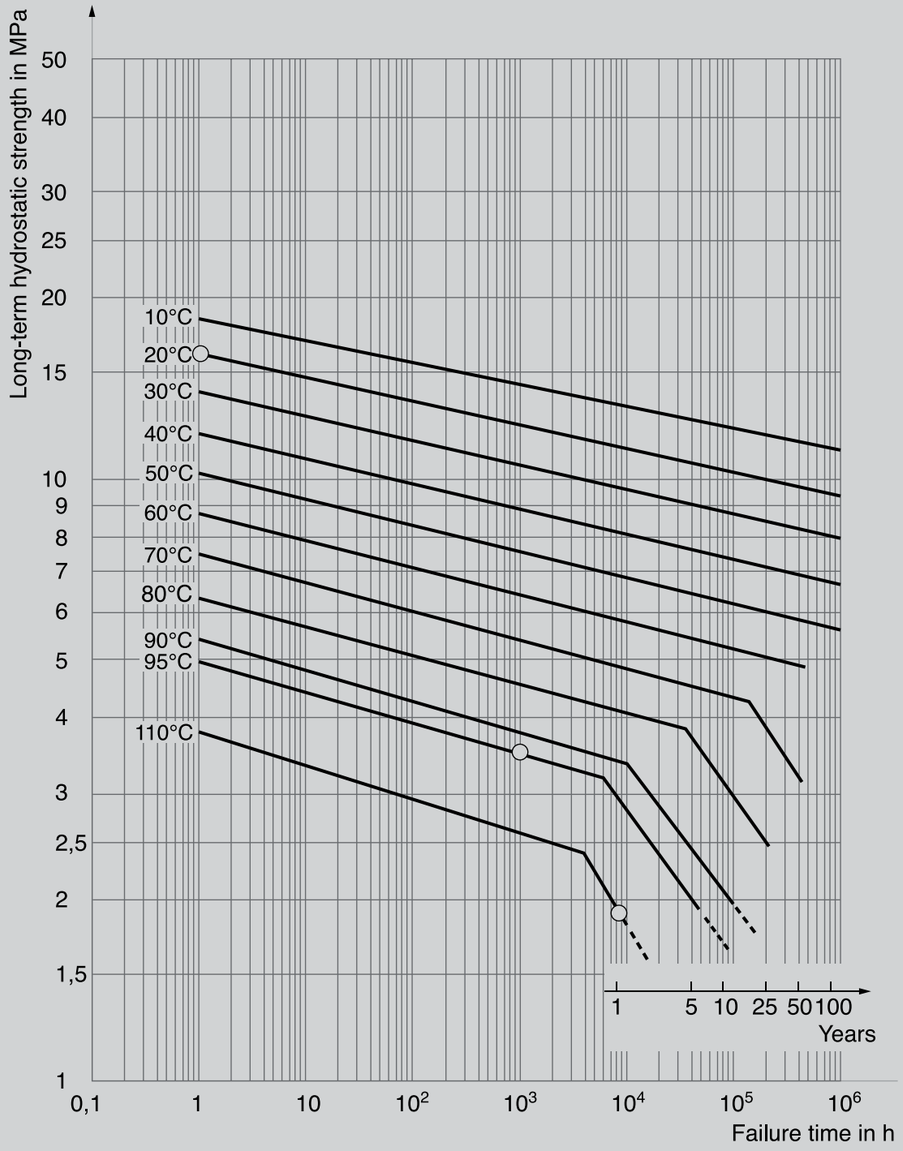


- The addition of the single necessities allows to determine a **UDC equal to 13**
- Graphically a **corresponding flow equal to 0,64 l/s** can be determined.
- This flow allows a **speed of 2.4 m/s** (see the diagram of distributed pressure losses).
- The main pipe in the flat will be done using a **pipe of 25mm.**
- The following distribution, both for hot and cold water will be done using a **pipes 20mm**, enough for the involved contemporary flows.



PHYSICAL BEHAVIOUR





- If working conditions (such as timer and temperature) are determined by the diagram of regression curves, it is possible to determine the max . Working pressure and the safety factor.
- This verification allows an evaluation of the admitted pressure (and of safety factor).
- Time taken into consideration in a continuos working time of the system, which will be lower than effective duration of the system (except for system for hot water recycle).

For MetiTherm products: the situation can be as follow:

YEARS	TEMPERATURE (°C)	MAX. PRESSURE (BAR)	SAFETY COEFFICIENT
50	10	30.6	1.5
50	20	26.0	1.5
50	30	21.7	1.5
50	40	18.5	1.5
50	50	15.6	1.5
50	60	13.1	1.5
25	70	10.1	1.5
25	80	6.5	1.5
10	90	5.4	1.5

MEMO

MEMO

CHEMICAL BEHAVIOUR

Products	Solution	Conc. %	Temperature		
			20˚C	60˚C	100˚C
Accumulator			v.r.	v.r.	
Acetic glacial acid		100	v.r.	a.b.r.	n
Acetic acid	w.s.	50	v.r.	v.r.	
Acetic acid	w.s.	10	v.r.	v.r.	
Acetic anhydride		100	v.r.		
Acetone		100	v.r.	a.b.r.	n
Acrylonitrile		100	r		
Aluminum salts					
Allum	w.s.	all	v.r.	v.r.	
Ammonia	w.s.	high	v.r.	v.r.	
Ammonia	w.s.	10	v.r.	v.r.	
Ammonia	gas	100	v.r.	v.r.	
Ammonium acetate	w.s.	all	v.r.	v.r.	v.r.
Ammonium carbonate	w.s.	all	v.r.	v.r.	v.r.
Ammonium chloride		all	v.r.	v.r.	v.r.
Ammonium metaphosphate		s.s	r	r	r
Ammonium nitrate	w.s.	all	v.r.	v.r.	v.r.
Ammonium phosphate	w.s.	all	v.r.	v.r.	v.r.
Ammonium sulphate		s.s	r	r	r
Ammonium bicarbonate		s.s	r	r	
Animal cooking oil			v.r.	a.b.r.	
Anti-freeze car			v.r.	v.r.	
Aqua regia			v.r.	n	
Barium chloride		all	v.r.	v.r.	v.r.
Barium salts					
Beer			v.r.		
Benzaldehyde			v.r.	v.r.	
Benzaldehyde	w.s.	s.s	v.r.	v.r.	v.r.
Benzene			a.b.r.	n	
Benzoic acid	w.s.	s.s	v.r.	v.r.	v.r.
Benzole chloride		100	n		
Bitter almonds fragrance			v.r.		
Bleach		12.50%	a.b.r.	a.b.r.	
Borax	w.s.				
Boric acid		100	v.r.	v.r.	
Boric acid	w.s.	s.s	v.r.	v.r.	
Brandy			v.r.		

Products	Solution	Conc. %	Temperature		
			20˚C	60˚C	100˚C
Bromine		100	n		
Bromine	liquids	high	n	n	
Bromine	vapour	low	n	n	
Bromine water	vapour	s.s.	n	n	
Butane	liquids	100	v.r.		
Butane	gas	100	v.r.	v.r.	
Butter			v.r.	v.r.	
Butyol alcohol		100	v.r.	v.r.	
Calciumnitrate	w.s.	s.s	v.r.	v.r.	
Camphor			v.r.		
Carbon tetrachloride		100	a.b.r.	n	
Chlorine	liquids	100	n		
Chlorine (dry)	gas	100	n	n	n
Chlorine (wet)	gas	10	a.b.r.	n	n
Chlorine lime		aq .sosp.		v.r.	
Chlorine water		s.s	a.b.r.	n	
Chlorosulphanic		100	n	n	
Chloroform		1000	a.b.r.	n	
Chromic acid	w.s.	s.s	v.r.	n	
Chromium (3) salts					
Chromium (6) salts					
Citric acid	w.s.	s.s	v.r.	v.r.	v.r.
Cocoa			v.r.	v.r.	r
Cod liver oil			v.r.		
Copper salts					
Cresol		100	v.r.	a.b.r.	
Cresol oil			v.r.		
Cyclohexane		100	v.r.		
Cyclohexanol		100	v.r.	v.r.	
Cycloexanon		100	v.r.	n	
Decahydronahtalene		100	a.b.r.	n	
Dioxin		100	v.r.	a.b.r.	n
Distilled water		100	v.r.	v.r.	n
Engine oil			v.r.	a.b.r.	v.r.
Ethers		100	v.r.	a.b.r.	
Ethyl alcohol		w.s.	100	v.r.	
Ethyl alcohol		w.s.	96	v.r.	v.r.
Ethyl alcohol		w.s.	50	v.r.	v.r.
Ethyl alcohol (denatured)	s.s.		v.r.	v.r.	

CHEMICAL BEHAVIOUR

Products	Solution	Conc. %	Temperature		
			20˚C	60˚C	100˚C
Ethyl chlorides		100	n		
Ethylene chlorides		100	a.b.r.	a.b.r.	
Ethylene tetrachloride		100	a.b.r.	n	
Ethylene tetrachloride			v.r.	a.b.r.	
Floor wax			v.r.	a.b.r.	
Formaldehyde		40	v.r.	v.r.	
Formaldehyde		30	v.r.	v.r.	
Formaldehyde		10	v.r.	v.r.	
Formic acid		98	v.r.	a.b.r.	v.r.
Formic acid		90	v.r.		
Formic acid		50	v.r.	v.r.	
Formic acid		10	v.r.	v.r.	
Fruit-juice			v.r.	v.r.	
Fumic sulfuric acid			n	n	n
Galvanic solutions			v.r.	v.r.	
Glycerol		100	v.r.	v.r.	
Glycerol	w.s.	high	v.r.	v.r.	v.r.
Glycerol	w.s.	low	v.r.	v.r.	
Glycol		100	v.r.	v.r.	
Glycol	w.s.	high	v.r.	v.r.	
Glycol	w.s.	low	v.r.	v.r.	v.r.
Heptan		100	v.r.	a.b.r.	
Hexan		100	v.r.	a.b.r.	
Honey			v.r.	v.r.	
Hydrobromic acid		high	v.r.	v.r.	
Hydrobrmic acid		10	v.r.	v.r.	
Hydrofluoric acid		40	v.r.	v.r.	
Hydrogen peroxide water	w.s.	30	v.r.	a.b.r.	
Hydrogen peroxide water	w.s.	10	v.r.	v.r.	
Hydrogen peroxide water	w.s.	3	v.r.	v.r.	v.r.
Ink			v.r.	v.r.	
Iron salts					
Iso propanol		100	v.r.	v.r.	
Isooctane		100	v.r.	a.b.r.	
Lactic acid	w.s.	90	v.r.	v.r.	v.r.
Lactic acid	w.s.	50	v.r.	v.r.	v.r.
Lactic acid	w.s.	10	v.r.	v.r.	v.r.
Lactual water		100	v.r.	v.r.	
Limestone					
Linseed oil					

Products	Solution	Conc. %	Temperature		
			20˚C	60˚C	100˚C
Magnesium salts					
Mercury		100	v.r.	v.r.	
Mercury salts					
Methyl alcohol		100	v.r.	v.r.	
Methyl alcohol	w.s.	50	v.r.	v.r.	
Methyl chloride		100	a.b.r.		
Methym ethyl ketone		100	v.r.	a.b.r.	
Methylene diformammyde		100	v.r.		
Milk			v.r.	v.r.	r
Mineral water			v.r.	v.r.	v.r.
Naphtha			v.r.	a.b.r.	
Naphthalene		100	v.r.		
Nikel salts					
Nitric acid		50	a.b.r.	n	
Nitric acid		25	v.r.	v.r.	
Nitric acid		10	v.r.	v.r.	
Nitro benzene		100	r	a.b.r.	
Normal gasoline			r	n	
Oil			n	n	
Oil of peanut			v.r.	v	a.b.r.
Oleic acid		100	v.r.		
Olive oil			v.r.	v.r.	
Oxalic acid	w.s.	s.s.	v.r.	v.r.	v.r.
Ozone		<0.5 ppm	r	a.b.r.	
Paraffine		100	v.r.	v.r.	n
Petroleum		100	v.r.	a.b.r.	
Phenylamine			v.r.	r	
Phenylmethylketone		100	r	a.b.r.	
Phosphoric acid	w.s.	s.s.	v.r.	a.b.r.	
Phosphoric acid	w.s.	50	v.r.	v.r.	
Phosphoric acid	w.s.	10	v.r.	v.r.	v.r.
Potassium carbonate	w.s.	s.s.	v.r.	v.r.	
Potassium chlorate	w.s.	s.s.	v.r.	v.r.	
Potassium chloride	w.s.	s.s.	v.r.	v.r.	v.r.
Potassium dichromate	w.s.	s.s.	v.r.	v.r.	v.r.
Potassium hydroxide		50	v.r.	v.r.	
Potassium hydroxide		25	v.r.	v.r.	
Potassium hydroxide		10	v.r.	v.r.	
Potassium hypochloride	w.s.	5	v.r.		
Potassium iodide	w.s.	s.s.	v.r.	v.r.	

CHEMICAL BEHAVIOUR

Products	Solution	Conc. %	Temperature		
			20°C	60°C	100°C
Potassium nitrate	w.s.	s.s.	v.r.	v.r.	
Potassium permanganate	w.s.	s.s.			
Potassium sulphate	w.s.	s.s.	v.r.	v.r.	v.r.
Propane	Gas	100	v.r.	v.r.	v.r.
Propane	Liquids	100	v.r.	v.r.	v.r.
Pyridine		100	v.r.	a.b.r.	
Quinine			v.r.		
Sea water			v.r.	v.r.	
Shampoo			v.r.	v.r.	
Silicone oil			v.r.	r	
Silver salts					
Soap solution		s.s.	v.r.	v.r.	
Soap solution		10	v.r.	v.r.	v.r.
Sodium bicarbonate	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium carbonate	w.s.	s.s.	v.r.	v.r.	
Sodium carbonate	w.s.	10	v.r.	v.r.	v.r.
Sodium chlorate	w.s.	5	v.r.		
Sodium chlorite	w.s.	25	v.r.	v.r.	
Sodium chloride	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium disulphite	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium hydroxide		100	v.r.	v.r.	
Sodiumhydroxide		50	v.r.	v.r.	
Sodium hydroxide		25	v.r.	v.r.	
Sodium hydroxide		10	v.r.	v.r.	
Sodium nitrate	w.s.	s.s.	v.r.	v.r.	
Sodium nitrite	w.s.	s.s.	v.r.		
Sodium perborate	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium phosphate	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium sulphate	w.s.	s.s.	v.r.	v.r.	v.r.
Sodium sulphate	w.s.	s.s.	v.r.		
Soluble coffee			v.r.	v.r.	v.r.
Soy-bean oil			v.r.	a.b.r.	
Spirits			v.r.		
Stannus chloride	w.s	s.s.	v.r.	v.r.	
Starch		All	v.r.	v.r.	
Stearic acid		100	v.r.		
Succinic acid	w.s	s.s.	v.r.	v.r.	
Sulphochromic acid		100	n	n	
Sulphur		100	v.r.	v.r.	v.r.
Sulphur			v.r.	v.r.	v.r.
Sulphuric acid		96	v.r.	a.b.r.	

Products	Solution	Conc. %	Temperature		
			20°C	60°C	100°C
Sulphuric acid		50	v.r.	v.r.	
Sulphuric acid		25	v.r.	v.r.	
Sulphuric acid		10	v.r.	v.r.	v.r.
Sulphurous anhydride		low	v.r.	v.r.	
Super gasoline			v.r.	n	
Syntetic detersive			v.r.	v.r.	v.r.
Tar			v.r.	a.b.r.	
Tartaric acid	w.s.	s.s.	v.r.	v.r.	
Tartaric acid		10	r	r	
Tetrahydrifuran		100	a.b.r.	n	
Tetrahydronaphtalene		100	a.b.r.	n	
Thea			v.r.	v.r.	r.
Thiopene		100	a.b.r.	n	
Toluen		100	a.b.r.	n	
Tomatoes-juice			v.r.	v.r.	
Tooth paste			v.r.	v.r.	
Trichlorcethylene		100	a.b.r.	a.b.r.	
Turpentine			n	n	n
Turpentine oil			a.b.r.	n	
Two stroke engine oil			a.b.r.	a.b.r.	
Typewriter oil			v.r.	r	
Urea	w.s.	s.s.	v.r.	v.r.	
Vaseline			v.r.	a.b.r.	
Vegetable cooking oil			v.r.	a.b.r.	
Vine			v.r.	v.r.	
Water		100	v.r.	v.r.	v.r.
Whipper cream			v.r.		
whisky		40	v.r.		
xylene or xylol		100	a.b.r.	n	
Zinc salts					

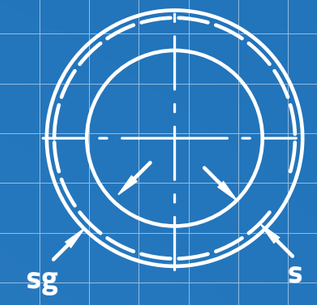
PPR 3 resistance to the chemical agents

w.s. water solution
s.s. saturated soultion
v very resistant
r resistant
b abit resistant
n not resistant

MAXIMUM FLOW RATE

ø16

12



Determination of the maximum flow rate V_S acc. to DIN 1988 Part 3
Determination of the maximum flow rate VS acc. to DIN 1988 Port 3
from the total flow $\sum V_R$ for buildings $V_S = 0.682 \cdot (\sum V_R)^{0,45} - 0.14$ [l/s]
calculated flow V_R of the respective water points is less than 0.5 l/s.

ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S
0.03	0.00	1.02	0.55	2.02	0.80	3.02	0.98	4.02	1.14	5.10	1.28	10.10	1.79	15.10	2.17
0.04	0.02	1.04	0.55	2.04	0.80	3.04	0.98	4.04	1.14	5.20	1.29	10.20	1.80	15.20	2.18
0.06	0.05	1.06	0.56	2.06	0.80	3.06	0.99	4.06	1.14	5.30	1.30	10.30	1.81	15.30	2.19
0.07	0.07	1.08	0.57	2.08	0.81	3.08	0.99	4.08	1.14	5.40	1.32	10.40	1.82	15.40	2.19
0.08	0.08	1.10	0.57	2.10	0.81	3.10	0.99	4.10	1.15	5.50	1.33	10.50	1.82	15.50	2.20
0.09	0.09	1.12	0.58	2.12	0.82	3.12	1.00	4.12	1.15	5.60	1.34	10.60	1.83	15.60	2.21
0.10	0.10	1.14	0.58	2.14	0.82	3.14	1.00	4.14	1.15	5.70	1.35	10.70	1.84	15.70	2.21
0.13	0.13	1.16	0.59	2.16	0.82	3.16	1.00	4.16	1.16	5.80	1.36	10.80	1.85	15.80	2.22
0.15	0.15	1.18	0.59	2.18	0.83	3.18	1.01	4.18	1.16	5.90	1.38	10.90	1.86	15.90	2.23
0.20	0.19	1.20	0.60	2.20	0.83	3.20	1.01	4.20	1.16	6.00	1.39	11.00	1.87	16.00	2.23
0.22	0.21	1.22	0.61	2.22	0.84	3.22	1.01	4.22	1.16	6.10	1.40	11.10	1.87	16.10	2.24
0.24	0.22	1.24	0.61	2.24	0.84	3.24	1.02	4.24	1.17	6.20	1.41	11.20	1.88	16.20	2.25
0.26	0.23	1.26	0.62	2.26	0.84	3.26	1.02	4.26	1.17	6.30	1.42	11.30	1.89	16.30	2.25
0.28	0.24	1.28	0.62	2.28	0.85	3.28	1.02	4.28	1.17	6.40	1.43	11.40	1.90	16.40	2.26
0.30	0.26	1.30	0.63	2.30	0.85	3.30	1.03	4.30	1.17	6.50	1.44	11.50	1.91	16.50	2.27
0.32	0.27	1.32	0.63	2.32	0.86	3.32	1.03	4.32	1.18	6.60	1.45	11.60	1.91	16.60	2.27
0.34	0.28	1.34	0.64	2.34	0.86	3.34	1.03	4.34	1.18	6.70	1.47	11.70	1.92	16.70	2.28
0.36	0.29	1.36	0.64	2.36	0.86	3.36	1.04	4.36	1.18	6.80	1.48	11.80	1.93	16.80	2.29
0.38	0.30	1.38	0.65	2.38	0.87	3.38	1.04	4.38	1.19	6.90	1.49	11.90	1.94	16.90	2.29
0.40	0.31	1.40	0.65	2.40	0.87	3.40	1.04	4.40	1.19	7.00	1.50	12.00	1.95	17.00	2.30
0.42	0.32	1.42	0.66	2.42	0.88	3.42	1.05	4.42	1.19	7.10	1.51	12.10	1.95	17.10	2.31
0.44	0.33	1.44	0.66	2.44	0.88	3.44	1.05	4.44	1.19	7.20	1.52	12.20	1.96	17.20	2.31
0.46	0.34	1.46	0.67	2.46	0.88	3.46	1.05	4.46	1.20	7.30	1.53	12.30	1.97	17.30	2.32
0.48	0.35	1.48	0.67	2.48	0.89	3.48	1.06	4.48	1.20	7.40	1.54	12.40	1.98	17.40	2.33
0.50	0.36	1.50	0.68	2.50	0.89	3.50	1.06	4.50	1.20	7.50	1.55	12.50	1.99	17.50	2.33
0.52	0.37	1.52	0.68	2.52	0.89	3.52	1.06	4.52	1.20	7.60	1.56	12.60	1.99	17.60	2.34
0.54	0.38	1.54	0.69	2.54	0.90	3.54	1.06	4.54	1.21	7.70	1.57	12.70	2.00	17.70	2.35
0.56	0.39	1.56	0.69	2.56	0.90	3.56	1.07	4.56	1.21	7.80	1.58	12.80	2.01	17.80	2.35
0.58	0.39	1.58	0.70	2.58	0.90	3.58	1.07	4.58	1.21	7.90	1.59	12.90	2.02	17.90	2.36
0.60	0.40	1.60	0.70	2.60	0.91	3.60	1.07	4.60	1.22	8.00	1.60	13.00	2.02	18.00	2.36
0.62	0.41	1.62	0.71	2.62	0.91	3.62	1.08	4.62	1.22	8.10	1.61	13.10	2.03	18.10	2.37
0.64	0.42	1.64	0.71	2.64	0.92	3.64	1.08	4.64	1.22	8.20	1.62	13.20	2.04	18.20	2.38
0.66	0.43	1.66	0.72	2.66	0.92	3.66	1.08	4.66	1.22	8.30	1.63	13.30	2.05	18.30	2.38
0.68	0.43	1.68	0.72	2.68	0.92	3.68	1.09	4.68	1.23	8.40	1.64	13.40	2.05	18.40	2.39
0.70	0.44	1.70	0.73	2.70	0.93	3.70	1.09	4.70	1.23	8.50	1.65	13.50	2.06	18.50	2.40
0.72	0.45	1.72	0.73	2.72	0.93	3.72	1.09	4.72	1.23	8.60	1.66	13.60	2.07	18.60	2.40
0.74	0.46	1.74	0.74	2.74	0.93	3.74	1.09	4.74	1.23	8.70	1.67	13.70	2.07	18.70	2.41
0.76	0.46	1.76	0.74	2.76	0.94	3.76	1.10	4.76	1.24	8.80	1.67	13.80	2.08	18.80	2.41
0.78	0.47	1.78	0.74	2.78	0.94	3.78	1.10	4.78	1.24	8.90	1.68	13.90	2.09	18.90	2.42
0.80	0.48	1.80	0.75	2.80	0.94	3.80	1.10	4.80	1.24	9.00	1.69	14.00	2.10	19.00	2.43
0.82	0.48	1.82	0.75	2.82	0.95	3.82	1.11	4.82	1.24	9.10	1.70	14.10	2.10	19.10	2.43
0.84	0.49	1.84	0.76	2.84	0.95	3.84	1.11	4.84	1.25	9.20	1.71	14.20	2.11	19.20	2.44
0.86	0.50	1.86	0.76	2.86	0.95	3.86	1.11	4.86	1.25	9.30	1.72	14.30	2.12	19.30	2.44
0.88	0.50	1.88	0.77	2.88	0.96	3.88	1.12	4.88	1.25	9.40	1.73	14.40	2.12	19.40	2.45
0.90	0.51	1.90	0.77	2.90	0.96	3.90	1.12	4.90	1.25	9.50	1.74	14.50	2.13	19.50	2.46
0.92	0.52	1.92	0.77	2.92	0.96	3.92	1.12	4.92	1.26	9.60	1.75	14.60	2.14	19.60	2.46
0.94	0.52	1.94	0.78	2.94	0.97	3.94	1.12	4.94	1.26	9.70	1.76	14.70	2.15	19.70	2.47
0.96	0.53	1.96	0.78	2.96	0.97	3.96	1.13	4.96	1.26	9.80	1.76	14.80	2.15	19.80	2.47
0.98	0.54	1.98	0.79	2.98	0.97	3.98	1.13	4.98	1.26	9.90	1.77	14.90	2.16	19.90	2.48
1.00	0.54	2.00	0.79	3.00	0.98	4.00	1.13	5.00	1.27	10.00	1.78	15.00	2.17	20.00	2.49

Determination of the maximum flow rate VS acc. to DIN 1988 Port 3
from the total flow $\sum V_R$ for buildings $V_S = 1.7 \cdot (\sum V_R)^{0.21} - 0.7$ [l/s]
This table is valid, if the calculated flow V_R of the respective water points is less 0.5 l/s.

ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S	ΣV_R	V_S
1.00	1.00	5.10	1.69	10.10	2.06	15.10	2.31	22.40	2.57	142.40	4.12	262.40	4.78	382.40	5.23
1.05	1.02	5.20	1.70	10.20	2.07	15.20	2.31	24.80	2.64	144.80	4.13	264.80	4.79	384.80	5.23
1.10	1.03	5.30	1.71	10.30	2.07	15.30	2.31	27.20	2.70	147.20	4.15	267.20	4.80	387.20	5.24
1.15	1.05	5.40	1.72	10.40	2.08	15.40	2.32	29.60	2.76	149.60	4.17	269.60	4.81	389.60	5.25
1.20	1.07	5.50	1.73	10.50	2.09	15.50	2.32	32.00	2.82	152.00	4.18	272.00	4.82	392.00	5.26
1.25	1.08	5.60	1.74	10.6	2.09	15.60	2.33	34.40	2.87	154.40	4.20	274.40	4.83	394.40	5.26
1.30	1.10	5.70	1.75	10.70	2.10	15.70	2.33	36.80	2.92	156.80	4.21	276.80	4.84	396.80	5.27
1.35	1.11	5.80	1.76	10.80	2.10	15.80	2.34	39.20	2.97	159.20	4.23	279.20	4.85	399.20	5.28
1.40	1.12	5.90	1.77	10.90	2.11	15.90	2.34	41.60	3.02	161.60	4.25	281.60	4.86	401.60	5.29
1.45	1.14	6.00	1.78	11.00	2.11	16.00	2.34	44.00	3.06	164.00	4.26	284.00	4.87	404.00	5.29
1.50	1.15	6.10	1.79	11.10	2.12	16.10	2.35	46.40	3.11	166.40	4.28	286.40	4.88	406.40	5.30
1.55	1.16	6.20	1.79	11.20	2.12	16.20	2.35	48.80	3.15	168.80	4.29	288.80	4.89	408.80	5.31
1.60	1.18	6.30	1.80	11.30	2.13	16.30	2.35	51.20	3.19	171.20	4.31	291.20	4.90	411.20	5.32
1.65	1.19	6.40	1.81	11.40	2.13	16.40	2.36	53.60	3.22	173.60	4.32	293.60	4.91	413.60	5.32
1.70	1.20	6.50	1.82	11.50	2.14	16.50	2.36	56.00	3.26	176.00	4.34	296.00	4.92	416.00	5.33
1.75	1.21	6.60	1.83	11.60	2.14	16.60	2.37	58.40	3.29	178.40	4.35	298.40	4.93	418.40	5.34
1.80	1.22	6.70	1.83	11.70	2.15	16.70	2.37	60.80	3.33	180.80	4.36	300.80	4.93	420.80	5.35
1.85	1.23	6.80	1.84	11.80	2.15	16.80	2.37	63.20	3.36	183.20	4.38	303.20	4.94	423.20	5.35
1.90	1.25	6.90	1.85	11.90	2.16	16.90	2.38	65.60	3.39	185.60	4.39	305.60	4.95	425.60	5.36
2.00	1.27	7.00	1.86	12.00	2.16	17.00	2.38	68.00	3.42	188.00	4.41	308.00	4.96	428.00	5.37
2.10	1.29	7.10	1.87	12.10	2.17	17.10	2.39	70.40	3.45	190.40	4.42	310.40	4.97	430.40	5.38
2.20	1.31	7.20	1.87	12.20	2.17	17.20	2.39	72.80	3.48	192.80	4.43	312.80	4.98	432.80	5.38
2.30	1.32	7.30	1.88	12.30	2.18	17.30	2.39	75.20	3.51	195.20	4.45	315.20	4.99	435.20	5.39
2.40	1.34	7.40	1.89	12.40	2.18	17.40	2.40	77.60	3.54	197.60	4.46	317.60	5.00	437.60	5.40
2.50	1.36	7.50	1.90	12.50	2.19	17.50	2.40	80.00	3.57	200.00	4.47	320.00	5.01	440.00	5.40
2.60	1.38	7.60	1.90	12.60	2.19	17.60	2.40	82.40	3.59	202.40	4.49	322.40	5.02	442.40	5.41
2.70	1.39	7.70	1.91	12.70	2.20	17.70	2.41	84.80	3.62	204.80	4.50	324.80	5.03	444.80	5.42
2.80	1.41	7.80	1.92	12.80	2.20	17.80	2.41	87.20	3.64	207.20	4.51	327.20	5.04	447.20	5.42
2.90	1.43	7.90	1.92	12.90	2.21	17.90	2.42	89.60	3.67	209.60	4.52	329.60	5.04	452.00	5.43
3.00	1.44	8.00	1.93	13.00	2.21	18.00	2.42	92.00	3.69	212.00	4.54	332.00	5.05	454.40	5.44
3.10	1.46	8.10	1.94	13.10	2.22	18.10	2.42	94.40	3.72	214.40	4.55	334.40	5.06	456.80	5.44
3.20	1.47	8.20	1.94	13.20	2.22	18.20	2.43	96.80	3.74	216.80	4.56	336.80	5.07	459.20	5.45
3.30	1.48	8.30	1.95	13.30	2.23	18.30	2.43	99.20	3.76	219.20	4.57	339.20	5.08	461.60	5.46
3.40	1.50	8.40	1.96	13.40	2.23	18.40	2.43	101.60	3.79	221.60	4.58	341.60	5.09	464.00	5.47
3.50	1.51	8.50	1.96	13.50	2.24	18.50	2.44	104.00	3.81	224.00	4.60	344.00	5.10	466.40	5.47
3.60	1.52	8.60	1.97	13.60	2.24	18.60	2.44	106.40	3.83	226.40	4.61	346.40	5.10	468.80	5.48
3.70	1.54	8.70	1.98	13.70	2.25	18.70	2.44	108.80	3.85	228.80	4.62	348.80	5.11	471.20	5.49
3.80	1.55	8.80	1.98	13.80	2.25	18.80	2.45	111.20	3.87	231.20	4.63	351.20	5.12	473.60	5.49
3.90	1.56	8.90	1.99	13.90	2.25	18.90	2.45	113.60	3.89	233.60	4.64	353.60	5.13	476.00	5.50
4.00	1.57	9.00	2.00	14.00	2.26	19.00	2.45	116.00	3.91	236.00	4.66	356.00	5.14	478.40	5.51
4.10	1.59	9.10	2.00	14.10	2.26	19.10	2.46	118.40	3.93	238.40	4.67	358.40	5.15	480.80	5.51
4.20	1.60	9.20	2.01	14.20	2.27	19.20	2.46	120.80	3.95	240.80	4.68	360.80	5.15	483.20	5.52
4.30	1.61	9.30	2.02	14.30	2.27	19.30	2.47	123.20	3.97	243.20	4.69	363.20	5.16	485.60	5.52
4.40	1.62	9.40	2.02	14.40	2.28	19.40	2.47	125.60	3.99	245.60	4.70	365.00	5.17	488.00	5.53
4.50	1.63	9.50	2.03	14.50	2.28	19.50	2.47	128.00	4.01	248.00	4.71	368.00	5.18	490.40	5.54
4.60	1.64	9.60	2.03	14.60	2.29	19.60	2.48	130.40	4.03	250.40	4.72	370.40	5.19	492.40	5.54
4.70	1.65	9.70	2.04	14.70	2.29	19.70	2.48	132.80	4.05	252.80	4.76	372.80	5.19	492.80	5.55
4.80	1.66	9.80	2.05	14.80	2.29	19.80	2.48	135.20	4.06	255.20	4.74	375.20	5.20	495.20	5.56
4.90	1.67	9.90	2.05	14.90	2.30	19.90	2.49	137.60	4.08	257.60	4.75	377.60	5.21	497.60	5.56
5.00	1.68	10.00	2.06	15.00	2.30	20.00	2.49	140.00	4.10	260.00	4.77	380.00	5.22	500.00	5.57

PIPE FRACTION FACTOR & FLOW RATE

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 11 (PN10)

V = circulatory (l/s)		R= pressure gradient (mbar/m)					v= flow rate (m/s)				
dxs >>		20x1.9	25x2.3	32x2.9	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10.0	125x11.4
V	d i	16.2mm	20.4mm	26.0mm	32.6mm	40.8mm	51.4mm	61. mm	73.6mm	90.0mm	102.2mm
0.01	R	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	v	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.02	R	0.12	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	v	0.10	0.06	0.04	0.02	0.02	0.01	0.01	0.00	0.00	0.00
0.03	R	0.18	0.07	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	v	0.15	0.09	0.60	0.04	0.02	0.01	0.01	0.01	0.00	0.00
0.04	R	0.50	0.17	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.19	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.00	0.00
0.05	R	0.74	0.25	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.24	0.15	0.09	0.06	0.04	0.02	0.02	0.01	0.00	0.00
0.06	R	1.01	0.34	0.11	0.02	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.29	0.18	0.11	0.07	0.05	0.03	0.02	0.01	0.00	0.00
0.07	R	1.32	0.44	0.14	0.05	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.34	0.21	0.13	0.08	0.05	0.03	0.02	0.02	0.00	0.00
0.08	R	1.66	0.56	0.18	0.06	0.02	0.00	0.00	0.00	0.00	0.00
	v	0.39	0.24	0.15	0.10	0.06	0.04	0.03	0.02	0.00	0.00
0.09	R	2.03	0.68	0.22	0.07	0.03	0.01	0.00	0.00	0.00	0.00
	v	0.44	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.00	0.00
0.10	R	2.44	0.82	0.26	0.09	0.03	0.01	0.00	0.00	0.00	0.00
	v	0.49	0.31	0.19	0.12	0.08	0.05	0.03	0.02	0.00	0.00
0.12	R	3.35	1.12	0.35	0.12	0.04	0.01	0.01	0.00	0.00	0.00
	v	0.58	0.37	0.23	0.14	0.09	0.06	0.04	0.03	0.00	0.00
0.14	R	4.39	1.46	0.46	0.16	0.06	0.02	0.01	0.00	0.00	0.00
	v	0.68	0.43	0.26	0.17	0.11	0.07	0.05	0.03	0.00	0.00
0.16	R	5.55	1.85	0.58	0.20	0.07	0.02	0.01	0.00	0.00	0.00
	v	0.78	0.49	0.30	0.19	0.12	0.08	0.05	0.04	0.00	0.00
0.18	R	6.84	2.27	0.72	0.24	0.08	0.03	0.01	0.01	0.00	0.00
	v	0.87	0.55	0.34	0.22	0.14	0.09	0.06	0.04	0.00	0.00
0.20	R	8.23	2.73	0.86	0.29	0.10	0.03	0.01	0.01	0.00	0.00
	v	0.97	0.61	0.38	0.24	0.15	0.10	0.07	0.05	0.00	0.00
0.30	R	16.93	5.59	1.75	0.59	0.20	0.07	0.03	0.01	0.00	0.00
	v	1.46	0.92	0.57	0.36	0.23	0.14	0.10	0.07	0.00	0.04
0.40	R	28.37	9.32	2.91	0.99	0.34	0.11	0.05	0.02	0.01	0.00
	v	1.94	1.22	0.75	0.48	0.31	0.19	0.14	0.09	0.06	0.05
0.50	R	42.45	13.89	4.32	1.46	0.50	0.17	0.07	0.03	0.01	0.01
	v	2.34	1.53	0.94	0.60	0.38	0.24	0.17	0.12	0.08	0.06
0.60	R	59.11	19.28	5.98	2.02	0.69	0.23	0.10	0.04	0.02	0.01
	v	2.91	1.48	1.13	0.72	0.46	0.29	0.20	0.14	0.09	0.07
0.70	R	78.31	25.46	7.87	2.65	0.90	0.30	0.13	0.05	0.02	0.01
	v	3.40	2.14	1.32	0.84	0.54	0.34	0.24	0.16	0.11	0.09

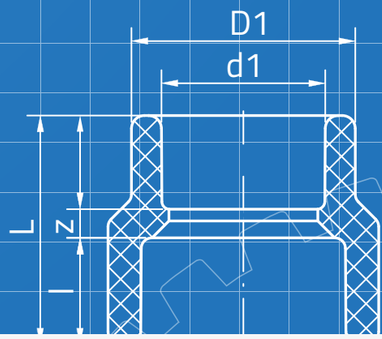
Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 11 (PN10)

V = circulatory (l/s)		R= pressure gradient (mbar/m)				v= flow rate (m/s)				
dxs >>		20x1.9	25x2.3	32x2.9	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10.0
V	d i	16.2 mm	20.4 mm	26.0 mm	32.6 mm	40.8 mm	51.4 mm	61.2 mm	73.6 mm	90.0 mm
0.80	R	100.01	32.43	10.01	3.36	1.15	0.38	0.17	0.07	0.03
	v	3.88	2.45	1.51	0.96	0.61	0.39	0.27	0.19	0.13
0.90	R	124.19	40.18	12.37	4.15	1.41	0.47	0.20	0.08	0.03
	v	4.37	2.75	1.70	1.08	0.69	0.43	0.31	0.21	0.14
1.00	R	150.84	48.69	14.96	5.01	1.70	0.56	0.24	0.10	0.04
	v	4.85	3.06	1.88	1.20	0.76	0.48	0.34	0.24	0.16
1.20	R	211.46	67.99	20.81	6.95	2.36	0.78	0.34	0.14	0.05
	v	5.82	3.67	2.26	1.44	0.92	0.58	0.41	0.28	0.19
1.40	R	281.77	90.28	27.55	9.18	3.11	1.02	0.44	0.18	0.07
	v	6.79	4.28	2.64	1.68	1.07	0.67	0.48	0.33	0.22
1.60	R	361.70	115.54	35.16	11.69	3.95	1.30	0.56	0.23	0.09
	v	7.76	4.90	3.01	1.92	1.22	0.77	0.54	0.38	0.25
1.80	R	451.22	143.73	43.63	14.48	4.88	1.60	0.69	0.29	0.11
	v	8.73	5.51	3.39	2.16	1.38	0.87	0.61	0.42	0.28
2.00	R	552.07	174.84	52.94	17.54	5.90	1.94	0.84	0.35	0.13
	v	9.70	6.12	3.77	2.40	1.53	0.96	0.68	0.47	0.31
2.20	R	660.78	208.86	63.11	20.87	7.02	2.30	0.99	0.41	0.16
	v	10.67	6.73	4.14	2.64	1.68	1.06	0.75	0.52	0.35
2.40	R	778.98	245.77	74.11	24.47	8.21	2.69	1.16	0.48	0.18
	v	11.64	7.34	4.52	2.88	1.84	1.16	0.82	0.56	0.38
2.60	R	906.64	285.56	85.94	28.33	9.50	3.10	1.34	0.55	0.21
	v	12.61	7.95	4.90	3.11	1.99	1.25	0.88	0.61	0.41
2.80	R	1,043.75	328.23	98.61	32.46	10.87	3.55	1.53	0.63	0.24
	v	13.58	8.57	5.27	3.35	2.14	1.35	0.95	0.66	0.44
3.00	R	1,190.30	373.77	112.10	36.85	12.32	4.02	1.73	0.71	0.27
	v	14.55	9.18	5.65	3.59	2.29	1.45	1.02	0.71	0.47
3.20	R	1,346.28	423.56	126.42	41.50	13.86	4.52	1.94	0.80	0.30
	v	15.52	9.79	6.03	3.83	2.45	1.54	1.09	0.75	0.50
3.40	R	1,511.68	474.89	141.56	46.41	15.49	5.04	2.17	0.89	0.34
	v	16.50	10.40	6.40	4.07	2.60	1.64	1.16	0.80	0.53
3.60	R	1,686.50	529.07	157.51	51.58	17.19	5.59	2.40	0.99	0.38
	v	17.47	11.01	6.78	4.31	2.75	1.73	1.22	0.85	0.57
3.80	R	1,870.73	586.10	174.29	57.00	18.98	6.17	2.65	1.09	0.41
	v	18.44	11.63	7.16	4.55	2.91	1.83	1.29	0.89	0.60
4.00	R	2,064.37	645.97	191.88	62.69	20.86	6.77	2.91	1.19	0.45
	v	19.41	12.24	7.53	4.79	3.06	1.93	1.36	0.94	0.63
4.20	R	2,267.41	708.68	210.28	68.63	22.81	7.40	3.18	1.30	0.49
	v	20.38	12.85	7.91	5.03	3.21	2.02	1.43	0.99	0.66
4.40	R	2,479.85	774.22	229.50	74.82	24.85	8.06	3.46	1.42	0.54
	v	21.35	13.46	8.29	5.27	3.37	2.12	1.50	1.03	0.69

PIPE FRACTION FACTOR & FLOW RATE



Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 11 (PN10)

V = circulatory (l/s)		R= pressure gradient (mbar/m)				v= flow rate (m/s)				
dxs >>		20x1.9	25x2.3	32x2.9	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10.0
V	d i	16.2mm	20.4mm	26.0mm	32.6mm	40.8mm	51.4mm	61. mm	73.6mm	90.0mm
4.60	R	2701.69	842.61	249.53	81.27	26.97	8.74	3.75	1.54	0.58
	v	22.32	14.07	8.66	5.51	3.52	2.22	1.56	1.08	0.72
4.80	R	2932.92	913.82	271.35	87.98	29.17	9.44	4.05	1.66	0.63
	v	23.29	14.69	9.04	5.75	3.67	2.31	1.63	1.13	0.75
5.00	R	3173.54	987.87	293.03	94.93	31.45	10.17	4.36	1.78	0.68
	v	24.26	15.30	9.42	5.99	3.82	2.41	1.70	1.18	0.79
5.20	R	3423.56	1064.75	315.52	102.14	33.81	10.93	4.68	1.92	0.73
	v	25.23	15.91	9.79	6.23	3.98	2.51	1.77	1.22	0.82
5.40	R	3682.96	1144.46	338.82	109.61	36.26	11.71	5.01	2.05	0.78
	v	26.20	16.52	10.17	6.47	4.13	2.60	1.84	1.27	0.85
5.60	R	3951.74	1227.00	362.92	117.32	38.78	12.52	5.36	2.19	0.83
	v	27.17	17.13	10.55	6.71	4.28	2.70	1.90	1.32	0.88
5.80	R	4229.92	1312.37	387.82	125.29	41.39	13.35	5.71	2.33	0.88
	v	28.14	17.75	10.92	6.95	4.44	2.80	1.97	1.36	0.91
6.00	R	4517.48	1400.00	413.53	133.51	44.07	14.21	6.07	2.48	0.94
	v	29.11	18.36	11.30	7.19	4.59	2.89	2.04	1.41	0.94
6.20	R	4814.42	1491.58	440.05	141.98	46.83	15.09	6.45	2.63	1.00
	v	30.08	18.97	11.68	7.43	4.74	2.99	2.11	1.46	0.97
6.40	R	5120.74	1585.42	467.37	150.70	49.68	16.00	6.83	2.79	1.06
	v	31.05	19.58	12.05	7.67	4.90	3.08	2.18	1.50	1.01
6.60	R	5436.44	1682.09	495.48	159.67	52.60	16.93	7.23	2.95	1.12
	v	32.02	20.19	12.43	7.91	5.05	3.18	2.24	1.55	1.04
6.80	R	5761.53	1781.58	524.41	168.89	55.60	17.89	7.63	3.12	1.18
	v	32.99	20.80	12.81	8.15	5.20	3.28	2.31	1.60	1.07
7.00	R	6095.99	1883.89	554.13	178.37	58.69	18.87	8.05	3.28	1.24
	v	33.96	21.42	13.18	8.39	5.35	3.37	2.38	1.65	1.10
7.50	R	6973.19	2152.02	631.95	203.89	66.74	21.43	9.13	3.72	1.41
	v	36.39	22.95	14.13	8.99	5.74	3.61	2.55	1.76	1.18
8.00	R	7908.99	2437.78	714.76	230.26	75.28	24.14	10.28	4.19	1.58
	v	38.81	24.48	15.07	9.58	6.12	3.86	2.72	1.88	1.26
9.00	R	9956.40	3062.18	895.39	287.67	93.85	30.02	12.77	5.19	1.96
	v	43.66	27.54	16.95	10.78	6.88	4.34	3.06	2.12	1.41
10.00	R		3757.04	1095.99	351.27	114.38	36.51	15.50	6.30	2.37
	v		30.59	18.83	11.98	7.65	4.82	3.40	2.35	1.57

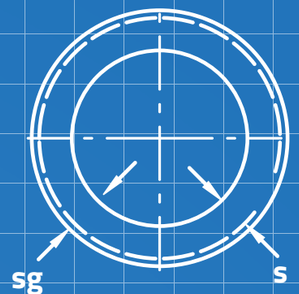
Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16x2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6mm	13.2mm	16.6mm	21.2mm	26.6mm	33.2 mm	42.0 mm	50.0 mm	60.0 mm	73.2 mm
0.01	R	0.33	0.14	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.11	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
0.02	R	1.15	0.27	0.11	0.04	0.02	0.01	0.00	0.00	0.00	0.00
	v	0.23	0.15	0.09	0.06	0.04	0.02	0.01	0.01	0.01	0.00
0.03	R	2.29	0.81	0.16	0.06	0.02	0.01	0.00	0.00	0.00	0.00
	v	0.34	0.22	0.14	0.08	0.05	0.03	0.02	0.02	0.01	0.00
0.04	R	3.74	1.33	0.45	0.14	0.03	0.01	0.01	0.00	0.00	0.00
	v	0.45	0.29	0.18	0.11	0.07	0.05	0.03	0.02	0.01	0.00
0.05	R	5.51	1.94	0.66	0.21	0.07	0.02	0.01	0.00	0.00	0.00
	v	0.57	0.37	0.23	0.14	0.09	0.06	0.04	0.03	0.02	0.00
0.06	R	7.56	2.66	0.90	0.28	0.10	0.02	0.01	0.00	0.00	0.00
	v	0.68	0.44	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.00
0.07	R	9.89	3.48	1.17	0.37	0.13	0.04	0.01	0.00	0.00	0.00
	v	0.79	0.51	0.32	0.20	0.13	0.08	0.05	0.04	0.02	0.00
0.08	R	12.50	4.39	1.48	0.46	0.16	0.06	0.02	0.01	0.00	0.00
	v	0.91	0.58	0.37	0.23	0.14	0.09	0.06	0.04	0.03	0.00
0.09	R	15.38	5.39	1.81	0.57	0.19	0.07	0.02	0.01	0.00	0.00
	v	1.02	0.66	0.42	0.25	0.16	0.10	0.06	0.05	0.03	0.00
0.10	R	18.52	6.48	2.17	0.68	0.23	0.08	0.03	0.01	0.00	0.00
	v	1.13	0.73	0.46	0.28	0.18	0.12	0.07	0.05	0.04	0.00
0.12	R	25.57	8.92	2.99	0.93	0.32	0.11	0.04	0.02	0.01	0.00
	v	1.36	0.88	0.55	0.34	0.22	0.14	0.09	0.06	0.04	0.00
0.14	R	33.63	11.71	3.91	1.22	0.42	0.15	0.05	0.02	0.01	0.00
	v	1.59	1.02	0.65	0.40	0.25	0.16	0.10	0.07	0.05	0.00
0.16	R	42.69	14.83	4.94	1.54	0.52	0.18	0.06	0.03	0.01	0.00
	v	1.81	1.17	0.74	0.45	0.29	0.18	0.12	0.08	0.06	0.00
0.18	R	52.73	18.28	6.08	1.89	0.64	0.22	0.07	0.03	0.01	0.01
	v	2.04	1.32	0.83	0.51	0.32	0.21	0.13	0.09	0.06	0.04
0.20	R	63.72	22.05	7.32	2.27	0.77	0.27	0.09	0.04	0.02	0.01
	v	2.27	1.46	0.92	0.57	0.36	0.23	0.14	0.10	0.07	0.05
0.30	R	132.83	45.61	15.05	4.64	1.57	0.55	0.18	0.08	0.03	0.01
	v	3.40	2.19	1.39	0.85	0.54	0.35	0.22	0.15	0.11	0.07
0.40	R	224.93	76.78	25.21	7.74	2.61	0.90	0.29	0.13	0.05	0.02
	v	4.53	2.92	1.85	1.13	0.72	0.46	0.29	0.20	0.14	0.10
0.50	R	339.55	115.34	37.70	11.53	3.87	1.34	0.44	0.19	0.08	0.03
	v	5.67	3.65	2.31	1.42	0.90	0.58	0.36	0.25	0.18	0.12
0.60	R	476.42	161.16	52.48	16.00	5.35	1.85	0.60	0.26	0.11	0.04
	v	6.80	4.38	2.77	1.70	1.08	0.69	0.43	0.31	0.21	0.14
0.70	R	635.34	214.16	69.50	21.13	7.05	2.43	0.79	0.34	0.14	0.06
	v	7.93	5.12	3.23	1.98	1.26	0.81	0.51	0.36	0.25	0.17

PIPE FRACTION FACTOR & FLOW RATE



Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)				v= flow rate (m/s)					
dxs >>		16x 2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6 mm	13.2mm	16.6 mm	21.2mm	26.6mm	33.2 mm	42.0 mm	50.0mm	60.0 mm	73.2 mm
0.80	R	816.21	274.25	88.74	26.90	8.96	3.08	1.00	0.43	0.18	0.07
	v	9.07	5.85	3.70	2.27	1.44	0.92	0.58	0.41	0.28	0.19
0.90	R	1021.95	341.40	110.17	33.31	11.08	3.80	1.23	0.53	0.22	0.09
	v	10.20	6.58	4.16	2.55	1.62	1.04	0.65	0.46	0.32	0.21
1.00	R	1246.72	415.58	133.77	40.36	13.39	4.59	1.48	0.64	0.27	0.10
	v	11.33	7.31	4.62	2.83	1.80	1.16	0.72	0.51	0.35	0.24
1.20	R	1761.36	584.86	187.44	56.32	18.63	6.37	2.05	0.89	0.37	0.14
	v	13.60	8.77	5.54	3.40	2.16	1.39	0.87	0.61	0.42	0.29
1.40	R	2362.60	784.32	249.67	74.74	24.65	8.41	2.70	1.17	0.49	0.19
	v	15.86	10.23	6.47	3.97	2.52	1.62	1.01	0.71	0.50	0.33
1.60	R	3050.27	1009.36	320.39	95.60	31.45	10.70	3.43	1.48	0.62	0.24
	v	18.13	11.69	7.39	4.53	2.88	1.85	1.15	0.81	0.57	0.38
1.80	R	3824.26	1261.97	399.56	118.88	39.02	13.25	4.24	1.83	0.76	0.29
	v	20.40	13.15	8.32	5.10	3.24	2.08	1.30	0.92	0.64	0.43
2.00	R	4684.50	1542.10	487.13	144.56	47.34	16.05	5.13	2.21	0.92	0.35
	v	22.66	14.61	9.24	5.67	3.60	2.31	1.44	1.02	0.71	0.48
2.20	R	5630.92	1849.71	584.92	172.62	56.42	19.09	6.10	2.63	1.09	0.42
	v	24.93	16.08	10.17	6.23	3.96	2.54	1.59	1.12	0.78	0.52
2.40	R	6663.50	2184.77	689.39	203.06	66.24	22.38	7.14	3.07	1.28	0.49
	v	27.20	17.54	11.06	6.80	4.32	2.77	1.73	1.22	0.85	0.57
2.60	R	7782.20	2547.26	802.20	235.86	76.81	25.91	8.25	3.55	1.47	0.57
	v	29.46	19.00	12.01	7.37	4.68	3.00	1.88	1.32	0.92	0.62
2.80	R	8986.99	2937.15	923.33	271.02	88.12	29.69	9.44	4.06	1.68	0.65
	v	31.73	20.46	12.94	7.93	5.04	3.23	2.02	1.43	0.99	0.67
3.00	R		3354.43	1052.78	308.54	100.16	33.70	10.70	4.59	1.90	0.73
	v		21.92	13.86	8.50	5.40	3.47	2.17	1.53	1.06	0.71
3.20	R		3799.10	1190.54	348.40	112.93	37.95	12.04	5.16	2.14	0.87
	v		23.38	14.79	9.07	5.76	3.70	2.31	1.63	1.13	0.76
3.40	R		4271.13	1336.61	391.92	126.44	42.43	13.45	5.76	2.39	0.91
	v		24.85	15.71	9.63	6.12	3.93	2.45	1.73	1.20	0.81
3.60	R		4770.53	1490.96	436.53	140.68	47.16	14.93	6.39	2.65	1.01
	v		26.31	16.63	10.20	6.48	4.16	2.60	1.83	1.27	0.86
3.80	R		5297.29	1653.61	483.48	155.64	52.11	16.48	7.06	2.92	1.17
	v		27.77	17.56	10.77	6.84	4.39	2.74	1.94	1.34	0.90
4.00	R		5851.39	1824.55	532.75	171.33	57.30	18.10	7.75	3.20	1.23
	v		29.23	18.48	11.33	7.20	4.62	2.89	2.04	1.41	0.95
4.20	R		6432.84	2003.76	584.35	187.74	62.73	19.80	8.47	3.50	1.34
	v		30.69	19.41	11.90	7.56	4.85	3.03	2.14	1.49	1.00
4.40	R		7041.63	2191.26	638.28	204.87	68.39	21.57	9.22	3.80	1.45
	v		32.15	20.33	12.46	7.92	5.08	3.18	2.24	1.56	1.05

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16x2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6mm	13.2mm	16.6mm	21.2mm	26.6mm	33.2 mm	42.0 mm	50.0 mm	60.0 mm	73.2 mm
4.60	R		7677.76	2387.03	694.53	222.73	74.28	23.40	9.99	4.12	1.58
	v		33.61	21.25	13.03	8.28	5.31	3.32	2.34	1.63	1.03
4.80	R		8341.23	2591.07	753.10	241.30	80.40	25.31	10.80	4.45	1.70
	v		35.08	22.18	13.60	8.64	5.54	3.46	2.44	1.70	1.09
5.00	R		9032.03	2803.39	813.99	261.55	86.75	27.29	11.64	4.80	1.83
	v		36.54	23.10	14.16	9.00	5.78	3.61	2.55	1.77	1.19
5.20	R		9750.16	3023.97	877.20	281.60	93.33	29.33	12.51	5.15	1.97
	v		38.00	24.03	14.73	9.36	6.01	3.75	2.65	1.84	1.24
5.40	R			3252.82	942.73	302.37	100.15	31.45	13.40	5.52	2.11
	v			24.95	15.30	9.72	6.24	3.90	2.75	1.91	1.28
5.60	R			3489.94	1010.58	323.85	107.19	33.64	14.33	5.90	2.25
	v			25.88	15.86	10.08	6.47	4.04	2.85	1.98	1.33
5.80	R			3735.32	1080.74	346.04	114.46	35.89	15.28	6.29	2.40
	v			26.80	16.43	10.44	6.70	4.19	2.95	2.05	1.38
6.00	R			3988.97	1153.21	368.95	121.96	38.22	16.26	6.69	2.55
	v			27.72	17.00	10.80	6.93	4.33	3.06	2.12	1.43
6.20	R			4250.88	1228.00	392.58	129.69	40.61	17.27	7.10	2.70
	v			28.65	17.56	11.16	7.16	4.48	3.16	2.19	1.47
6.40	R			4521.05	1305.10	416.92	137.65	43.07	18.31	7.52	2.87
	v			29.57	18.13	11.52	7.39	4.62	3.26	2.26	1.52
6.60	R			4799.49	1384.52	441.97	145.84	45.60	19.38	7.96	3.03
	v			30.50	18.70	11.88	7.62	4.76	3.36	2.33	1.57
6.80	R			5086.18	1466.24	467.74	154.25	48.20	20.48	8.41	3.20
	v			31.42	19.26	12.24	7.85	4.91	3.46	2.41	1.62
7.00	R			5381.13	1550.28	494.21	162.90	50.87	21.60	8.86	3.27
	v			32.34	19.83	12.60	8.09	5.05	3.57	2.48	1.66
7.50	R			6154.64	1770.48	563.52	186.21	57.84	24.53	10.06	3.82
	v			34.65	21.25	13.50	8.66	5.41	3.82	2.65	1.78
8.00	R			6979.76	2005.11	637.28	210.27	65.24	27.64	11.32	4.30
	v			36.96	22.66	14.40	9.24	5.77	4.07	2.83	1.90
9.00	R			8784.80	2517.66	798.11	262.63	81.30	34.39	14.06	5.33
	v			41.58	25.50	16.20	10.40	6.50	4.58	3.18	2.14
10.00	R				3087.89	976.68	320.63	99.05	41.83	17.08	6.47
	v				28.33	17.99	11.55	7.22	5.09	3.54	2.38

PIPE FRACTION FACTOR & FLOW RATE

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16x2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6 mm	13.2 mm	16.6 mm	21.2 mm	26.6 mm	33.2 mm	42.0 mm	50.0 mm	60.0 mm	73.2 mm
0.01	R	0.28	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	v	0.11	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
0.02	R	0.90	0.32	0.11	0.03	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.23	0.15	0.09	0.06	0.04	0.02	0.01	0.01	0.01	0.00
0.03	R	1.82	0.64	0.22	0.07	0.02	0.01	0.00	0.00	0.00	0.00
	v	0.34	0.22	0.14	0.08	0.05	0.03	0.02	0.02	0.01	0.00
0.04	R	3.02	1.06	0.36	0.11	0.04	0.01	0.00	0.00	0.00	0.00
	v	0.45	0.29	0.18	0.11	0.07	0.05	0.03	0.02	0.01	0.00
0.05	R	4.47	1.56	0.52	0.16	0.06	0.02	0.01	0.00	0.00	0.00
	v	0.57	0.37	0.23	0.14	0.09	0.06	0.04	0.03	0.02	0.00
0.06	R	6.18	2.15	0.72	0.22	0.08	0.03	0.01	0.00	0.00	0.00
	v	0.68	0.44	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.00
0.07	R	8.14	2.83	0.94	0.29	0.10	0.04	0.01	0.01	0.00	0.00
	v	0.79	0.51	0.32	0.20	0.13	0.08	0.05	0.04	0.02	0.00
0.08	R	10.34	3.59	1.19	0.37	0.13	0.04	0.01	0.01	0.00	0.00
	v	0.91	0.58	0.37	0.23	0.14	0.09	0.06	0.04	0.03	0.00
0.09	R	12.77	4.42	1.47	0.46	0.15	0.05	0.02	0.01	0.00	0.00
	v	1.02	0.66	0.42	0.25	0.16	0.10	0.06	0.05	0.03	0.00
0.10	R	15.44	5.34	1.77	0.55	0.19	0.06	0.02	0.01	0.00	0.00
	v	1.13	0.73	0.46	0.28	0.18	0.12	0.07	0.05	0.04	0.00
0.12	R	21.48	7.40	2.45	0.76	0.26	0.09	0.03	0.01	0.01	0.00
	v	1.36	0.88	0.55	0.34	0.22	0.14	0.09	0.06	0.04	0.00
0.14	R	28.43	9.76	3.22	0.99	0.34	0.12	0.04	0.02	0.01	0.00
	v	1.59	1.02	0.65	0.40	0.25	0.16	0.10	0.07	0.05	0.00
0.16	R	36.29	12.43	4.09	1.26	0.42	0.15	0.05	0.02	0.01	0.00
	v	1.81	1.17	0.74	0.45	0.29	0.18	0.12	0.08	0.06	0.00
0.18	R	45.04	15.38	5.05	1.55	0.52	0.18	0.06	0.03	0.01	0.00
	v	2.04	1.32	0.83	0.51	0.32	0.21	0.13	0.09	0.06	0.00
0.20	R	54.69	18.63	6.11	1.87	0.63	0.22	0.07	0.03	0.01	0.01
	v	2.27	1.46	0.92	0.57	0.36	0.23	0.14	0.10	0.07	0.05
0.30	R	116.05	39.19	12.74	3.88	1.30	0.45	0.14	0.06	0.03	0.01
	v	3.40	2.19	1.39	0.85	0.54	0.35	0.22	0.15	0.11	0.07
0.40	R	199.10	66.77	21.56	6.53	2.17	0.75	0.24	0.10	0.04	0.07
	v	4.53	2.92	1.85	1.13	0.72	0.46	0.29	0.20	0.14	0.10
0.50	R	304.37	101.28	32.54	9.80	3.25	1.11	0.36	0.16	0.06	0.03
	v	5.67	3.65	2.31	1.42	0.90	0.58	0.36	0.25	0.18	0.12
0.60	R	430.39	142.66	45.63	13.68	4.52	1.54	0.50	0.21	0.09	0.03
	v	6.80	4.38	2.77	1.70	1.08	0.69	0.43	0.31	0.21	0.14
0.70	R	577.71	191.41	60.82	18.17	5.98	2.04	0.65	0.28	0.12	0.05
	v	7.93	5.12	3.23	1.98	1.26	0.81	0.51	0.36	0.25	0.17

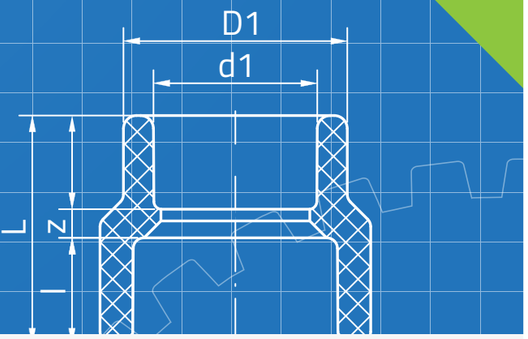
Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16x2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6 mm	13.2 mm	16.6 mm	21.2 mm	26.6 mm	33.2 mm	42.0 mm	50.0 mm	60.0 mm	73.2 mm
0.80	R	746.30	246.48	78.10	23.26	7.64	2.60	0.83	0.36	0.15	0.06
	v	9.07	5.85	3.70	2.27	1.44	0.92	0.58	0.41	0.28	0.19
0.90	R	936.14	308.34	97.45	28.94	9.48	3.22	1.03	0.44	0.18	0.07
	v	10.20	6.58	4.16	2.55	1.62	1.04	0.65	0.46	0.32	0.21
1.00	R	1147.21	376.96	119.25	35.20	11.51	3.90	1.24	0.54	0.22	0.09
	v	11.33	7.31	4.62	2.83	1.80	1.16	0.72	0.51	0.35	0.24
1.20	R	1633.00	534.49	168.32	49.49	16.12	5.44	1.73	0.74	0.31	0.12
	v	13.60	8.77	5.54	3.40	2.16	1.39	0.87	0.61	0.42	0.29
1.40	R	2203.62	719.03	225.60	66.10	21.45	7.21	2.29	0.98	0.41	0.16
	v	15.86	10.23	6.47	3.97	2.52	1.62	1.01	0.71	0.50	0.33
1.60	R	2859.02	930.53	291.06	85.30	27.51	9.23	2.92	1.25	0.52	0.20
	v	18.13	11.69	7.39	4.53	2.88	1.85	1.15	0.81	0.57	0.38
1.80	R	3599.19	1168.99	364.69	106.55	34.28	11.47	3.63	1.55	0.64	0.25
	v	20.40	13.15	8.32	5.10	3.24	2.08	1.30	0.92	0.64	0.43
2.00	R	4424.11	1434.39	446.49	130.10	41.77	13.95	4.40	1.88	0.78	0.30
	v	22.66	14.61	9.24	5.67	3.60	2.31	1.44	1.02	0.71	0.48
2.20	R	5333.78	1726.73	536.44	155.94	49.97	16.65	5.24	2.24	0.92	0.35
	v	24.93	16.08	10.17	6.23	3.96	2.54	1.59	1.12	0.78	0.52
2.40	R	6328.19	2045.99	634.54	184.06	59.09	19.58	6.15	2.62	1.08	0.41
	v	27.20	17.54	11.09	6.80	4.32	2.77	1.73	1.22	0.75	0.57
2.60	R	7407.34	2392.18	740.78	214.47	68.72	22.74	7.13	3.04	1.25	0.48
	v	29.46	19.00	12.01	7.37	4.68	3.00	1.88	1.32	0.92	0.62
2.80	R	8571.21	2765.29	855.16	247.16	79.05	26.13	8.18	3.48	1.43	0.55
	v	31.73	20.46	12.94	7.93	5.04	3.23	2.02	1.43	0.99	0.67
3.00	R	9819.81	3165.32	977.69	282.12	90.09	29.73	9.30	3.95	1.62	0.62
	v	34.00	21.92	13.86	8.50	5.40	3.47	2.17	1.53	1.06	0.71
3.20	R		3592.26	1108.35	319.37	101.83	33.57	10.48	4.45	1.83	0.70
	v		23.38	14.79	9.07	5.76	3.70	2.31	1.63	1.13	0.76
3.40	R		4046.11	1247.15	358.89	114.27	37.63	11.74	4.98	2.04	0.78
	v		24.75	15.71	9.63	6.12	3.93	2.45	1.73	1.20	0.81
3.60	R		4526.88	1394.09	400.68	127.42	42.06	13.06	5.53	2.27	0.86
	v		26.31	16.63	10.20	6.48	4.16	2.60	1.83	1.27	0.86
3.80	R		5034.56	1549.16	444.76	141.26	46.58	14.44	6.12	2.50	0.95
	v		27.77	17.56	10.77	6.84	4.39	2.74	1.94	1.34	0.90
4.00	R		5569.15	1712.36	491.10	155.80	51.31	15.89	6.73	2.75	1.04
	v		29.23	18.48	11.33	7.20	4.62	2.89	2.04	1.41	0.95
4.20	R		6130.65	1883.69	539.72	171.05	56.27	17.41	7.36	3.01	1.14
	v		30.69	19.41	11.90	7.56	4.85	3.03	2.14	1.49	1.00
4.40	R		6719.05	2063.16	590.61	186.99	61.45	19.00	8.03	3.28	1.24
	v		32.15	20.33	12.46	7.96	5.08	3.18	2.24	1.56	1.05

PIPE FRACTION FACTOR & FLOW RATE



Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6 (PN20)

V = circulatory (l/s)		R= pressure gradient (mbar/m)					v= flow rate (m/s)			
dxs >>		16x2.7	20x3.4	25x4.2	32x5.4	40x6.7	50x8.3	63x10.5	75x12.5	90x15.0	110x18.3
V	d i	10.6mm	13.2 mm	16.6 mm	21.2 mm	26.6 mm	33.2 mm	42.0 mm	50.0 mm	60.0 mm	73.2 mm
4.60	R		7334.37	2250.76	643.77	203.63	66.85	20.65	8.72	3.56	1.35
	v		33.61	21.25	13.03	8.28	5.31	3.32	2.34	1.63	1.09
4.80	R		7976.60	2446.49	699.21	220.97	72.47	22.37	9.44	3.85	1.46
	v		35.08	22.18	13.60	8.64	5.54	3.46	2.44	1.70	1.14
5.00	R		8645.73	2650.35	756.92	239.00	78.32	24.16	10.19	4.15	1.57
	v		36.54	23.10	14.16	9.00	5.78	3.61	2.55	1.77	1.19
5.20	R		9341.77	2862.34	816.90	257.74	84.39	26.01	10.96	4.47	1.69
	v		38.00	24.03	14.73	9.36	6.01	3.75	2.65	1.84	1.24
5.40	R			3082.46	879.14	277.17	90.67	28.03	11.76	4.79	1.81
	v			24.95	15.30	9.72	6.24	3.90	2.75	1.91	1.28
5.60	R			3310.71	943.67	297.30	97.18	30.02	12.59	5.13	1.94
	v			25.88	15.86	10.08	6.47	4.04	2.85	1.98	1.33
5.80	R			3547.09	1010.46	318.13	103.91	32.07	13.44	5.47	2.06
	v			26.80	16.43	10.44	6.70	4.19	2.95	2.05	1.38
6.00	R			3791.60	1079.52	339.65	110.86	34.19	14.33	5.83	2.20
	v			27.72	17.00	10.80	6.93	4.33	3.06	2.12	1.43
6.20	R			4044.24	1150.85	361.87	118.03	36.37	15.23	6.19	2.33
	v			28.65	17.56	11.16	7.16	4.48	3.16	2.19	1.47
6.40	R			4305.01	1224.45	384.79	125.42	38.62	16.17	6.57	2.47
	v			29.57	18.13	11.52	7.39	4.62	3.26	2.26	1.52
6.60	R			4573.91	1300.32	408.40	133.03	40.94	17.13	6.96	2.62
	v			30.50	18.70	11.88	7.62	4.76	3.36	2.33	1.57
6.80	R			4850.94	1378.47	432.71	140.87	43.32	18.12	7.35	2.77
	v			31.42	19.26	12.24	7.85	4.91	3.46	2.41	1.62
7.00	R			5136.09	1458.88	457.72	148.92	45.76	19.14	7.76	2.92
	v			32.34	19.83	12.60	8.09	5.05	3.57	2.48	1.66
7.50	R			5884.55	1669.84	523.29	170.01	52.16	21.88	8.83	3.32
	v			34.65	21.25	13.50	8.66	5.41	3.82	2.65	1.78
8.00	R			6683.80	1894.98	593.20	192.49	58.96	24.71	9.96	3.74
	v			36.96	22.66	14.40	9.24	5.77	4.07	2.83	1.90
9.00	R			8434.72	2387.82	746.09	241.55	73.80	30.86	12.42	4.66
	v			41.58	25.50	16.20	10.40	6.50	4.58	3.18	2.14
10.00	R				2937.39	916.37	296.12	90.26	37.67	15.21	5.66
	v				28.33	17.99	11.55	7.22	5.09	3.54	2.38

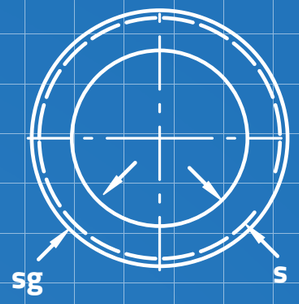
Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x 10.4	90 x 12.5	110 x 15.2
V	d i	11.6 mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
0.01	R	0.23	0.10	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.00	0.00	0.00
0.02	R	0.46	0.19	0.08	0.03	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.19	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00
0.03	R	1.49	0.54	0.12	0.04	0.02	0.01	0.00	0.00	0.00	0.00
	v	0.28	0.18	0.12	0.07	0.05	0.03	0.02	0.01	0.01	0.00
0.04	R	2.44	0.88	0.31	0.06	0.02	0.01	0.00	0.00	0.00	0.00
	v	0.38	0.25	0.16	0.10	0.06	0.04	0.02	0.02	0.01	0.00
0.05	R	3.59	1.29	0.45	0.14	0.03	0.01	0.00	0.00	0.00	0.00
	v	0.47	0.31	0.20	0.12	0.08	0.05	0.03	0.02	0.02	0.00
0.06	R	4.92	1.76	0.61	0.19	0.07	0.01	0.01	0.00	0.00	0.00
	v	0.57	0.37	0.24	0.14	0.09	0.06	0.04	0.03	0.02	0.00
0.07	R	6.43	2.30	0.80	0.25	0.09	0.03	0.01	0.00	0.00	0.00
	v	0.66	0.43	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.00
0.08	R	8.12	2.90	1.01	0.32	0.11	0.04	0.01	0.00	0.00	0.00
	v	0.76	0.49	0.31	0.19	0.12	0.08	0.05	0.03	0.02	0.00
0.09	R	9.99	3.56	1.23	0.39	0.13	0.05	0.02	0.00	0.00	0.00
	v	0.85	0.55	0.35	0.22	0.14	0.09	0.06	0.04	0.03	0.00
0.10	R	12.02	4.28	1.48	0.46	0.16	0.05	0.02	0.00	0.00	0.00
	v	0.95	0.61	0.39	0.24	0.15	0.10	0.06	0.04	0.03	0.00
0.12	R	16.58	5.88	2.03	0.63	0.22	0.07	0.03	0.01	0.00	0.00
	v	1.14	0.74	0.47	0.29	0.18	0.12	0.07	0.05	0.04	0.00
0.14	R	21.78	7.72	2.66	0.83	0.29	0.10	0.03	0.01	0.01	0.00
	v	1.32	0.86	0.55	0.34	0.21	0.14	0.09	0.06	0.04	0.00
0.16	R	27.62	9.76	3.36	1.04	0.36	0.12	0.04	0.02	0.01	0.00
	v	1.51	0.98	0.63	0.39	0.25	0.16	0.10	0.07	0.05	0.00
0.18	R	34.08	12.03	4.13	1.28	0.44	0.15	0.05	0.02	0.01	0.00
	v	1.70	1.11	0.71	0.43	0.28	0.17	0.11	0.08	0.05	0.00
0.20	R	41.16	14.50	4.97	1.54	0.53	0.18	0.06	0.03	0.01	0.00
	v	1.89	1.23	0.79	0.48	0.31	0.19	0.12	0.09	0.06	0.00
0.30	R	85.52	29.92	10.19	3.14	1.07	0.36	0.12	0.05	0.02	0.01
	v	2.84	1.84	1.18	0.72	0.46	0.29	0.18	0.13	0.09	0.06
0.40	R	144.45	50.25	17.04	5.23	1.78	0.60	0.20	0.09	0.04	0.01
	v	3.78	2.46	1.57	0.96	0.61	0.39	0.24	0.17	0.12	0.08
0.50	R	217.60	75.36	25.45	7.79	2.64	0.88	0.29	0.13	0.05	0.02
	v	4.73	3.07	1.96	1.20	0.77	0.49	0.31	0.22	0.15	0.10
0.60	R	304.78	105.14	35.38	10.79	3.65	1.22	0.41	0.18	0.08	0.03
	v	5.68	3.68	2.36	1.44	0.92	0.58	0.37	0.26	0.18	0.12
0.70	R	405.84	139.52	46.81	14.24	4.81	1.60	0.53	0.23	0.10	0.04
	v	6.62	4.30	2.75	1.68	1.07	0.68	0.43	0.30	0.21	0.14

PIPE FRACTION FACTOR & FLOW RATE



Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x10.4	90 x12.5	110 x15.2
V	d i	11.6 mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
0.80	R	520.68	178.47	59.71	18.11	6.11	2.03	0.67	0.29	0.12	0.05
	v	7.57	4.91	3.14	1.93	1.23	0.78	0.49	0.35	0.24	0.16
0.90	R	649.23	221.93	74.06	22.41	7.54	2.51	0.83	0.36	0.15	0.06
	v	8.52	5.53	3.54	2.17	1.38	0.87	0.55	0.39	0.27	0.18
1.00	R	791.45	269.88	89.86	27.13	9.12	3.03	1.00	0.44	0.18	0.07
	v	9.46	6.14	3.93	2.41	1.54	0.97	0.61	0.43	0.30	0.20
1.20	R	1119.70	379.18	125.78	37.82	12.67	4.19	1.38	0.60	0.25	0.10
	v	11.35	7.37	4.72	2.89	1.84	1.17	0.73	0.52	0.36	0.24
1.40	R	1499.59	506.22	167.26	50.13	16.75	5.53	1.82	0.79	0.33	0.13
	v	13.25	8.60	5.50	3.37	2.15	1.36	0.86	0.61	0.42	0.28
1.60	R	1933.55	650.91	214.40	64.07	21.35	7.04	2.31	1.01	0.42	0.16
	v	15.14	9.82	6.29	3.85	2.46	1.55	0.98	0.69	0.48	0.32
1.80	R	2421.48	815.49	267.11	79.59	26.47	8.71	2.85	1.24	0.52	0.20
	v	17.03	11.05	7.07	4.33	2.76	1.75	1.10	0.78	0.54	0.36
2.00	R	2963.31	995.51	325.37	96.70	32.09	10.54	3.45	1.50	0.63	0.24
	v	18.92	12.28	7.86	4.81	3.07	1.94	1.22	0.87	0.60	0.40
2.20	R	3558.98	1193.02	389.15	115.39	38.22	12.53	4.10	1.78	0.74	0.28
	v	20.82	13.51	8.65	5.30	3.38	2.14	1.35	0.95	0.66	0.44
2.40	R	4208.48	1407.98	458.44	135.64	44.85	14.68	4.79	2.08	0.87	0.33
	v	22.71	14.74	9.43	5.78	3.68	2.33	1.47	1.04	0.72	0.48
2.60	R	4911.76	1640.39	534.89	157.45	51.98	16.99	5.54	2.40	1.00	0.38
	v	24.60	15.96	10.22	6.26	3.99	2.53	1.59	1.13	0.78	0.52
2.80	R	5668.81	1890.23	615.26	180.82	59.60	19.46	6.33	2.75	1.14	0.43
	v	26.49	17.19	11.00	6.74	4.30	2.72	1.71	1.21	0.84	0.56
3.00	R	6479.61	2157.47	701.10	205.73	67.71	22.08	7.18	3.11	1.29	0.49
	v	28.39	18.42	11.79	7.22	4.61	2.91	1.84	1.30	0.90	0.60
3.20	R	7344.14	2442.11	792.39	232.18	76.31	24.85	8.07	3.50	1.45	0.55
	v	30.28	19.65	12.58	7.70	4.91	3.11	1.96	1.39	0.96	0.64
3.40	R	8262.40	2744.15	889.14	260.18	85.39	27.77	9.01	3.90	1.62	0.61
	v	32.17	20.88	13.36	8.18	5.22	3.30	2.08	1.47	1.02	0.68
3.60	R	9234.38	3063.57	991.34	289.71	94.97	30.85	10.00	4.33	1.80	0.68
	v	34.06	22.10	14.15	8.66	5.53	3.50	2.20	1.56	1.08	0.72
3.80	R		3400.36	1098.99	320.78	105.02	34.08	11.04	4.77	1.98	0.75
	v		23.33	14.93	9.15	5.83	3.69	2.33	1.65	1.15	0.76
4.00	R		3754.53	1212.07	354.57	115.56	37.46	12.12	5.24	2.17	0.82
	v		24.56	15.72	9.63	6.14	3.89	2.45	1.73	1.21	0.80
4.20	R		4126.07	1330.59	388.75	126.58	41.00	13.25	5.72	2.37	0.89
	v		25.79	16.50	10.11	6.45	4.08	2.57	1.82	1.27	0.84
4.40	R		4514.97	1454.54	424.46	138.09	44.68	14.43	6.23	2.58	0.97
	v		27.02	17.29	10.59	6.75	4.28	2.69	1.91	1.33	0.88

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 60 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 6

V = circulatory (l/s)		R= pressure gradient (mbar/m)						v= flow rate (m/s)			
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x 10.4	90 x12.5	110 x 15.2
V	d i	11.6mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
4.60	R		4921.23	1583.93	461.69	150.07	48.51	15.66	6.75	2.80	1.05
	v		28.25	18.08	11.07	7.06	4.47	2.82	1.99	1.39	0.92
4.80	R		5344.85	1718.74	500.44	162.53	52.49	16.93	7.30	3.02	1.14
	v		29.47	18.86	11.55	7.37	4.66	2.94	2.08	1.45	0.96
5.00	R		5785.83	1858.98	540.71	175.47	56.62	18.25	7.86	3.25	1.22
	v		30.70	19.65	12.03	7.68	4.86	3.06	2.17	1.51	1.00
5.20	R		6244.16	2004.64	582.51	188.89	60.89	19.61	8.44	3.49	1.31
	v		31.93	20.43	12.52	7.98	5.05	3.18	2.25	1.57	1.04
5.40	R		6719.85	2155.73	625.82	202.78	65.32	21.02	9.05	3.74	1.40
	v		33.16	21.22	13.00	8.29	5.25	3.31	2.34	1.63	1.09
5.60	R		7212.88	2312.24	670.65	217.15	69.89	22.48	9.67	4.00	1.50
	v		34.39	22.01	13.48	8.60	5.44	3.43	2.43	1.69	1.13
5.80	R		7723.26	2474.18	717.00	232.86	74.61	23.98	10.31	4.26	1.60
	v		35.61	22.79	13.96	8.90	5.64	3.55	2.51	1.75	1.17
6.00	R		8250.99	2641.53	764.86	248.21	79.48	25.52	10.97	4.53	1.70
	v		36.84	23.58	14.44	9.21	5.83	3.67	2.60	1.81	1.21
6.20	R		8796.07	2814.30	814.25	264.03	84.50	27.12	11.65	4.81	1.80
	v		38.07	24.36	14.92	9.52	6.02	3.80	2.69	1.87	1.25
6.40	R		9358.49	2992.49	865.14	280.33	89.66	28.76	12.35	5.10	1.91
	v		39.30	25.15	15.40	9.82	6.22	3.92	2.77	1.93	1.29
6.60	R		9938.26	3176.09	917.55	297.09	94.97	30.44	13.07	5.39	2.02
	v		40.53	25.94	15.89	10.13	6.41	4.04	2.86	1.99	1.33
6.80	R			3365.11	971.48	314.34	100.42	32.17	13.80	5.69	2.13
	v			26.72	16.37	10.44	6.61	4.16	2.95	2.05	1.37
7.00	R			3559.55	1026.92	332.05	106.02	33.94	14.56	6.00	2.25
	v			27.51	16.85	10.75	6.80	4.29	3.03	2.11	1.41
7.50	R			4069.34	1172.13	378.40	120.66	38.57	16.53	6.81	2.55
	v			29.47	18.05	11.51	7.29	4.59	3.25	2.26	1.51
8.00	R			4612.96	1326.80	427.70	136.21	43.48	18.62	7.66	2.86
	v			31.44	19.26	12.28	7.77	4.90	3.47	2.41	1.61
9.00	R			5801.69	1664.46	535.13	170.68	54.14	23.14	9.51	3.55
	v			35.37	21.66	13.82	8.74	5.51	3.90	2.71	1.81
10.00	R			7125.70	2039.87	654.31	208.18	65.91	28.13	11.55	4.30
	v			39.30	24.07	15.35	9.72	6.12	4.33	3.01	2.01

PIPE FRACTION FACTOR & FLOW RATE

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 7.4 (PN20) I Stabi Composite Pipe

= circulatory (l/s)		R= pressure gradient (mbar/m)					v= flow rate (m/s)				
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x 10.4	90 x 12.5	110 x 15.2
V	d i	11.6 mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
0.01	R	0.18	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
	v	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.00	0.00	0.00
0.02	R	0.59	0.21	0.07	0.02	0.01	0.00	0.00	0.00	0.00	0.00
	v	0.19	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00
0.03	R	1.19	0.42	0.15	0.05	0.02	0.00	0.00	0.00	0.00	0.00
	v	0.28	0.18	0.12	0.07	0.05	0.03	0.02	0.01	0.01	0.00
0.04	R	1.96	0.70	0.24	0.08	0.03	0.01	0.00	0.00	0.00	0.00
	v	0.38	0.25	0.16	0.10	0.06	0.04	0.02	0.02	0.01	0.00
0.05	R	2.90	1.03	0.36	0.11	0.04	0.01	0.00	0.00	0.00	0.00
	v	0.47	0.31	0.20	0.12	0.08	0.05	0.03	0.02	0.02	0.00
0.06	R	4.01	1.42	0.49	0.15	0.05	0.02	0.01	0.00	0.00	0.00
	v	0.57	0.37	0.24	0.14	0.09	0.06	0.04	0.03	0.02	0.00
0.07	R	5.27	1.86	0.64	0.20	0.07	0.02	0.01	0.00	0.00	0.00
	v	0.66	0.43	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.00
0.08	R	6.68	2.36	0.81	0.25	0.09	0.03	0.01	0.00	0.00	0.00
	v	0.76	0.49	0.31	0.19	0.12	0.08	0.05	0.03	0.02	0.00
0.09	R	8.25	2.91	1.00	0.31	0.11	0.04	0.01	0.01	0.00	0.00
	v	0.85	0.55	0.35	0.22	0.14	0.09	0.06	0.04	0.03	0.00
0.10	R	9.97	3.51	1.20	0.37	0.13	0.04	0.01	0.01	0.00	0.00
	v	0.95	0.61	0.39	0.24	0.15	0.10	0.06	0.04	0.03	0.00
0.12	R	13.85	4.86	1.66	0.51	0.18	0.06	0.02	0.01	0.00	0.00
	v	1.14	0.74	0.47	0.29	0.18	0.12	0.07	0.05	0.04	0.00
0.14	R	18.31	6.40	2.18	0.67	0.23	0.08	0.03	0.01	0.00	0.00
	v	1.32	0.86	0.55	0.34	0.21	0.14	0.09	0.06	0.04	0.00
0.16	R	23.34	8.14	2.77	0.85	0.29	0.10	0.03	0.01	0.01	0.00
	v	1.51	0.98	0.63	0.39	0.25	0.16	0.10	0.07	0.05	0.00
0.18	R	28.93	10.07	3.42	1.05	0.36	0.12	0.04	0.02	0.01	0.00
	v	1.70	1.11	0.71	0.43	0.28	0.17	0.11	0.08	0.05	0.00
0.20	R	35.09	12.19	4.13	1.27	0.43	0.14	0.05	0.02	0.01	0.00
	v	1.89	1.23	0.79	0.48	0.31	0.19	0.12	0.09	0.06	0.00
0.30	R	74.18	25.55	8.58	2.61	0.88	0.30	0.10	0.04	0.02	0.01
	v	2.84	1.84	1.18	0.72	0.46	0.29	0.18	0.13	0.09	0.06
0.40	R	126.91	43.42	14.50	4.39	1.48	0.49	0.16	0.07	0.03	0.01
	v	3.78	2.46	1.57	0.96	0.61	0.39	0.24	0.17	0.12	0.08
0.50	R	193.69	65.73	21.84	6.58	2.21	0.73	0.24	0.11	0.04	0.02
	v	4.73	3.07	1.96	1.20	0.77	0.49	0.31	0.22	0.15	0.10
0.60	R	273.37	92.42	30.59	9.18	3.07	1.02	0.33	0.15	0.06	0.02
	v	5.68	3.68	2.36	1.44	0.92	0.58	0.37	0.26	0.18	0.12
0.70	R	366.39	123.47	40.72	12.18	4.06	1.34	0.44	0.19	0.08	0.03
	v	6.62	4.30	2.75	1.68	1.07	0.68	0.43	0.30	0.21	0.14

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: 0.0070 mm
Sp. Density: 998.00 kg/m³
Temperature: 20 °C
Viscosity: 1.02x10⁻⁶m²/s

MetiTherm Pipe SDR 7.4 I Stabi Composite Pipe

V = circulatory (l/s)		R= pressure gradient (mbar/m)					v= flow rate (m/s)				
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x 10.4	90 x 12.5	110 x 15.2
V	d i	11.6 mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
0.80	R	472.71	159.33	52.23	15.58	5.18	1.71	0.56	0.24	0.10	0.04
	v	7.57	4.91	3.14	1.93	1.23	0.78	0.49	0.35	0.24	0.16
0.90	R	592.31	199.09	65.10	19.36	6.43	2.11	0.69	0.30	0.13	0.05
	v	8.52	5.53	3.54	2.17	1.38	0.87	0.55	0.39	0.27	0.18
1.00	R	725.17	243.16	79.34	23.53	7.80	2.56	0.84	0.36	0.15	0.06
	v	9.46	6.14	3.93	2.41	1.54	0.97	0.61	0.43	0.30	0.20
1.20	R	1030.66	344.20	112.23	33.04	10.91	3.57	1.16	0.50	0.21	0.08
	v	11.35	7.37	4.72	2.89	1.84	1.17	0.73	0.52	0.36	0.24
1.40	R	1389.12	462.41	150.22	44.07	14.50	4.73	1.54	0.67	0.28	0.10
	v	13.25	8.60	5.50	3.37	2.15	1.36	0.86	0.61	0.42	0.28
1.60	R	1800.52	597.75	193.59	56.62	18.57	6.04	1.96	0.85	0.35	0.13
	v	15.14	9.82	6.29	3.85	2.46	1.55	0.98	0.69	0.48	0.32
1.80	R	2264.83	750.22	242.32	70.93	23.13	7.50	2.43	1.05	0.44	0.16
	v	17.03	11.05	7.07	4.33	2.76	1.75	1.10	0.78	0.54	0.36
2.00	R	2782.05	919.80	296.41	86.53	28.16	9.11	2.94	1.27	0.53	0.20
	v	18.92	12.28	7.86	4.81	3.07	1.94	1.22	0.87	0.60	0.40
2.20	R	3352.17	1106.49	355.85	103.63	33.66	10.87	3.51	1.51	0.63	0.24
	v	20.82	13.51	8.65	5.30	3.38	2.14	1.35	0.95	0.66	0.44
2.40	R	3975.17	1310.27	420.64	122.22	39.63	12.78	4.11	1.77	0.73	0.28
	v	22.71	14.74	9.43	5.78	3.68	2.33	1.47	1.04	0.72	0.48
2.60	R	4651.06	1531.15	490.77	142.32	46.07	14.83	4.77	2.05	0.85	0.32
	v	24.60	15.96	10.22	6.26	3.99	2.53	1.59	1.13	0.78	0.52
2.80	R	5379.84	1769.13	566.24	163.91	53.17	17.02	5.47	2.35	0.97	0.36
	v	26.49	17.19	11.00	6.74	4.30	2.72	1.71	1.21	0.84	0.56
3.00	R	6161.49	2024.19	647.05	186.99	60.56	19.36	6.21	2.67	1.10	0.41
	v	28.39	18.42	11.79	7.22	4.61	2.91	1.84	1.30	0.90	0.60
3.20	R	6996.02	2296.33	733.20	211.56	68.42	21.85	7.00	3.00	1.24	0.46
	v	30.28	19.65	12.58	7.70	4.91	3.11	1.96	1.39	0.96	0.64
3.40	R	7883.42	2585.57	824.68	237.63	76.74	24.48	7.83	3.35	1.38	0.52
	v	32.17	20.88	13.36	8.18	5.22	3.30	2.08	1.47	1.02	0.68
3.60	R	8823.70	2891.88	921.50	265.18	85.53	27.25	8.70	3.73	1.54	0.57
	v	34.06	22.10	14.15	8.66	5.53	3.50	2.20	1.56	1.08	0.72
3.80	R	9816.85	3215.28	1023.65	294.23	94.78	30.17	9.62	4.12	1.69	0.63
	v	35.96	23.33	14.93	9.15	5.83	3.69	2.33	1.65	1.15	0.76
4.00	R		3555.76	1131.13	324.76	104.50	33.23	10.59	4.53	1.86	0.69
	v		24.56	15.72	9.63	6.14	3.89	2.45	1.73	1.21	0.80
4.20	R		3913.33	1243.94	356.78	114.67	36.57	11.60	4.96	2.04	0.76
	v		25.79	16.50	10.11	6.45	4.08	2.57	1.82	1.27	0.84
4.40	R		4287.97	1362.08	390.29	125.32	39.91	12.65	5.40	2.22	0.83
	v		27.02	17.29	10.59	6.75	4.28	2.69	1.91	1.33	0.88

PIPE FRACTION FACTOR & FLOW RATE

Pipe friction factor R and calculated flow rate V in dependence on the circulatory V

Roughness: **0.0070 mm** **Temperature:** **20 °C**
Sp. Density: **998.00 kg/m³** **Viscosity:** **1.02x10⁻⁶m²/s**

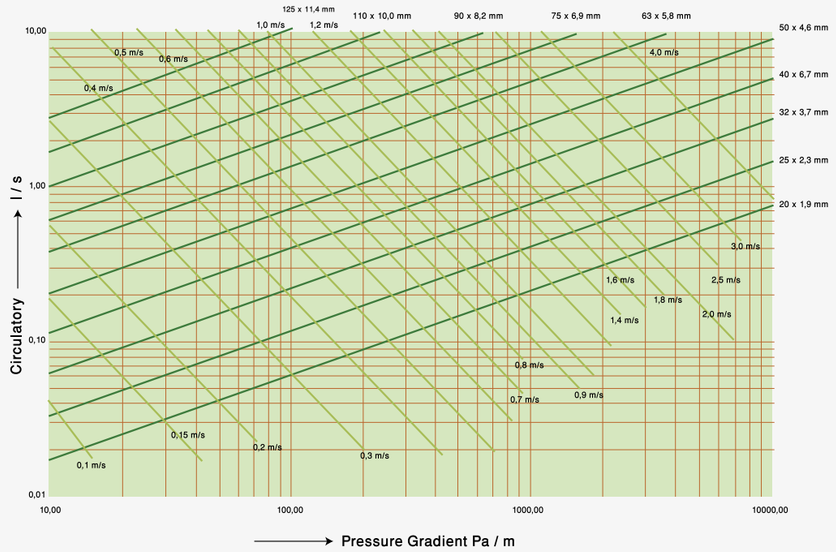
MetiTherm Pipe SDR 7.4 I Stabi Composite Pipe

V = circulatory (l/s)		R= pressure gradient (mbar/m)					v= flow rate (m/s)			
dxs >>		16 x 2.2	20 x 2.8	25 x 3.5	32 x 4.5	40 x 5.6	50 x 6.9	63 x 8.7	75 x 10.4	90 x 12.5	110 x 15.2
V	d i	11.6 mm	14.4 mm	18.0 mm	23.0 mm	28.8 mm	36.2 mm	45.6 mm	54.2 mm	65.0 mm	79.6 mm
4.60	R		4679.70	1485.56	425.28	136.42	43.41	13.74	5.86	2.41	0.90
	v		28.25	18.08	11.07	7.06	4.47	2.82	1.99	1.39	0.92
4.80	R		5088.50	1614.36	461.77	147.99	47.04	14.88	6.35	2.60	0.97
	v		29.47	18.86	11.55	7.37	4.66	2.94	2.08	1.45	0.96
5.00	R		5514.38	1748.49	499.73	160.01	50.82	16.06	6.85	2.81	1.04
	v		30.70	19.65	12.03	7.68	4.86	3.06	2.17	1.51	1.00
5.20	R		5957.35	1887.95	539.19	172.50	54.73	17.29	7.36	3.02	1.12
	v		31.93	20.43	12.52	7.98	5.05	3.18	2.25	1.57	1.04
5.40	R		6417.39	2032.75	580.13	185.46	58.79	18.56	7.90	3.24	1.20
	v		33.16	21.22	13.00	8.29	5.25	3.31	2.34	1.63	1.09
5.60	R		6894.51	2182.87	622.55	198.87	62.99	19.87	8.45	3.46	1.29
	v		34.39	22.01	13.48	8.60	5.44	3.43	2.43	1.69	1.13
5.80	R		7388.70	2338.31	666.46	212.75	67.33	21.23	9.03	3.69	1.37
	v		35.61	22.79	13.96	8.90	5.64	3.55	2.51	1.75	1.17
6.00	R		7899.98	2499.09	711.86	227.08	71.81	22.62	9.61	3.93	1.46
	v		36.84	23.58	14.44	9.21	5.83	3.67	2.60	1.81	1.21
6.20	R		8428.34	2665.19	758.74	241.88	76.44	24.16	10.22	4.18	1.55
	v		38.07	24.36	14.92	9.52	6.02	3.80	2.69	1.87	1.25
6.40	R		8973.77	2836.63	807.11	257.14	81.20	25.65	10.85	4.43	1.64
	v		39.30	25.15	15.40	9.82	6.22	3.92	2.77	1.93	1.29
6.60	R		9536.28	3013.39	856.96	272.86	86.11	27.18	11.49	4.69	1.74
	v		40.53	25.94	15.89	10.13	6.41	4.04	2.86	1.99	1.33
6.80	R			3195.48	908.29	289.04	91.15	28.75	12.15	4.96	1.84
	v			26.72	16.37	10.44	6.61	4.16	2.95	2.05	1.37
7.00	R			3382.89	961.11	305.68	96.34	30.37	12.83	5.23	1.94
	v			27.51	16.85	10.75	6.80	4.29	3.03	2.11	1.41
7.50	R			3874.74	1099.66	349.30	109.92	34.60	14.60	5.95	2.20
	v			29.47	18.05	11.51	7.29	4.59	3.25	2.26	1.51
8.00	R			4399.89	1247.48	395.80	124.38	39.09	16.48	6.71	2.48
	v			31.44	19.26	12.28	7.77	4.90	3.47	2.41	1.61
9.00	R			5550.06	1570.95	497.44	155.94	48.88	20.66	8.36	3.08
	v			35.37	21.66	13.82	8.74	5.51	3.90	2.71	1.81
10.00	R			6833.41	1931.52	610.57	191.01	59.73	25.20	10.19	3.75
	v			39.30	24.07	15.35	9.72	6.12	4.33	3.01	2.01

PRESSURE GRADIENT DIAGRAM

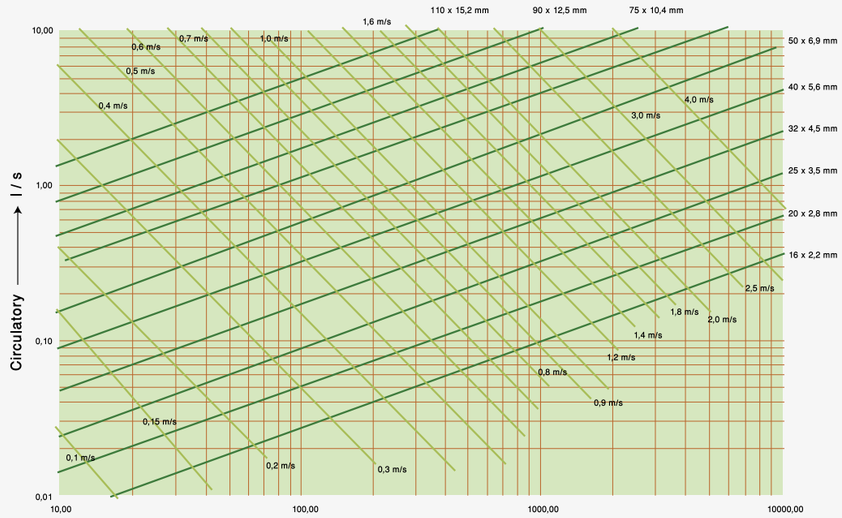
MetiTherm Pipe SDR 11 (PN10)

Temperature: **20 °C**

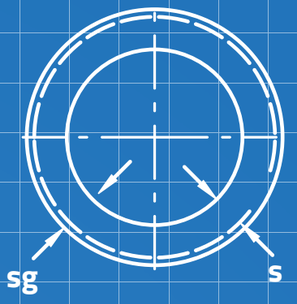


MetiTherm Pipe SDR 7.4 (PN16)

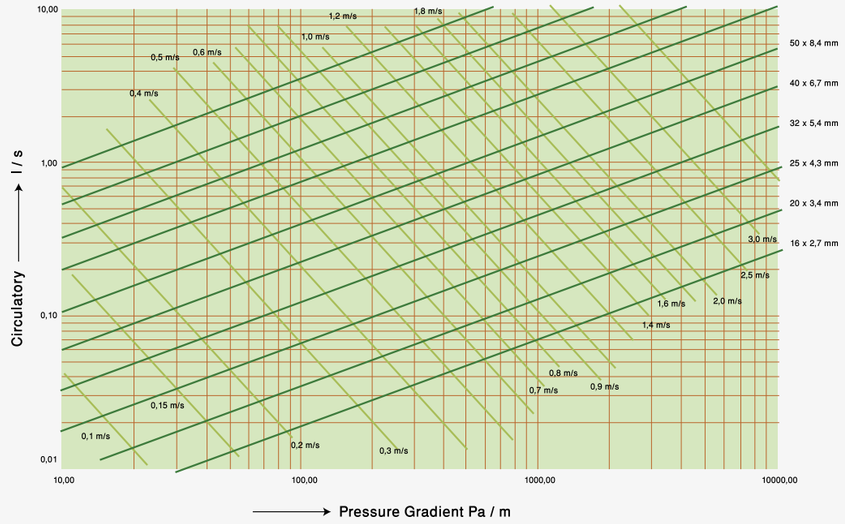
Temperature: **20 °C**



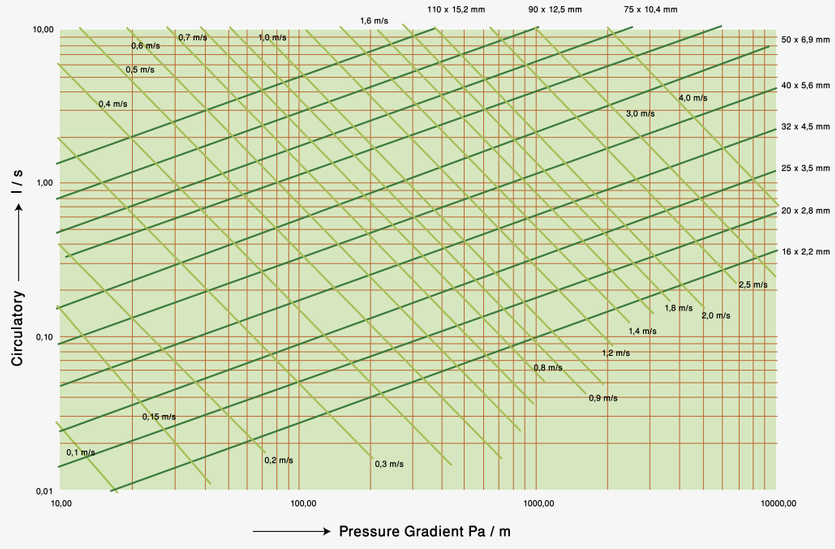
PRESSURE GRADIENT DIAGRAM



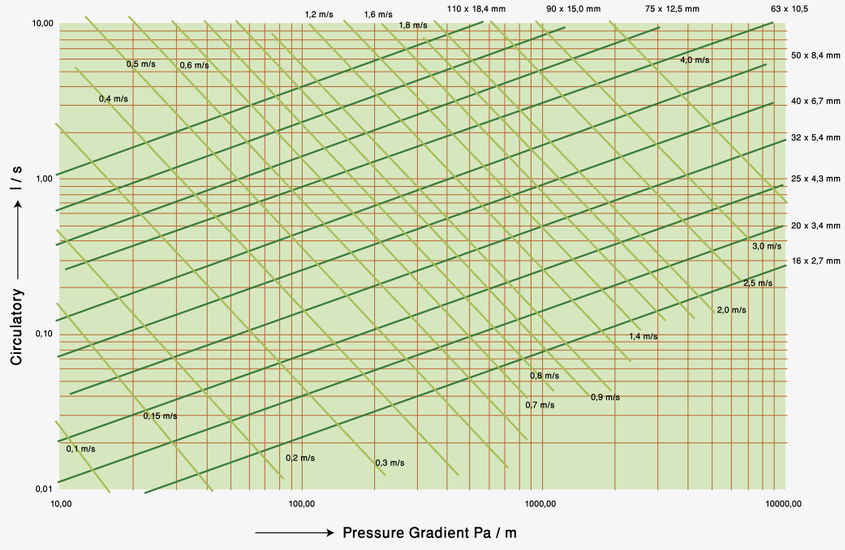
MetiTherm Pipe SDR 6 (PN20) Temperature: 20 °C



MetiTherm Pipe SDR 7.4 (PN16) Temperature: 60 °C



MetiTherm Pipe SDR 6 (PN20) Temperature: 60 °C



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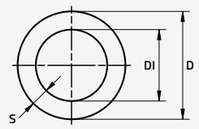
P.P.R PIPES

Propylene Random Copolymer Pipes

METITHERM GREEN PIPE - SDR 11

Material: PP-R
Pipe Series: SDR 11 – PN 10
Standards: DIN 8077/8078
Colour: Green
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:



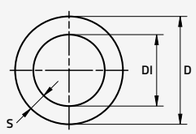
PN 10

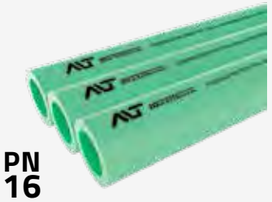
SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
11	114032429	32	2.9	26.2	0.539	40
	114040437	40	3.7	32.6	0,834	40
	114050446	50	4.6	40.8	1.307	20
	114063458	63	5.8	51.4	2.074	12
	114075468	75	6.8	61.4	2.959	12
	114090482	90	8.2	73.6	4.252	8
	114110410	110	10.0	90.0	6.359	8

P.P.R PIPES

METITHERM GREEN PIPE - SDR 7,4

Material: PP-R
Pipe Series: SDR 7,4 MS – PN 16
Standards: DIN 8077/8078
Colour: Green
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:



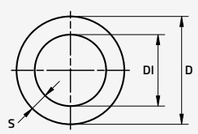


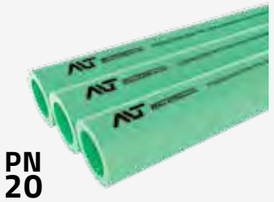
PN 16

SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
7,4	1140202804	20	2.8	14.4	0.163	80
	11402503504	25	3.5	18.0	0.254	80
	11403204404	32	4.4	23.0	0.415	40
	11404005504	40	5.5	28.8	0.651	40
	11405006904	50	6.9	36.2	1.029	20
	11406307104	63	7.10	45.6	1.632	12
	11407508404	75	8.4	54.4	2.306	12
	11409010104	90	10.10	65.4	3.317	8
	11411015104	110	15.10	79.8	4.974	8

METITHERM GREEN PIPE - SDR 6

Material: PP-R
Pipe Series: SDR 6 – PN20
Standards: DIN 8077/8078
Colour: Green
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:



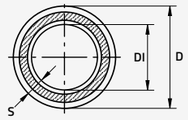


PN 20

SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
6	114020400	20	3.4	13.2	0.137	80
	114025400	25	4.2	16.6	0.216	80
	114032400	32	5.4	21.2	0.353	40
	114040400	40	6.7	26.6	0.555	40
	114050400	50	8.3	33.4	0.876	20
	114063400	63	10.5	42.0	1.385	12
	114075400	75	12.5	50.0	1.963	12
	114090400	90	15.0	60.0	2.826	8
	114110400	110	18.3	73.4	4.229	8

P.P.R PIPES

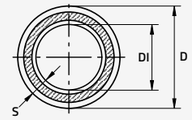
METITHERM FIBER PIPE - SDR 7,4



Material: PP-R
Pipe Series: SDR 7.4
Standards: DIN 8077/8078
Colour: GREEN
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:

SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
7.4	11410204016	20	2.8	14.4	0.163	80
	11410254016	25	3.5	18.0	0.254	80
	11410324016	32	4.4	23.0	0.415	40
	11410404016	40	5.5	28.8	0.651	40
	11410504016	50	6.9	36.2	1.029	20
	11410634016	63	7.10	45.6	1.632	12
	11410754016	75	8.4	54.4	2.306	12
	11410904016	90	10.10	65.4	3.317	8
	11411104016	110	15.10	79.8	4.974	8

METITHERM FIBER PIPE - SDR 6



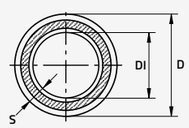
Material: PP-R
Pipe Series: SDR 6
Standards: DIN 8077/8078
Colour: GREEN
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:

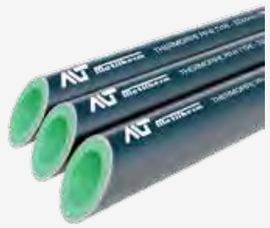
SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
6	11410204020	20	3.4	13.2	0.137	80
	11410254020	25	4.2	16.6	0.216	80
	11410324020	32	5.4	21.2	0.353	40
	11410404020	40	6.7	26.6	0.555	40
	11410504020	50	8.3	33.4	0.876	20
	11410634020	63	10.5	42.0	1.385	12
	11410754020	75	12.5	50.0	1.963	12
	11410904020	90	15.0	60.0	2.826	8
	11411104020	110	18.3	73.4	4.229	8

P.P.R PIPES

METITHERM STABI COMPOSITE PIPE

Material: PP-R
Pipe Series: SDR 7.4
Standards: DIN 8077/8078
Colour: Black
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:

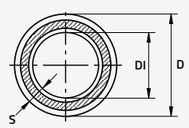


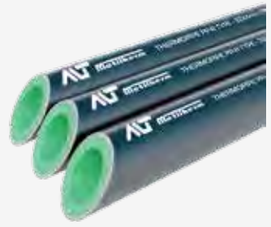


SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
7.4	11414204016	20	2.8	14.4	0.163	80
	11414254016	25	3.5	18.0	0.254	80
	11414324016	32	4.4	23.0	0.415	40
	11414404016	40	5.5	28.8	0.651	40
	11414504016	50	6.9	36.2	1.029	20
	11414634016	63	7.10	45.6	1.632	12
	11414754016	75	8.4	54.4	2.306	12
	11414904016	90	10.10	65.4	3.317	8
	11441104016	110	15.10	79.8	4.974	8

METITHERM STABI COMPOSITE PIPE

Material: PP-R
Pipe Series: SDR 6
Standards: DIN 8077/8078
Colour: Black
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:



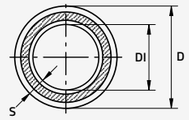


SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
6	11414204020	20	3,4	13,2	0,137	80
	11414254020	25	4,2	16,6	0,216	80
	11414324020	32	5,4	21,2	0,353	40
	11414404020	40	6,7	26,6	0,555	40
	11414504020	50	8,3	33,4	0,876	20
	11414634020	63	10,5	42,0	1,385	12
	11414754020	75	12,5	50,0	1,963	12
	11414904020	90	15	60,0	2,826	8
	114141104020	110	18,3	73,4	4,229	8

P.P.R PIPES

METITHERM FIBER UV RESISTANT

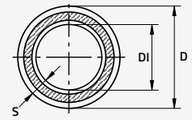
Material: PP-R
Pipe Series: SDR 7.4
Standards: DIN 8077/8078
Colour: Black
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:

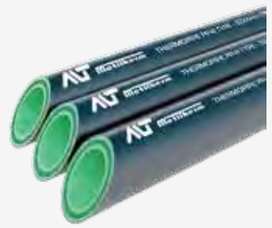


SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
7.4	11410204017	20	2.8	14.4	0.163	80
	11410254017	25	3.5	18.0	0.254	80
	11410324017	32	4.4	23.0	0.415	40
	11410404017	40	5.5	28.8	0.651	40
	11410504017	50	6.9	36.2	1.029	20
	11410634017	63	7.10	45.6	1.632	12
	11410754017	75	8.4	54.4	2.306	12
	11410904017	90	10.10	65.4	3.317	8
	11411104017	110	15.10	79.8	4.974	8

METITHERM FIBER UV RESISTANT

Material: PP-R
Pipe Series: SDR 6
Standards: DIN 8077/8078
Colour: Black
Form supplied: 4m straight lengths, also* in coils
Packing Unit: PU in Meter
Application:





SDR	CODE	Dimension d [mm]	Wall thickness s [mm]	Internal diameter di [mm]	Water content [l/m]	PU in Meter
6	11410204021	20	3,4	13,2	0,137	80
	11410254021	25	4,2	16,6	0,216	80
	11410324021	32	5,4	21,2	0,353	40
	11410404021	40	6,7	26,6	0,555	40
	11410504021	50	8,3	33,4	0,876	20
	11410634021	63	10,5	42,0	1,385	12
	11410754021	75	12,5	50,0	1,963	12
	11410904021	90	15	60,0	2,826	8
	11411104021	110	18,3	73,4	4,229	8

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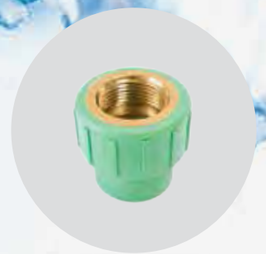
P.P.R FITTINGS

Propylene Random Copolymer Fittings

MALE ADAPTER BRASS THREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225039020012	20 x 2/1"	100
1225039020034	20 x 4/3"	80
1225039025012	25 x 2/1"	80
1225039025034	25 x 4/3"	70
1225039032012	32 x 2/1"	50
1225039032034	32 x 4/3"	50
1225039032100	32 X 1"	40



FEMALE ADAPTER BRASS TREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225042020012	20 x 2/1"	100
1225042020034	20 x 4/3"	100
1225042025012	25 x 2/1"	80
1225042025034	25 x 4/3"	80
1225042032012	32 x 2/1"	80
1225042032034	32 x 4/3"	80
1225042032100	32 X 1"	40

ELBOW 90° MALE THREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225017020012	20 x 2/1"	80
1225017020034	20 x 4/3"	70
1225017025012	25 x 2/1"	70
1225017025034	25 x 4/3"	60
1225017032034	32 x 4/3"	30
1225017032100	32 x 1"	30

ELBOW 90°FEMALE THREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225019020012	20 x 2/1"	80
1225019020034	20 x 4/3"	80
1225019025012	25 x 2/1"	70
1225019025034	25 x 4/3"	70
1225019032034	32 x 4/3"	30
1225019032100	32 x 1"	30

P.P.R FITTINGS

TEE 90˚ FEMALE THREADED PN25

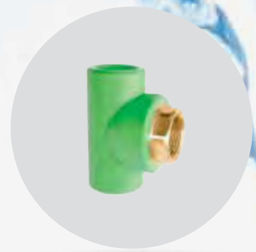
CODE	SIZE (mm)	PCS / BOX
1225049020012	20 x 2/1"	60
1225049020034	20 x 4/3"	60
1225049025012	25 x 2/1"	60
1225049025034	25 x 4/3"	60
1225049032034	32 x 4/3"	40
1225049032100	32 x 1"	30

ELBOW 90 ˚ FEMALE THREADED WALL MOUNT PN 25

CODE	SIZE (mm)	PCS / BAG
1225014020012	20 x 2/1"	60
1225014025012	25 x 2/1"	60
1225014032100	32 x 1"	20

ELBOW 90˚HEX. FEMALE THREADED PN25

CODE	SIZE (mm)	PCS / BAG
1225018032100	32 x 1"	20

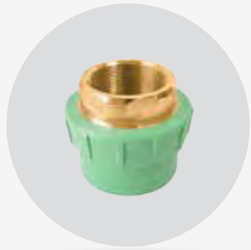


TEE 90˚ HEX. FEMALE THREADED PN25

CODE	SIZE (mm)	PCS / BAG
1225048032100	32 x 1"	20

MALE ADAPTER HEXAGONAL PN25

CODE	SIZE (mm)	PCS / BOX
1225033025034	25 x 4/3"	70
1225033032100	32 x 1"	40
1225033040114	40 x 4/11"	20
1225033050112	50 x 2/11"	12
1225033063200	63 x 2"	10
1225033075212	75 x 2/21"	6
1225033090300	90 x 3"	4
1225033110400	110 x 4"	2



FEMALE ADAPTER HEXAGONAL PN25

CODE	SIZE (mm)	PCS / BOX
1225043032100	32 x 1"	30
1225043010114	40 x 4/1 1"	20
1225043050112	50 x 2/1 1"	12
1225043063200	63 x 2"	8
1225043075212	75 x 2/1 2"	6
1225043090300	90 x 3"	4
1225043110400	110 x 4"	2

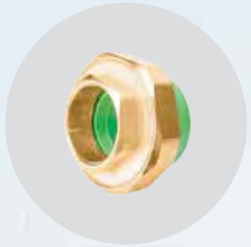
DOUBLE FEMALE ELBOW 90˚W/ TAPE CONNECTOR PN25

CODE	SIZE (mm)	PCS / BAG
1225016025012	25 x 2/1"	15

PPR UNION PN25

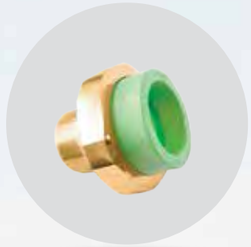
CODE	SIZE (mm)	PCS / BOX
1225045020	20 - 20	40
1225045025	25 - 25	30
1225045032	32 - 32	15
1225045040	40 - 40	10
1225045050	50 - 50	6
1225045063	63 - 63	4

P.P.R FITTINGS



PPR UNION FEMALE THREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225047020012	20 x 2/1"	50
1225047025034	25 x 4/3"	50
1225047032100	32 x 1"	30
1225047040114	40 x 4/11"	20
1225047050112	50 x 2/11"	15
1225047063200	63 x 2"	10



PPR UNION MALE THREADED PN25

CODE	SIZE (mm)	PCS / BOX
1225046020012	20 x 2/1"	50
1225046025034	25 x 4/3"	50
1225046032100	32 x 1"	30
1225046040114	40 x 4/11"	20
1225046050112	50 x 2/11"	15
1225046063200	63 x 2"	10

ELBOW 90° PN25

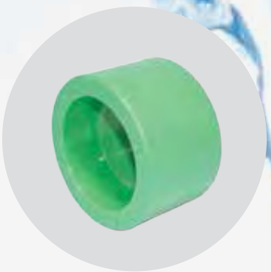
CODE	SIZE (mm)	PCS / BOX
1225010020	20	160
1225010025	25	100
1225010032	32	60
1225010040	40	30
1225010050	50	15
1225010063	63	8
1225010075	75	6
1225010090	90	3
1225010110	110	2
1225010125	125	1

TEE 90° PN25

CODE	SIZE (mm)	PCS / BOX
1225050020	20	120
1225050025	25	60
1225050032	32	40
1225050040	40	20
1225050050	50	10
1225050063	63	5
1225050075	75	5
1225050090	90	3
1225050110	110	2
1225050125	125	1

ELBOW 45° PN25

CODE	SIZE (mm)	PCS / BOX
1225011020	20	160
1225011025	25	140
1225011032	32	60
1225011040	40	35
1225011050	50	15
1225011063	63	8
1225011075	75	6
1225011090	90	3
1225011110	110	2
1225011125	125	1



COUPLING PN25

CODE	SIZE (mm)	PCS / BOX
1225020020	20	180
1225020025	25	150
1225020032	32	80
1225020040	40	40
1225020050	50	20
1225020063	63	15
1225020075	75	10
1225020090	90	8
1225020110	110	4
1225020125	125	2
1225020160	160	1

END CAP PN25

CODE	SIZE (mm)	PCS / BOX
1225070020	20	200
1225070025	25	150
1225070032	32	100
1225070040	40	80
1225070050	50	40
1225070063	63	15
1225070075	75	20
1225070090	90	12
1225070110	110	6

PLASTIC UNION PN25

CODE	SIZE (mm)	PCS / BAG
1225048020	20	100
1225048025	25	80
1225048032	32	50
1225048040	40	30
1225048050	50	8
1225048063	63	5

P.P.R FITTINGS

TEE 90˚ REDUCER PN25

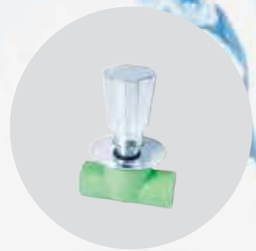
CODE	SIZE (mm)	PCS / BAG
1225055025020	25 x 20 x 25	75
1225055032020	32 x 20 x 32	50
1225055032025	32 x 25 x 32	40
1225055040020	40 x 20 x 40	30
1225055040025	40 x 25 x 40	30
1225055040032	40 x 32 x 40	30
1225055050020	50 x 20 x 50	12
1225055050025	50 x 25 x 50	12
1225055050032	50 x 32 x 50	12
1225055050040	50 x 40 x 50	15
1225055063020	63 x 20 x 63	8
1225055063025	63 x 25 x 63	8
1225055063032	63 x 32 x 63	8
1225055063040	63 x 40 x 63	8
1225055063050	63 x 50 x 63	8
1225055075020	75 x 20 x 75	6
1225055075025	75 x 25 x 75	6
1225055075032	75 x 32 x 75	6
1225055075040	75 x 40 x 75	6
1225055075050	75 x 50 x 75	6
1225055075063	75 x 63 x 75	6
1225055090050	90 x 50 x 90	3
1225055090063	90 x 63 x 90	3
1225055090075	90 x 75 x 90	3
1225055110063	110x 63 x 110	2
1225055110075	110x 75 x 110	2
1225055110090	110x 90 x 110	2
1225055160090	160x 90	1

REDUCER PN25

CODE	SIZE (mm)	PCS / BAG
1225060025020	25 x 20	200
1225060032020	32 x 20	125
1225060032025	32 x 25	125
1225060040020	40 x 20	70
1225060040025	40 x 25	70
1225060040032	40 x 32	75
1225060050020	50 x 20	50
1225060050025	50 x 25	50
1225060050032	50 x 32	50
1225060050040	50 x 40	40
1225060063025	63 x 25	30
1225060063032	63 x 32	25
1225060063040	63 x 40	30
1225060063050	63 x 50	25
1225060075032	75 x 32	20
1225060075040	75 x 40	20
1225060075050	75 x 50	20
1225060075063	75 x 63	15
1225060090032	90 x 32	15
1225060090040	90 x 40	15
1225060090050	90 x 50	12
1225060090063	90 x 63	10
1225060090075	90 x 75	8
1225060110050	110x 50	8
1225060110063	110x 63	6
1225060110075	110x 75	6
1225060110090	110x 90	6
1225060160110	160x 90	1

SLANTING VALVE

CODE	SIZE (mm)	PCS / BAG
1225400025	25	1
1225400032	32	1
1225400040	40	1



CONCEAL VALVE PN25

CODE	SIZE (mm)	PCS / BAG
1225300020	20	25
1225300025	25	25
1225300032	32	15

STOP VALVE HANDLE

CODE	SIZE (mm)	PCS / BAG
1225325020	20	50
1225325025	25	50
1225325032	32	25

STOP VALVE"SURFACE ASSEMBLY" PN25

CODE	SIZE (mm)	PCS / BAG
1225320020	20	15
1225320025	25	15
1225320032	32	10

CONCEAL VALVE HANDLE

CODE	SIZE (mm)	PCS / BAG
1225315020	20	25
1225315025	25	25
1225315032	32	15

P.P.R FITTINGS

CONCEAL VALVE LOWER PART PN25

CODE	SIZE (mm)	PCS / BAG
1225310020	20	40
1225310025	25	40
1225310032	32	20

CONCEAL VALVE EXTENSION

CODE	SIZE (mm)	PCS / BAG
1225315100	109	100

COMPACT VALVE PN25

CODE	SIZE (mm)	PCS / BAG
1225320120	20	40
1225320125	25	20
1225320132	32	15

BRIDGE BEND PN25

CODE	SIZE (mm)	PCS / BAG
1225088020	20	60
1225088025	25	40
1225088032	32	20

DOUBLE UNION BALL VALVE PN25

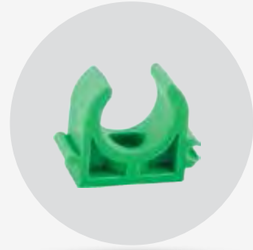
CODE	SIZE (mm)	PCS / BAG
1225200020	20	30
1225200025	25	20
1225200032	32	15
1225200040	40	10
1225200050	50	8
1225200063	63	5
1225200075	75	1
1225200090	90	1
1225200110	110	1

FEMALE UNION BALL VALVE PN25

CODE	SIZE (mm)	PCS / BAG
1225210032	32 X 1"	20

TEST PLUG

CODE	SIZE (mm)	PCS / BAG
1225034012	2/1"	100
1225034034	4/3"	60
1225034100	1"	40



PIPE CLIP

CODE	SIZE (mm)	PCS / BAG
1225065020	20	450
1225065025	25	300
1225065032	32	200

P.P.R FITTINGS

SADDLE CONNECTOR PN25

CODE	SIZE (mm)	PCS / BAG
1225054063032	63 x 32	60
1225054090032	90 x 32	75

STEEL FLANGE PN25

CODE	SIZE (mm)	PCS / BAG
1225091063	63	15
1225091075	75	10
1225091090	90	6
1225091110	110	5

MANIFOLD WITHOUT TEE

CODE	SIZE	WAYS	PCS / BAG
1225089490	90mmX 1"	4	1
1225089463	63 x 1"	4	1
1225089450	50 x 4/3 "	4	1

2 WAY MANIFOLD WITHOUT TEE

CODE	SIZE (mm)	PCS / BAG
1225089290	90 x 1"	2
1225089263	63 x 1"	2
1225089250	50 x 4/3 "	2

FLANGE ADAPTER WITH O-RING PN25

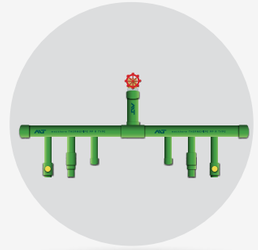
CODE	SIZE (mm)	PCS / BAG
1225090063	63	15
1225090075	75	10
1225090090	90	10
1225090110	110	8

MANIFOLD WITH TEE °90

CODE	SIZE (mm)	WAYS	PCS / BAG
1225089090	90 x 1"	4	1
1225089063	63 x 1"	4	1
1225089050	50 x 3/4"	4	1

CROSSOVER PN20

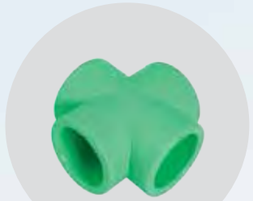
CODE	SIZE (mm)	PCS / BAG
1225087020	20	300
1225087025	25	250
1225087032	32	200



PP-R MAIN CONNECTOR

CODE	WAYS	PCS / BAG
1225100000	10	1
1225163032	9 (63x32mm)	1
1225263032	9 super (63x32mm)	1
1225800000	8	1

P.P.R FITTINGS



CROSS TEE

CODE	SIZE (mm)	PCS / BAG
1225057020	20	1
1225057025	25	1
1225057032	32	1
1225057040	40	1
1225057050	50	1
1225057063	63	1

MATRICES

CODE	SIZE (mm)	PCS / BAG
1225330020	20	1
1225330025	25	1
1225330032	32	1
1225330040	40	1
1225330050	50	1
1225330063	63	1
1225330075	75	1
1225330090	90	1
1225330110	110	1

PIPE CUTTER

CODE	SIZE (mm)	PCS / BAG
1225330020040	40 - 20	1

WELDING MACHINE COMPLETE SET

CODE	SIZE (mm)	PCS / BAG
1225330020063	20-63	1
1225330075110	75-110	1

MEMO

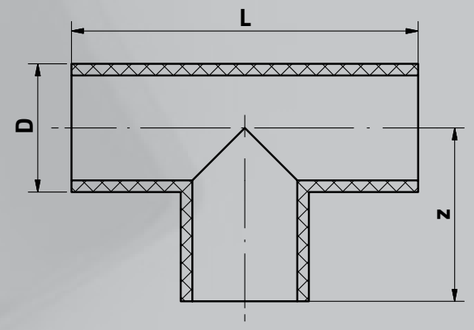
WELDING

Assembly of the **MetiTherm** system is easily done by electric heating tools (threaded inserts), mounted on the **MetiTherm** welding device... a process called fusion welding.

Fusion welding requires the heating of the pipe and its respective fitting socket simultaneously to the right fusion temperature. A homogeneous melt between two parts occurs and a uniform layer is formed. These parts are thereafter joined easily by inserting the male part into the female part. This combination is held in place till the parts cool down to ambient temperature and become one. This process is repeated throughout the network of pipes and fittings at the construction site and combined with other units until a closed efficient water delivery system is formed.

This technique permits joining to be carried out with simple equipment supplied by your local **MetiTherm** agent or representative. Needless to say, parts to be welded must have the same properties, and therefore, to avoid failures in the network and guarantee a long and trouble-free service life, **never mix MetiTherm pipes or fittings with other brands.**

It is widely acknowledged that, in order to establish a consistent and structurally sound joint, it is necessary to follow **MetiTherm** fusion welding preparation procedure. If the appropriate procedures are followed, contamination and disturbance effects that might weaken the fusion mechanism will be avoided.



USING WELDING DEVICE & TOOLS

- Only use original **MetiTherm** welding devices and welding tools to ensure proper fusion of pipes and fittings.

- Take out the device and other required equipment from the portable storage box.
- Before heating up the device, mount and finger tighten the threaded inserts so as to hold the tools firmly.
- Never install a tool in a location on the device which makes it extend outside the edge of the tongue of the device! Always place the larger size diameter tools on the inner positions of the welding device. This is especially true for diameters over 40 mm.

- Plug in and switch on welding device. At this point, both thermostat and control lamps will light up. Adjust the thermostat to the correct fusion temperature at 260 °C. The thermostat lamp goes off when the temperature reaches the set temperature.

  Depending on the ambient temperature, the heating-up process should take between 5 to 25 minutes. Allow a few more minutes in extreme cold cases.

  Note that DVS-Welding Guidelines state that the temperature of the welding device has to be checked at its application area before starting the welding process or whenever a new tool is to be changed.

- Use an Allen Key® to tighten up the tools. Do not use pliers or any other tools for this job. This can scratch or damage the stick-free coating on the device and insert.
- After finishing the welding process and the device has been switched off, wait until it has cooled down before reusing or storing it away.
- Always keep the device in a dry and clean place. The device may be only used when completely dry.
- To avoid shock hazards, never use a device that has been exposed to water or other fluids or in rain. Moreover, never clean the device with water or handle the device with wet hands.
- Never use water to cool down the device temperature, even after it has been unplugged. This could damage the thermostat.
- It is necessary to maintain the device clean at all times, especially in the locations where the threaded inserts (tools) are mounted. Failure to do so may result in improper contact between the inserts and device, and a resulting inefficient heating of the inserts and inadequate welding thereof. Cleaning should be done with a paper or non fibrous cloth and alcohol.
- Durable and proper joining with the device can only be guaranteed when the tools and the tongue are assured of perfectly good condition. It is recommended to replace any defective device or tool.
- Never attempt to open a defective device. Let the expert hands of **MetiTherm**'s engineers help in assessment of the device's qualification and if possible make the necessary repairs.

WELDING

GUIDELINES & SAFETY PRECAUTIONS

The welding process of plastic pipes and fittings is never free of risk of injury, therefore precaution should always be taken. When **MetiTherm** welding is to be performed, we recommend The General Regulations of DVS 2208 part 1 of The German Association of Welding Engineering, Registered Society (Deutscher Verband für Schweißtechnik e. V.) in addition to your local regulations of labor and prevention of accident guidelines, and never forget common sense.

To ensure safe and accident free operation of MetiTherm welding equipment, the following must be strictly adhered to:

- Keep **MetiTherm** welding devices and other electrical devices away from the reach of children.
- Never use this equipment in anything less than a total state of consciousness.
- Never let anyone but qualified trained persons use this device.
- Always wear tight-fit clothes for welding. Never wear loose clothes.
- Keep welding device and tools away from rain and water.
- Never use in wet or high humidity places.
- Never oil or grease the handle or any other part of the device.
- Always keep inflammable materials at a safe distance during the welding process.
- Always keep device in tidy, clean and dry storage area, when not in use.

HEATING OF METITHERM PIPES & FITTINGS

The following table depicts the general guidelines for heating of pipes and fittings for the purpose of welding according to DVS 2207 part 11.

Welding of **MetiTherm** PPR Pipes

Pipe external-Ø	Welding depth	Heating time		Welding time	Cooling time
mm	mm	sec. DVS	sec. AQE*	sec.	min.
16	13,0	5	8	4	2
20	14,0	5	8	4	2
25	15,0	7	11	4	2
32	16,5	8	12	6	4
40	18,0	12	18	6	4
50	20,0	18	27	6	4
63	24,0	24	36	8	6
75	26,0	30	45	8	8
90	29,0	40	60	8	8
110	32,5	50	75	10	8
125	40,0	60	90	10	8

*heating times recommended by aquatherm at ambient temperatures below + 5 °C

INSTRUCTIONS FOR WELDING OF WHAM PIPES & FITTINGS

The welding machine is heated up to 250 °C (described in "Using **MetiTherm** Welding Device & Tools").

1. Use **MetiTherm** pipe cutter to cut the pipe. Make sure that a straight and clean pipe end results and not at a skewed angle. This is to ensure that the welding adheres to the right conditions.

The joining process during **MetiTherm** fusion welding can be divided into three stages:

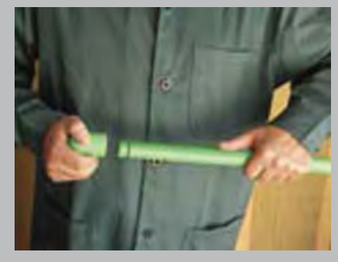
Stage I: Initial heating and fitting expansion.
Stage II: Heat soaking to create the joint.
Stage III: Joint cooling.

For successful joining of pipes, at least three preparation stages must be followed:

- Firstly, pipe ends must have properly finished squared ends as apposed to having a chamfered or broken edge. This ensures that the central cold zones come in full contact with the welding tools and proper heat conduction will accordingly be achieved. Before welding Stabi composite pipes peel-off the aluminum polypropylene layer completely.
- Secondly, the pipe surfaces to be joined must be properly cleaned to remove contaminants and foreign material. Otherwise, any contamination on the pipe surface is retained at the joint interface, which can significantly reduce the strength of the joint.
- Finally, the pipe and fitting should be clamped during welding to eliminate relative movement. This ensures that the molten polymer is allowed to fuse fully at the fusion interface, developing a strong joint.

2. Mark the welding depth with a pencil and measurement plate which are provided with the **MetiTherm** welding kit.

3. Enter the end of the pipe into the tool upto the marked depth without twisting it and simultaneously and also without twisting, push the fitting onto the heating tool, observing the general guidelines for heating up times.

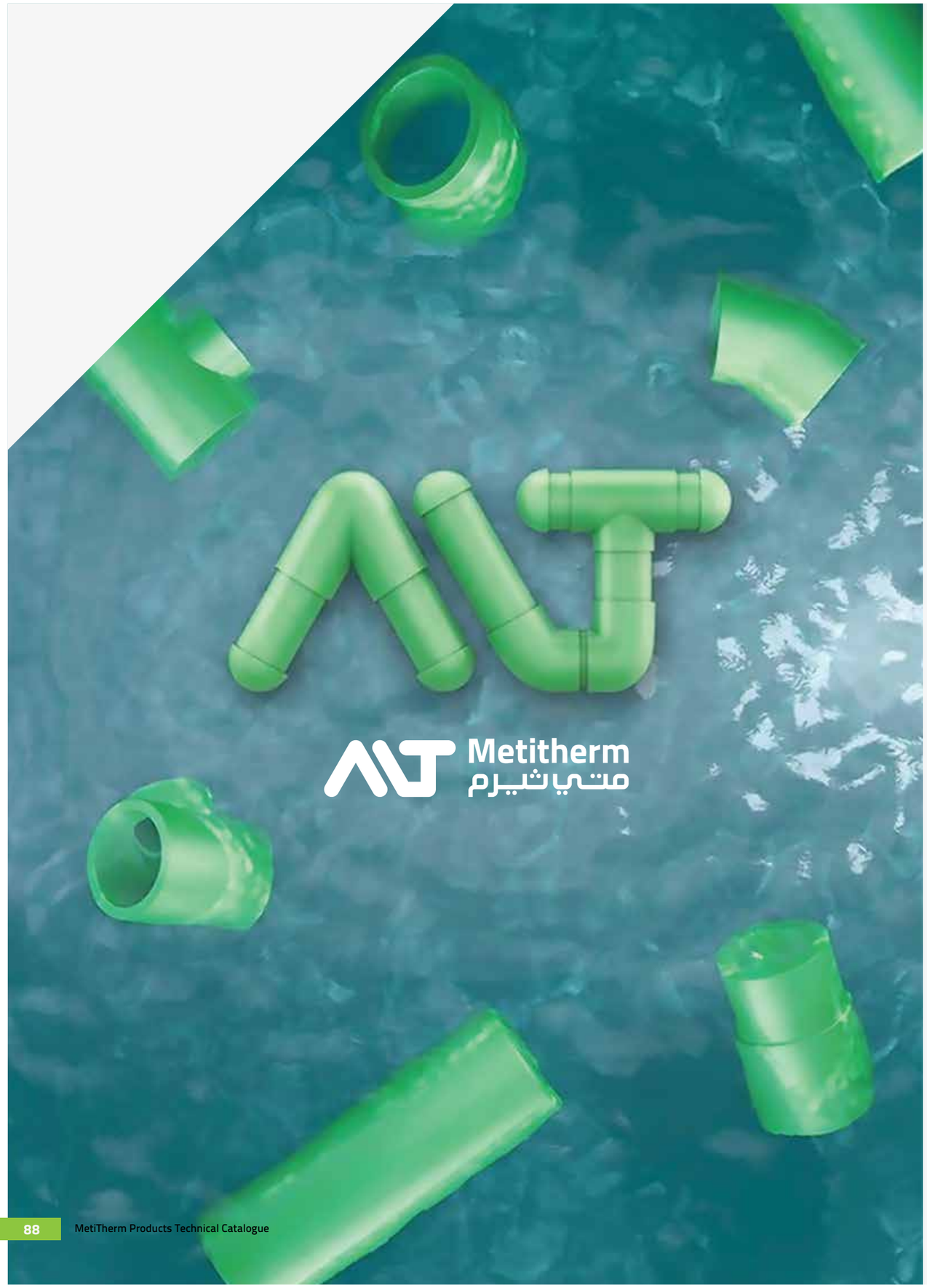


Timing for heating should not start until the pipe and fitting reaches to the marked welding depth. Both fitting and pipe should be heated for a set time, known as the heating time.

When heating time is complete, the pipe and fitting should be removed from the heating tool, and pressed together to the marked welding depth for a few seconds without twisting. A homogeneous structure of the same material is thereupon formed.

The maior alignment should be done before insertion of the pipe and fitting. Use fusion time for minor alignment before fusion is complete and the assembled parts have cooled. **Never mechanically stress the welding joint before cooling time.**

A cross-section of a properly welded **MetiTherm** joint will normally show a smooth transition between the two initial parts. This is because the components have uniformly melted and fused into each other to form one single piece.



INSTALLATION

INTRODUCTION

Water service lines are connections that lead from the water mains to the building plumbing network. The service line consists of all pipes, valves, and fittings between the main water cabinet through the meter, and ending at the individual outlets or endpoints.

DIN 1988 Parts l & 3 apply to drinking water supply systems inside buildings and their networks. It specifies requirements for design, installation, operation and maintenance of such systems in addition to alterations to these systems. It also gives particular attention to materials, components and appliances installed to supply a building with potable water. Designers and installers should make sure that only such required equipment and appliances are installed ensuring proper economic and technically qualified functioning of the system is maintained.

When installation is executed, **MetiTherm** instructions should be strictly followed. Additionally, the following must be readily available:

- A building site plan; engineering drawing of each floor including cellars (plan view), with simplified pipe work diagram and sectional drawings;
- Pipe sizing calculation in accordance with DIN 1988 part 3;
- A detailed pipe network diagram showing lengths of pipe runs, pipe nominal sizes, bore diameters, material, draw-off points (type, number and sizes or bore diameter), minimum flow pressure required, and the fitting group as defined in the of DIN 4109 series of standards, where necessary.

	Range of Working Pressure (fluctuating), in bar	Temperature, In °C	Frequency of Use (hours per year)
Cold Water pipes	0 to 10	Up to 25*	8760
Hot water pipes	0 to 10	Up to 60	8710
		Up to 85	50

* Reference temperature for creep rupture strength: 20 °c.

INSTALLATION

PIPE-JOINTS WITH THREADED FITTINGS

MetiTherm Pipe-joint assemblies are designed to resist axial tension when properly supported. If such joints occur in buried pipe work, properly sized supports should be located at bends and branches to counter the hydraulic forces acting on these joints. Care should be taken to ensure that the designed system has unobstructed flow at joints and where changes of direction occurs. The streamlined design of **MetiTherm** threaded fittings, in compliance with DIN 2999 part 1, ensures that this is met.

IN-LINE & PRESSURE RELIEF VALVES

When installing a **MetiTherm** system with pressure relief valves, the following should be taken into account to ensure full compliance with DIN 1988 part 2:

a. Valves in cold and hot water systems should only have a common outlet. If this cannot be achieved, then the passage of hot water into the cold water pipe should be prevented by the provision of suitable components such as approved check valves.

b. If, in domestic applications, the water temperature at the draw-off points exceeds 45 °C, mixing valves with safety stops will have to be installed to prevent scalding when hot water is drawn. As stipulated in the (work regulation), this temperature should also not be exceeded where water is used at places of work. To ensure this, the actuator should be fitted with a safety stop that prevents the temperature of the mixed water at the outlet rising above 40 °C.

c. Only valves that do not unduly obstruct the flow (oblique pattern valves and ball valves) should be installed in pipes. According to DIN 3512 straight pattern valves should only be installed in main branch pipes where the pressure is adequate.

d. Only valves that have been tested for noise emission as specified in DIN 52218 part 2 should be used to control the flow.

e. Valves that can be opened and closed by a single turn through 90° shall not be used as in-line valves unless they are intended to serve as servicing valves.

f. Relief valves should comply with the specifications of TRD 721. A pressure-relief valve is a valve that automatically discharges to the atmosphere when a preset working (threshold) pressure is exceeded and automatically closes back again once pressure has decreased below the threshold pressure.

Pressure relief valves in normal and drinking water heaters that are not vented should be fitted with at least one diaphragm valve which is type approved and provided with a test mark according to DIN 4753 part I. The minimum nominal size of pressure-relief valves should be as specified in the following table.

MINIMUM NOMINAL SIZE OF PRESSURE-RELIEF VALVES FOR UNVENTED WATER HEATERS.

Capacity, in liters	Minimum Nominal Size* DN	Maximum Heating Capacity, In Kw
≤ 200	15 (R/Rp ½)**	75
> 200 ≤ 1000	20 (R/Rp ¾)	150

The nominal size refers to the nominal size of the inlet connection.
**** R taper Whitworth external thread as in DIN**
Rp parallel Whitworth internal thread 2999 part 1

In the case of the installation of diaphragm valves, the following should be applied:

a. The valves should be installed in the cold water feed. No stop valve or any other constriction such as strainers should be located in the pipe connecting the pressure relief valve and the water heater.

b. The valve should be located at a sufficiently high level for the connecting vent pipe to be laid at a gradient. It is recommended that the pressure relief valve be mounted above the water heater so that replacing it is possible without draining the heater.

The following specifications should apply for the installation of vent pipes:

a. Proper installation ensures that persons are not endangered by hot water escaping from a responding pressure-relief valve. For this reason, each pressure-relief valve requires a vent pipe that is adequately protected against freezing. A suitable material is PP-R which is heat and corrosion resistant. The vent pipe should end 20 mm to 40 mm above a drainage fitting or discharge funnel inside buildings and be mounted in a visible position.

b. Vent pipes should be sized so as to suit the outlet cross section of the pressure relief valve, have not more than two bends and be no longer than 2m. If more bends or pipes longer than those specified are required, then the next highest nominal vent pipe size should be installed. More than three bends or a pipe length exceeding 4m should not be constructed.

c. A plate with the following text shall be mounted near the vent pipe, preferably on the pressure relief valve itself: **'When the water heater is in operation, water may escape from the vent pipe. Do not obstruct the outlet.'**

d. The nominal size of the pipe draining the funnel should be at least equal to twice that of the vent pipe.

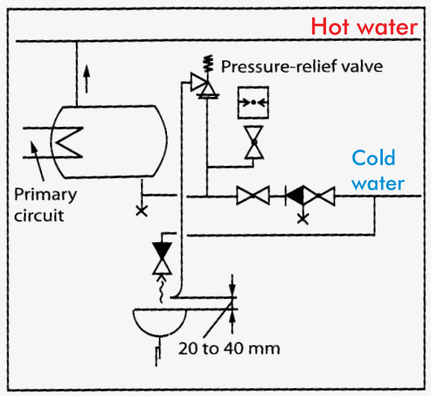
e. Pressure relief valves should be supplied with the set pressure already adjusted by the manufacturer. Set pressure in the pressure relief valves used should be equal to or less than the permissible working pressure of the water heater. The maximum pressure in the cold water shall be at least 20% below the set pressure of the valve If the set value is exceeded, a pressure reducing valve should be installed.

INSTALLATION

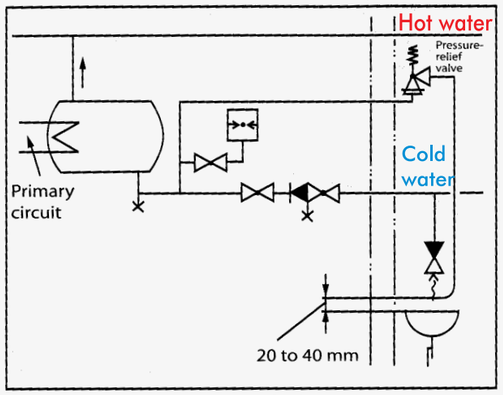
SET PRESSURE OF PRESSURE-RELIEF VALVES AS A FUNCTION OF PRESSURE IN COLD FEED PIPES

Maximum Pressure in Cold Pipe, in bar	Permissible Working Pressure of Water Heater, in bar	Set Pressure of Pressure-relief Valve, in bar
4,8	6	6
8	10	10

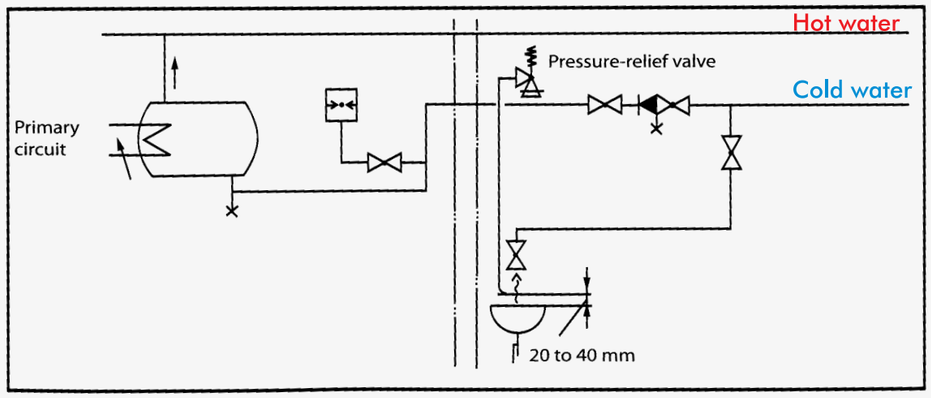
i-e Pressure relief valves installation diagrams



Installation of pressure - realief valve and water heater in the same room



Installation of pressure - realief valve and water heater in different rooms



Installation of complete safety system and water heater in different rooms

WATER METERS IN METITHERM PIPE INSTALLATION

As applies to other equipment, water meters are strictly controlled by your local authorities. According to DIN standards, cold water meters or flow meters designed for water at a temperature of up to 30 °C and comply with section I of appendix 6 to Eichordnung (German weights and measures Regulation) and according to ISO 4064 part I. On the other hand, heated water meters are flow meters designed for water with a maximum temperature of 90°C.

Water meters are part of the water meter assembly which, viewed in the direction of flow, consist of:

- Inlet stop valve (may be identical with service stop valve);
- Straight length of **MetiTherm** PP-R pipe;
- Water meter;
- Connector, variable in length, or flexible joint;
- Outlet stop valve;

HINTS ON THE DESIGN OF WATER METER NETWORK

a. Generally speaking, mounting fixtures should be installed in new assemblies. If old systems are to be altered it should be ensured that stresses induced during the removal of the water meter can be accommodated by the remaining pipe work.
b. Water meters should be installed in a contained area, near the wall closest to the road, which is usually a room in which the service pipe enters the building. This room should provide protection from frost, physical interference, and tampering.
c. Water meter assemblies should be designed to drain any escaping water when the meter is replaced.
d. Water meters should be easily accessible so as to facilitate reading, replacement and inspection.

INSTALLATION

INSTALLATION DIMENSIONS FOR WATER METER ASSEMBLIES

	Dimensions	Requirements (flow & vane type water meters)
a.	Minimum clearance to wall (from pipe axis)	Equal to maximum nominal size of service pipe plus 200 mm*
b.	Clearance to floor (from pipe axis)	Equal to maximum nominal size of service pipe plus 300 mm, but not exceeding 1200 mm
c.	Minimum clearance in front of water meter assembly (related to pipe axis)	800 mm
d.	Minimum clearance above water meter assembly (related to pipe axis)	Equal to maximum nominal size of service pipe plus 700 mm
e.	Minimum room height	1800 mm clear height

TAPS IN METITHERM PIPE INSTALLATION

Taps in **MetiTherm** hot and cold potable water pipes are arranged either next to, or above one another. The hot water tap should be located left of or above the cold water tap. Hot water taps must be clearly identified. If a color code is used for this purpose, red should identify hot, and blue should identify cold water.

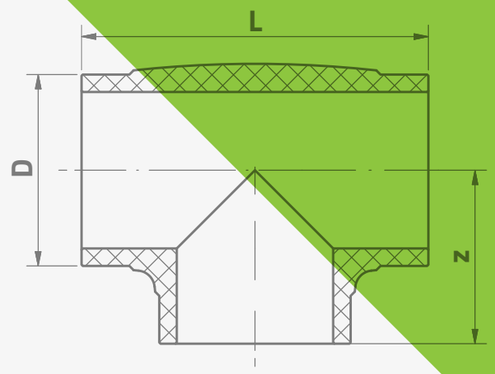
GENERAL GUIDELINES FOR THE INSTALLATION OF PIPE WORK INSIDE BUILDINGS

- No pipe should be secured to another pipe or used as a support for other pipes.
- The arrangement of pipes should facilitate their identification. Mounting plates should be used where required.
- Pipes should be laid so as to prevent the formation of air locks. Where pipes are likely to suffer from frost damage, drainage fittings should be provided at the lowest points of the system.
- Where pipes are laid above one another, exposed cold water pipes should be on the lowest level in order to minimize the risk of condensation.
- Where a system provides water to two or more buildings, a riser should be installed in each building.
- Where draw-off points on a storey require backflow prevention but are not individually isolated (DIN 1988 part 4), the main branch pipe should branch off from the riser not less than 300 mm above the maximum possible water level on the storey.

PIPE BENDING

MetiTherm PP-R pipes may be required to be bent during installation. Bending should be made only by direct hot air blowing. **Never use a direct flame for heating the pipes.**

The suitable temperature for **MetiTherm** PP-R pipes is I 40°C. Suitable minimum bending radiuses are given below in table.



RECOMMENDED BENDING RADIUS

Pipe Outside Diameter	Min. Bending Radius (In mm)
20 mm	160
25 mm	200
32 mm	256
40 mm	320
50 mm	400
63 mm	500
75 mm	600
90 mm	720
110 mm	880

SLIDING & FIXED POINT FASTENING METHODS

The right selection of one of these two methods of mounting, results in a satisfactory installation.

MetiTherm provides a full range of clamps to be used to support the pipes in the installation of the network.

The appropriate clamp should be chosen according to the installed pipe diameter. It is worthy to note that **MetiTherm** clamps are manufactured with a safety rubber coating especially made to ensure that pipe surfaces are not damaged during installation. The rubber coating also provides the desired guiding & holding in the installations.

Sliding points are used to allow axial movement of a pipe where required. While locating a sliding clamp, free movement of pipe should be ensured. This requires avoiding fittings or armatures installed in those areas. Ensure that fittings are at a sufficient distance from the sliding point clamps, else these will then act as fixed points.

Fixed points in pipe line installations are those points that restrict the pipe in its undesired axial movement. The free lengths from the fixed points are measured so as to calculate the possible linear expansion, as well as absorbing possible additional loads.

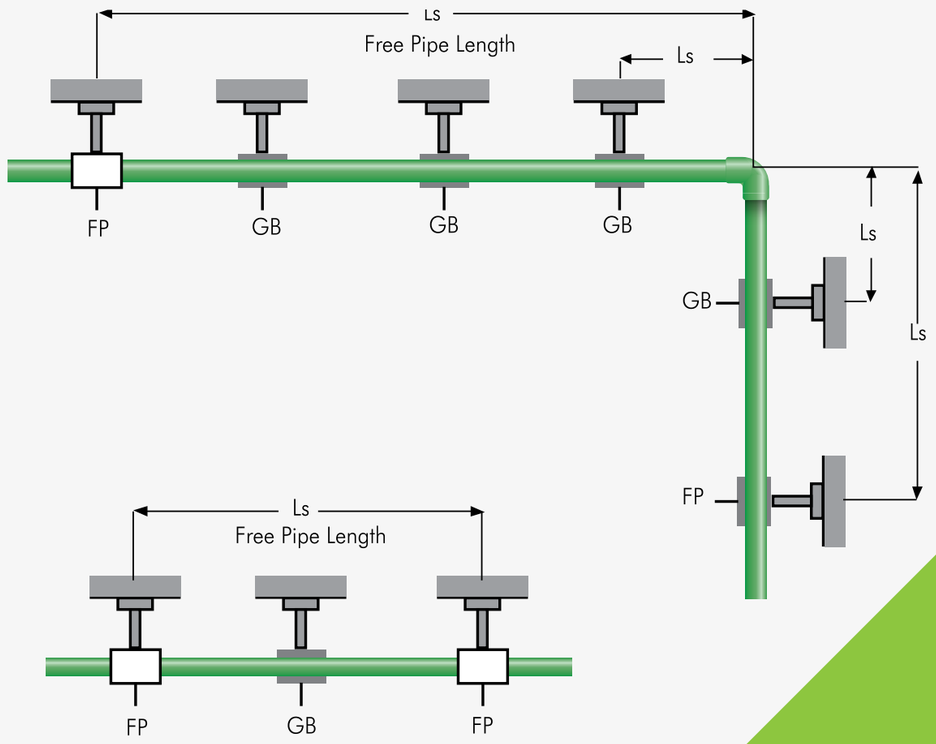
In the execution of fixed points in the pipeline installation, the following should be noted:

- While using threaded rods or threaded screws, the drop from the ceiling should be as short as possible.
- Only **MetiTherm** supports should be used as fixed points, and other supports avoided in order to ensure appropriate fixing of these points.
- In order to achieve good stability in the network, proper and sufficient support of the pipes must be done with a sufficient amount of properly installed and positioned **MetiTherm** fixed point clamps to counter any linear expansions of the pipes. The distance between the pipe and the wall or ceiling it is fixed to, should not be too large, otherwise the fixing point will fail to serve its purpose.
- Vertical distribution lines, and pipework laid beneath plaster or in concrete as well as roof topping can be laid in a rigid manner.
- Pipe branches which pass through a wall should be mounted in a fixed point rigid manner to prevent the branching pipe being cut or damaged due to expansion or uncontrolled movement of the pipe.

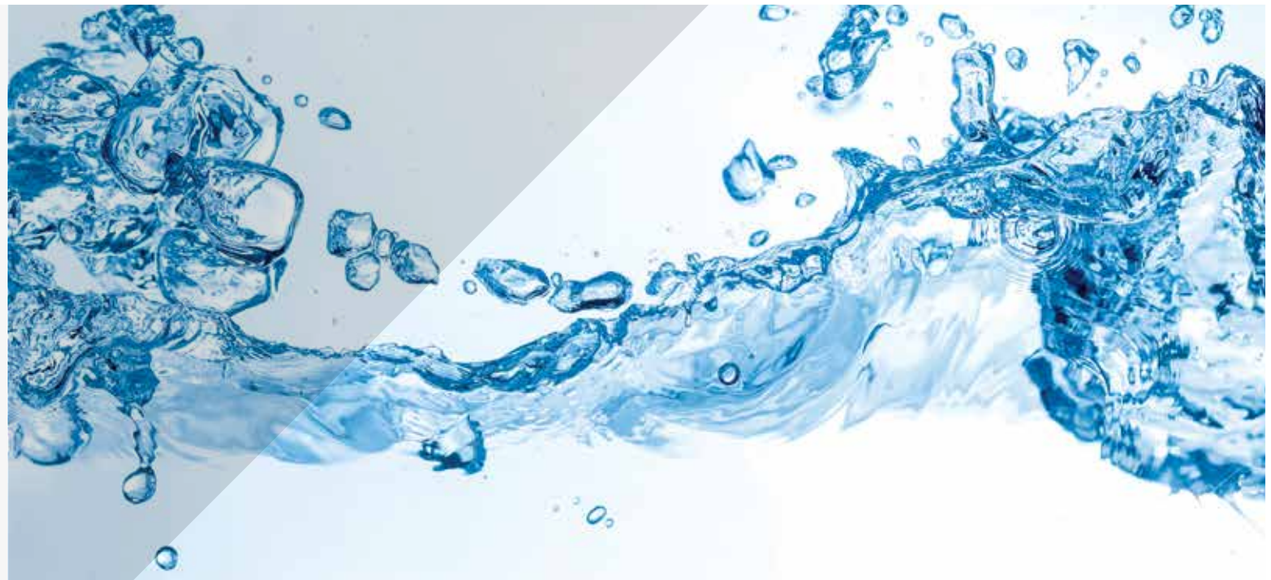
INSTALLATION

FREE PIPE LENGTH DEFINITION

The free pipe length is the length of pipe between two points at which the pipe is secured or clamped in a fixed manner.



FP= fixed points
GB= clamp permitting axial movement
L= length of pipe
LS= length of flexing leg



METITHERM PIPE BRACKET & CLAMPS

MetiTherm pipe brackets are designed to secure pipes directly to the structure and are not designed to be used for fixing components other than pipes. **MetiTherm** recommended pipe bracket spacing is given in the following table according to DIN 1988 part 2. These standards are also applicable for vertically laid pipes.

RECOMMENDED SPACING OF PIPE BRACKETS

Pipe Outside Diameter	Spacing of Bracket			
	20 °C	40 °C	60 °C	80 °C
20 mm	0.8 m	0.70 m	0.65 m	0.60 m
25 mm	0.85 m	0.85 m	0.75 m	0.70 m
32 mm	1.00 m	0.90 m	0.80 m	0.70 m
40 mm	1.10 m	1.05 m	0.95 m	0.85 m
50 mm	1.25 m	1.15 m	1.05 m	0.90 m
63 mm	1.40 m	1.30 m	1.20 m	1.05 m
75 mm	1.55 m	1.45 m	1.30 m	1.15 m
90 mm	1.70 m	1.60 m	1.45 m	1.30 m
110 mm	1.85 m	1.75 m	1.60 m	1.45 m

LINEAR EXPANSION

Linear expansion of pipes is directly proportional to the heat subjected to the pipe material. Hence, cold water pipes have practically no linear expansion and could be neglected in the installation design. On the other hand, expansion of pipes is significant in warm water and heating installations and in extreme temperature varying environments, and therefore needs to be considered.

FORMULA FOR CALCULATION OF LINEAR EXPANSION

The linear expansion ΔL is calculated according to following formula:

$\Delta L = \alpha - \cdot L \cdot \Delta T$

Where:

ΔL Expanded length (mm)
α Coefficient of linear expansion (mm/mK)
L Length of segment in calculation (mm)
ΔT Temperature difference between working and installation

INSTALLATION

LINEAR EXPANSION CALCULATION EXAMPLE:

Assuming you need to calculate the expansion (ΔL) of a standard **MetiTherm** pipe segment (L) of 1 .6 meters at a maximum working temperature of 70°C. You know that the **MetiTherm** standard pipe has a coefficient of linear expansion of (a =0.15). You know that the installation was executed at the typical ambient temperature of 25°C.

ΔL = α – · L · ΔT or ΔL = 0.15 * 1 .6 * (70°C - 25°C} = 10.8 mm

That means you can expect a linear expansion of 10.8 mm for this segment of pipe if the temperature difference is respected.
Alternatively, you can quickly obtain the result from the following table for different types of pipes:

STANDARD PIPE LINEAR EXPANSION CHART (METERS)

Length of segment (meters) \ ΔT(°X)**	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.1	0.15	0.23	0.30	0.38	0.45	0.53	0.60	0.68	0.75	0.83	0.90	0.98	1.05	1.13	1.20
0.2	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.65	1.80	1.95	2.10	2.25	2.40
0.3	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60
0.4	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20	4.50	4.80
0.5	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.13	4.50	4.88	5.25	5.63	6.00
0.6	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.95	5.40	5.85	6.30	6.75	7.20
0.7	1.05	1.58	2.10	2.63	3.15	3.68	4.20	4.73	5.25	5.78	6.30	6.83	7.35	7.88	8.40
0.8	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20	7.80	8.40	9.00	9.60
0.9	1.35	2.03	2.70	3.38	4.05	4.73	5.40	6.08	6.75	7.43	8.10	8.78	9.45	10.13	10.80
1.0	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00
2.0	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00
3.0	4.50	6.75	9.00	11.25	13.50	15.75	18.00	20.25	22.50	24.75	27.00	29.25	31.50	33.75	36.00
4.0	6.00	9.00	12.00	15.00	18.00	21.00	24.00	27.00	30.00	33.00	36.00	39.00	42.00	45.00	48.00
5.0	7.50	11.25	15.00	18.75	22.50	26.25	30.00	33.75	37.50	41.25	45.00	48.75	52.50	56.25	60.00
6.0	9.00	13.50	18.00	22.50	27.00	31.50	36.00	40.50	45.00	49.50	54.00	58.50	63.00	67.50	72.00
7.0	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	63.00	68.25	73.50	78.75	84.00
8.0	12.00	18.00	24.00	30.00	36.00	42.00	48.00	54.00	60.00	66.00	72.00	78.00	84.00	90.00	96.00
9.0	13.50	20.25	27.00	33.75	40.50	47.25	54.00	60.75	67.50	74.25	81.00	87.75	94.50	101.3	108.0
10.0	15.00	22.50	30.00	37.50	45.00	52.50	60.00	67.50	75.00	82.50	90.00	97.50	105.0	112.5	120.0

**** Difference between Installation and working temperature(°C)**

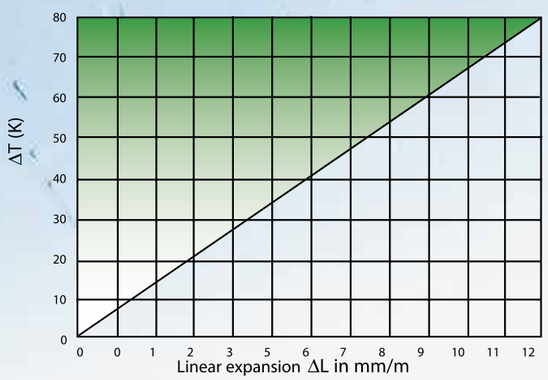
STABI COMPOSITE PIPE LINEAR EXPANSION CHART (METERS)

Length of segment (meters) \ ΔT(°X)**	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
0.1	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.21	0.23	0.24
0.2	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.48
0.3	0.09	0.14	0.18	0.23	0.27	0.32	0.36	0.41	0.45	0.50	0.54	0.59	0.63	0.68	0.72
0.4	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54	0.60	0.66	0.72	0.78	0.84	0.90	0.96
0.5	0.15	0.23	0.30	0.38	0.45	0.53	0.60	0.68	0.75	0.83	0.90	0.98	1.05	1.13	1.20
0.6	0.18	0.27	0.36	0.45	0.54	0.63	0.72	0.81	0.90	0.99	1.08	1.17	1.26	1.35	1.44
0.7	0.21	0.32	0.42	0.53	0.63	0.74	0.84	0.95	1.05	1.16	1.26	1.37	1.47	1.58	1.68
0.8	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20	1.32	1.44	1.56	1.68	1.80	1.92
0.9	0.27	0.41	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.49	1.62	1.76	1.89	2.03	2.16
1.0	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.65	1.80	1.95	2.10	2.25	2.40
2.0	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20	4.50	4.80
3.0	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.95	5.40	5.85	6.30	6.75	7.20
4.0	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20	7.80	8.40	9.00	9.60
5.0	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00
6.0	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00	9.90	10.80	11.70	12.60	13.50	14.40
7.0	2.10	3.15	4.20	5.25	6.30	7.35	8.40	9.45	10.50	11.55	12.60	13.65	14.70	15.75	16.80
8.0	2.40	3.60	4.80	6.00	7.20	8.40	9.60	10.80	12.00	13.20	14.40	15.60	16.80	18.00	19.20
9.0	2.70	4.05	5.40	6.75	8.10	9.45	10.80	12.15	13.50	14.85	16.20	17.55	18.90	20.25	21.60
10.0	3.00	4.50	6.00	7.50	9.00	10.50	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00

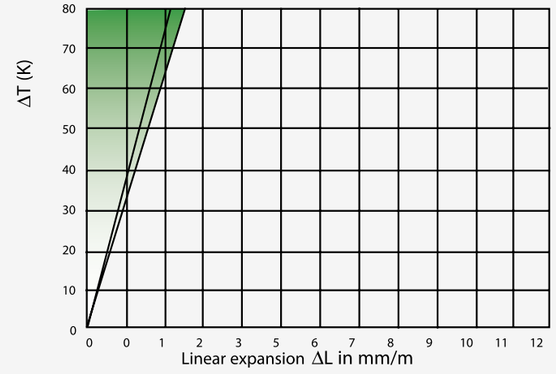
**** Difference between installation and working temperature (°C)**

INSTALLATION

LINEAR EXPANSION CAUSED BY TEMPERATURE FOR METITHERM STANDARD PIPES



LINEAR EXPANSION CAUSED BY TEMPERATURE FOR METITHERM STABI PIPES



For linear expansion calculations, it is necessary to distinguish between the following types of installations:

- Exposed installations
- Installations in ducts
- Concealed installations

If **MetiTherm** pipes are installed in an open and visible manner (exposed installations), consideration should be made to the aesthetic aspects since any expansion will cause undesirable deformations. Stabi composite pipes should be chosen to maximize dimensional stability and reduce linear expansion, because of their relatively low coefficient of expansion.

On the other hand, linear expansion has to be taken into account while installing branch off points in utility ducts only for standard pipes. In the case of composite pipes, fixing should be done just before branch-off points and at maximum distances of 3 meters. In this case, linear expansion can be neglected.

In the case of using standard pipes in utility ducts, there should be enough length of pipe to provide enough springy flaxure in case of epansion of the riser. The following figures show three cases whereby the first illustration proper fixing and enough length to provide springy flexure in the branching pipe (illustration A), In the second illustration a riser too close to the branch-out wall, whereby a clear sleeve is kept around the branching pipe in case of any linear expansion in the riser (illustration B). The third case, illustrates a riser too close to the branch-out wall, whereby a sleeve is not possible, but a springy flexture is executed by creating an elbow branch-out corner (illustration C).

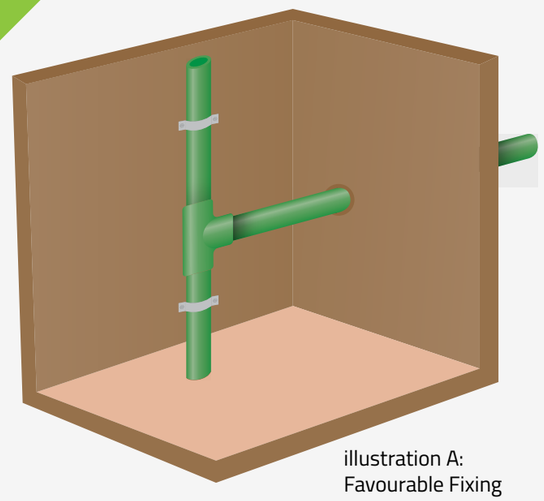


illustration A:
Favourable Fixing

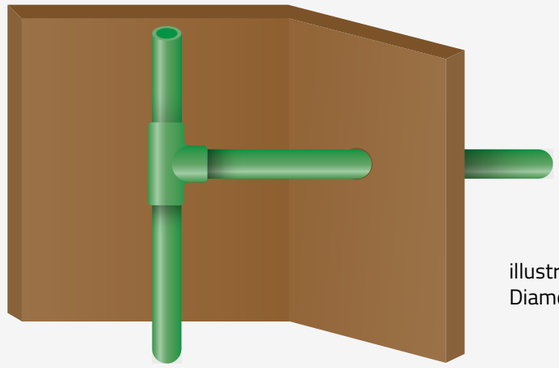


illustration B: Large Diameter Pipe line

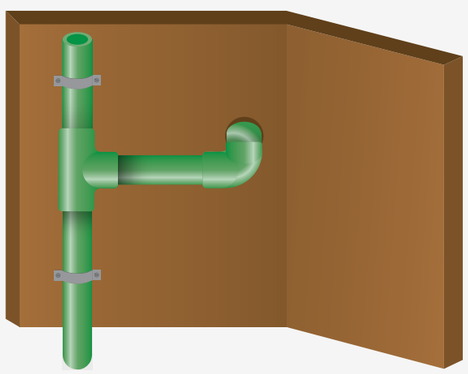


illustration C:
Installation of a spring leg

INSTALLATION

HIDDEN INSTALLATIONS

Hidden installations are those installations that are concealed behind walls, or floors and are not visible to the eye. Linear expansion of **MetiTherm** pipes seldom need to be taken into consideration when dealing with hidden installations. Usually, if the expansion amount forces or stresses a part of the network against a wall or a floor topping, the piping material will absorb the associated stresses when clamped appropriately. Therefore, there is usually no need to account for this expansion, since deformation is not visible.

EXPANSION PROVISIONS

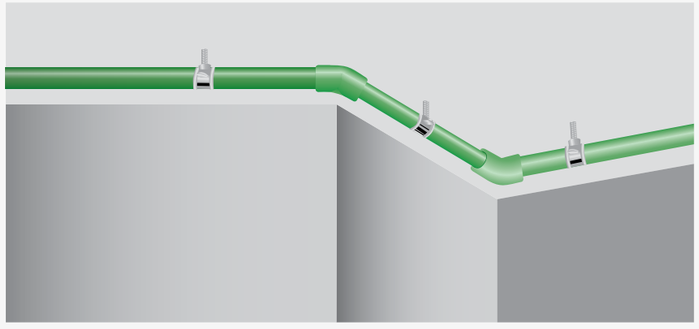
MetiTherm piping networks have to be installed properly to avoid or minimize the effect of linear expansion. Compatible material of pipe brackets or clips must be used. Expansion joints for corrugated pipes for metal material are unsuitable for **MetiTherm** pipes, and should not be used. Toggle lever-bellow or axial expansion joints may be used but manufacturer's instructions must be strictly followed.

While planning for linear expansion in open installations, the pipe route should be planned and installed in such a way facilitating the free movement of pipe within the determined expansion. Some examples and counter measures to compensate for linear expansion are given below:

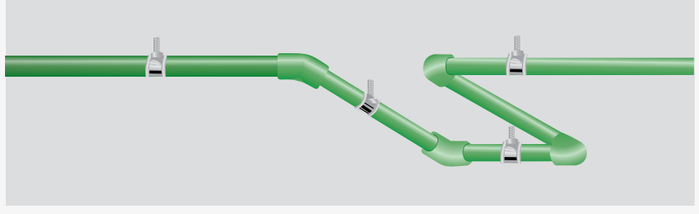
BENDING KNEES

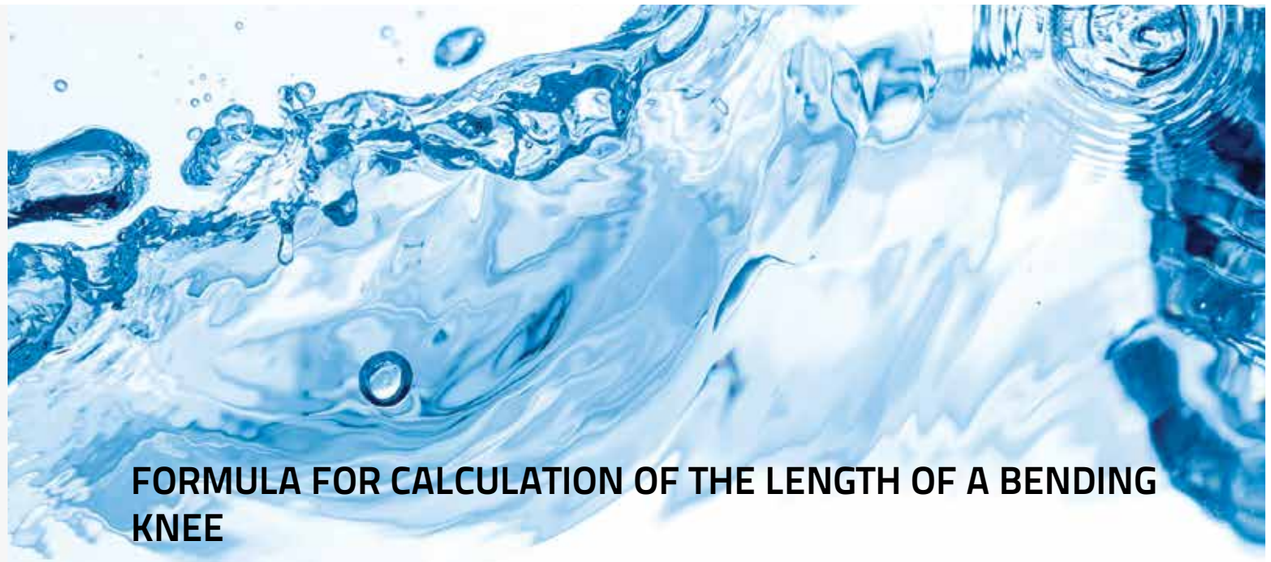
In most cases direction changes can be used to compensate for linear expansion in pipes. The following example depicts the calculation of the length of a bending knee.

BENDING KNEE



EXPANSION SINK





FORMULA FOR CALCULATION OF THE LENGTH OF A BENDING KNEE

The bending knee length L_K is calculated according to following formula:

$$L_K = c \cdot \sqrt{d} \times \Delta L \text{ (mm)}$$

Where:

- L_K Length (mm) of the bending knee
- **c** Material specific constant (equal to 20 for **MetiTherm** pipes)
- **d** Outside Diameter (mm)
- **ΔT** Linear expansion

BENDING KNEE CALCULATION EXAMPLE:

Assuming you need to calculate the bending knee length for a **MetiTherm** pipe corner. Assuming the (**ΔL**) of a standard **MetiTherm** pipe segment (L) of 3.2 meters of a diameter of 25 mm, and at a maximum working temperature of 60°C. You know that the **MetiTherm** standard pipe has a coefficient of linear expansion of (α =0.15). You know that the installation was executed at the typical ambient temperature of 20°C.

1. First calculate the amount of expansion in the main pipe length:

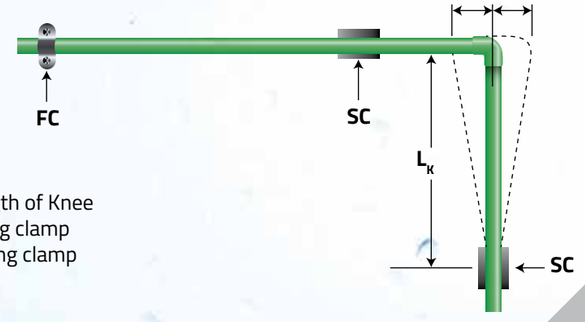
$\Delta L = \alpha \cdot L \cdot \Delta T$ or $\Delta L = 0.15 * 3.2 * (60°C - 20°C) = 19.2$ mm

That means you can expect a linear expansion of 19.2 mm for this segment of pipe if the temperature difference is respected.

2. Next, calculate the bending knee side length required:

$L_K = 20 \times \sqrt{25.0}$ mm X 19.2 mm
$L_K = 438.2$ mm

Therefore, the calculated minimum required bending side L_K comes up to 328.5 mm. A safety factor is suggested not to exceed 5% of this length .



L_K = Length of Knee
FC = Fixing clamp
SC = Sliding clamp

INSTALLATION

BENDING KNEES PRE-STRESSING

In tight areas, where there is no room for a bending knee of the full length, it is possible to pre-stress the knee in a **MetiTherm** pipe corner in the opposite direction of the expected linear expansion, minimizing the deformation of the knee. This, if executed properly, can conceal deformations to the naked eye.

Following is on example depicting the calculation of the length of a pre-stressed bending knee.

FORMULA FOR CALCULATION OF THE LENGTH OF A PRE-STRESSED BENDING KNEE.

The bending knee length L_k is calculated according to the following formula:

$$L_{kp} = c \cdot \sqrt{d \cdot \Delta L/2}$$

Where:

L_{kp} Length (mm) of the pre-stress bending knee
c Material specific constant (equal to 20 for **MetiTherm** pipes)
d Outside Diameter (mm)
ΔT Linear expansion

Pre-stressing bending Knee Calculation Example:

As per the previous example of bending knee calculation, we can calculate the pre-stress bending knee length required:

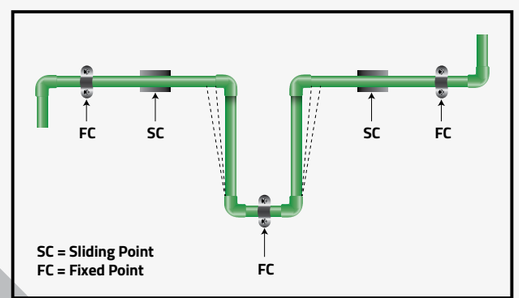
$$L_{kp} = 20 \text{ X } \sqrt{25.0 \text{ mm X } 19.2 \text{ mm}/2}$$

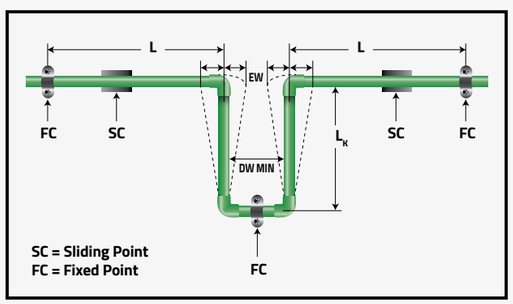
L_{kp} = 310 mm (as opposed to 438.2 mm with no pre-stressing, saving ~ 30% length)

Therefore, the calculated minimum required pre-stressed bending knee L_{kp} comes up to 310mm. A safety factor is suggested not to exceed 5% of this length.

EXPANSION SINK

If the linear expansion cannot be compensated through change in direction, it becomes necessary to install an expansion sink. The following example depicts the calculation of the length of an expansion sink.





FORMULA FOR CALCULATION OF THE WIDTH OF AN EXPANSION SINK

The recommended width of the expansion sink DW is calculated according to the following formula:

$$DW_{min} = EW + (\Delta L_1 + \Delta L_2)$$

Where:

EW Minimum Expansion Sink Width.
DW_{min} Recommended Designed (Fixed) Width of the expansion sink.
ΔL_1 Maximum expected linear expansion of the first side.
ΔL_2 Maximum expected linear expansion of the second side.

Expansion Sink Calculation Example:

Assuming you need to calculate the expansion sink width of length for a **MetiTherm** pipe corner. Assuming the maximum linear expansion of the first side to be 30 mm and the second side to be 65 mm, then

DW = 160 + (30 mm + 65 mm)
DW = 255 mm

EFFECTIVE SPANS

Support intervals for **MetiTherm** standard pipes in conjunction with temperature and outside diameter should be maintained between different clamps. These spans should not be exceeded for a given temperature rating of the line. The next tables outline the allowable spans for **MetiTherm** pipes.

EFFECTIVE SPANS FOR METITHERM STANDARD PIPES (PN 20)

Temperature Differences Δτ (K)	Pipe Diameter (mm) 20	25	32	40	50	63	75	90	110
	Support Spans in cm between pipe clamps								
0	85	105	125	140	165	190	205	220	250
20	60	75	90	100	120	140	150	160	180
30	60	75	90	100	120	140	150	160	180
40	60	70	80	90	110	130	140	150	170
50	60	70	80	90	110	130	140	150	170
60	55	65	75	85	100	115	125	140	160
70	50	60	70	80	95	105	105	125	140

INSTALLATION

EFFECTIVE SPANS FOR METITHERM STABI COMPOSITE PIPES (PN 20)

Temperature Differences Δt (K)	Pipe Diameter (mm) 20	25	32	40	50	63	75	90	110
	Support Spans in cm between pipe clamps								
0	155	170	195	220	245	270	285	300	325
20	120	130	150	170	190	210	220	230	250
30	120	130	150	170	190	210	220	230	240
40	110	120	140	160	180	200	210	220	230
50	110	120	140	160	180	200	210	220	210
60	100	110	130	150	170	190	200	210	200
70	90	100	120	140	160	180	190	200	200

INSULATION OF METITHERM PIPES

A major advantage of the use of polypropylene pipes is its low coefficient of conductivity. In other words, PP-R systems, in comparison to steel piping systems, offer superior insulating properties, if not insulated, and require much less insulation, if further heat loss is to be prevented.

Insulating material should ensure that the water is maintained at the designed operating temperature. Legal and other obligations (in building regulations) should also be complied to.

The insulating effect is mainly a function of the thickness of insulation and its thermal conductivity. It increases in direct proportion to the temperature. Moisture can impair the performance of insulating material. Hence open cell and fibrous insulating materials should be supplemented with a vapor barrier attached to the outer surface of the insulation.

Condensation can form on any insulating material if the pipe carrying cold water is inadequately lagged. Furthermore, it can lead towards moisture penetrating to the pipe in the case of using unsuitable materials. Obviously, closed cell material with a high moisture resistance should be used to insulate cold water pipes. All butt joints, cuts, ... and ends should be properly sealed.

Considering the areas where frost damage is common, even insulation would prove insufficient in preventing the freezing if the system is out of service. Pipes should hence be drained or protected.

INSULATION OF METITHERM PIPES FOR COLD WATER APPLICATIONS

For cold water, and according to the requirements of DIN 1988 part 2, insulation of pipes should be designed to adequately protect against condensation and moisture (see the next table).

METITHERM RECOMMENDED MINIMUM INSULATION THICKNESS FOR COLD WATER PIPES

Pipes Location	Insulation Thickness in mm, for λ = 0,040 W/(mK)*
Exposed pipes, in unheated room (e.g. cellar)	4
Exposed pipes, in heated room.	9
Ducted pipes (cold water only)	4
Ducted pipes (cold and hot water)	13
Pipes in wall recess, next to hot pipes	13
Pipes on concrete floor	4

***For other values of λ the thickness is to be obtained by conversion, on the basis of a pipe diameter of 20 mm.**

Under required circumstances, cold water pipe work should be adequately protected against condensation and sources of heat. The installation of cold water pipes should be done avoiding heat sources {hot pipes, chimneys, boilers}, unless the pipes are equipped with proper insulation so as to retain the water temperature.

For residential applications, assuming normal service conditions, the insulation thickness specified in the as above table should be used. However, insulation will not provide permanent protection of the water against warmth. The specifications of **Metitherm** recommended minimum insulation thickness for cold water pipes are also applicable where the protection against condensation on the outer surface of the insulation is concerned, assuming that the water temperature is 10°C.

PROTECTION OF METITHERM HOT WATER PIPES AGAINST HEAT LOSS

The minimum requirements specified (in the Heating System Regulation) should be complied with for restricting the heat loss of hot water pipes.

MetiTherm pipes and fittings have to be protected by insulation to prevent heat loss. Pipes and fittings made of PP-R 80 have heat conductivity constant of 0.15 W/mK. This indicates a significantly higher degree of self-insulation compared to metal pipes, meaning that in terms of heat transfer **MetiTherm** pipes and fittings offer superior natural insulating properties.

INSTALLATION

METITHERM PRESSURE TEST

An installation pressure test should be always performed after the end of all welding operations and before the piping system has been plastered or insulated, according to DIN 1988 TRWI.

The pressure test should be performed at l .5 times the operating pressure.

Using cold water, the pipe system should be filled slowly and bled completely using calibrated measuring instruments that indicate pressure changes of 0.1 bar wherever possible. Measurements should be taken at the lowest point of the pipe system.

Where pipes and fittings have been welded, the pressure test should not be performed before two hours have elapsed after the last welding operation.

The pressure test consists of two stages:

- For the first stage, a test pressure equal to the permissible working pressure plus 5 bar should be applied twice within 30 minutes at l O minute intervals. The pressure should be then checked. In case more than a 0.6 bar drop occurs over a period of 30 minutes at a rate of 0.1 bar/min, then a leakage is reported.

- The second stage should follow the first stage without interval and should last a minimum of 2 hours. Pressure drop should then be checked. If the pressure drop is more than 0.2 bar and the pipe work shows signs of leakage, then the network should be corrected and the test must be repeated.

FLUSHING THE PIPE WORK ACCORDING TO DIN 1988 PART 2 (TRWI)

Drinking water pipes should be thoroughly flushed after pipe laying immediately after pressure testing, and before using the network.

Other cold and hot water pipes should be flushed separately under pressure, using an intermittent water/air mixture. If possible, water from the mains should be used. The minimum flow rate in the largest pipe being 0,5 mis. This requires a certain number of taps to be open.

A reservoir and pump are to be used for flushing if the maximum flow rate is not achieved when the pipe work section tested is completely filled. In addition, the water used for flushing should be filtered.

Compressed air (supplied from cylinders or from compressors) should be available in sufficient quantity and in a quality harmless to health (oil free), with the air pressure at least equal to the static pressure of the water.
The system should be flushed in sections depending on its size and layout. No section exceeding 100m of pipe run should be flushed at one time.

The direction of flushing shall be from bottom to top and the sequence of flushing, by riser, from the closest to the most remote. Each riser should be flushed from bottom to top, storey by storey. At least as many taps per storey should be opened as specified in the next table.

Normally all the taps, shall be opened one after the other, starting with the most remote. The flushing period is a function of the length of pipe run and should not be less than 15 seconds per meter and not less than two minutes per draw-off point.

After flushing with the last tap opened, the taps should be closed in reverse sequence. The flushing effect shall be reinforced by periodic opening and closing of the air and water supply at regular intervals. Pressure surges produced by rapid opening and closing of valves such as globe valves, has proved particularly effective. For manual operation of the taps, an 'open' interval of about five seconds and a 'closed' interval of less than two seconds are recommended.

MINIMUM FLOW RATE AND MINIMUM NUMBER OF DRAW-OFF POINTS TO BE OPENED FOR FLUSHING (WITH A MINIMUM FLOW RATE OF 0.5M/S)

Maximum nominal size (DN)	25	32	40	50	65	80	100
Minimum flow rate with the pipe work section completely filled, in l/min	15	25	38	59	100	151	236
Minimum number of DN 15 taps to be opened	1	2	3	4	6	9	14

To protect sensitive valves and appliances (water heaters) from damage by solid matter flushed into them, such components should only be installed after flushing, interim fittings or flushing appliances should be used.

EARTH WIRING (ACCORDING TO DIN VDE 0100, PART 701)

All electrically conductive components such as metal taps and metal pipe systems (drinking water and hot water pipe systems) require to be connected together, and earthed properly to protect from shock. This includes rooms containing baths or shower basins. In the case of connecting batteries and metallic outlets to **MetiTherm** piping system, there is no need for them to be earthed. However, metal bath tubs and shower trays should be equalized in electrical potential.

Earthed wire conductor in buildings is either installed at a central point, e.g. power circuit distributor, or at the earth wire bus bar on the main potentials balance.
Note: It is essential to consult a qualified electrician or engineer to confirm potential balance.

TRANSPORT & STORAGE

During transportation and storage, **MetiTherm** piping system components could be exposed to open air at any temperature for short periods of time provided that it is kept in the shade protected from direct sunlight. However, at temperatures below O °C, the material becomes more susceptible to damage if hard blows are delivered. Hence, at low temperature, the material has to be treated with more caution. It is not recommended that **MetiTherm** pipes and fittings be stored in open air for long periods of time.

Additionally, a solid base is recommended to avoid any deformation of pipes during transportation and storage. Even though **MetiTherm** pipes are extremely robust it is recommended to treat the material with care.

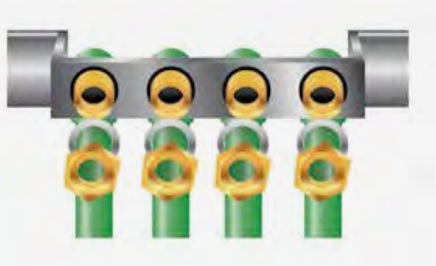
INSTALLATION

METITHERM WATER POINT CONNECTIONS

a. A Wall Disk in a Pipe Chase or Concealed Installation

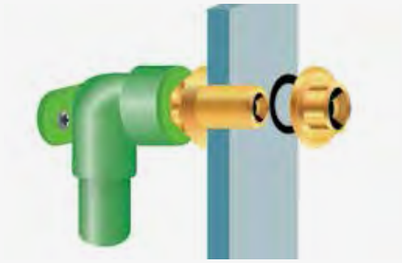
b. Wall Disks for Water Point Connections.

c. Cavity Wall Disk



d. Mounting Unit

e. Female/male Elbow Transition For Cavity Wall Connections With 30mm Thread



f. Cavity Wall Fitting Joint with Transition Elbow

PRINCIPLE OF CALCULATION OF PIPING NETWORK SIZE

Determination of pipe diameter in potable water networks involves complicated calculations.

Part 3 of the DIN 1988 (Technical Rules for Potable Water Installations) stipulates the calculation principles for the determining of the pipe diameter, based on the calculation of loss of pressure in pipes. The loss of pressure depends on the length of the pipe, the pipe material and the flow rate. This means the quantity and size of the water points to which the pipe is connected. The basis for determining the maximum flow rate should be calculated on the desired flow rate of each water point. DIN 1988 T3 should be used as a basis for these calculations.

The newer version of DIN 1988 is a simplified source for estimating the piping arrangement in the case of residential buildings, providing adequate solutions for actual operating conditions.

In order to select pipe diameter the following data has to be taken into account:

- Minimum supply pressure including boost pressure.
- Minimum pressure and flow speeds required at each outlet point.
- Coefficients of friction accounting for pressure loss due to fittings and pipe connections.
- Height (head) variations.
- Pressure loss due to fittings and connections, watermeters, filters, apparatus and softening installations.

MAXIMUM FLOW RATE

A further criterion for the selection of the pipe diameter is the maximum permissible flow rate. Because of sonic reasons and limitation of water hammer, the calculated flow rate may not exceed the values outlined in the table below.

MAXIMUM FLOW RATE

Part of The Installation	Max.calculated Flow Rate at Run	
	< 15min. m/s	> 15min. m/s
Connecting Pipes	2	2
Service Pipes. Parts with poor drag reducing passage armatures (<2.5)	5	2
Parts with passage armatures with a higher correction value of loss	2.5	2

INSTALLATION

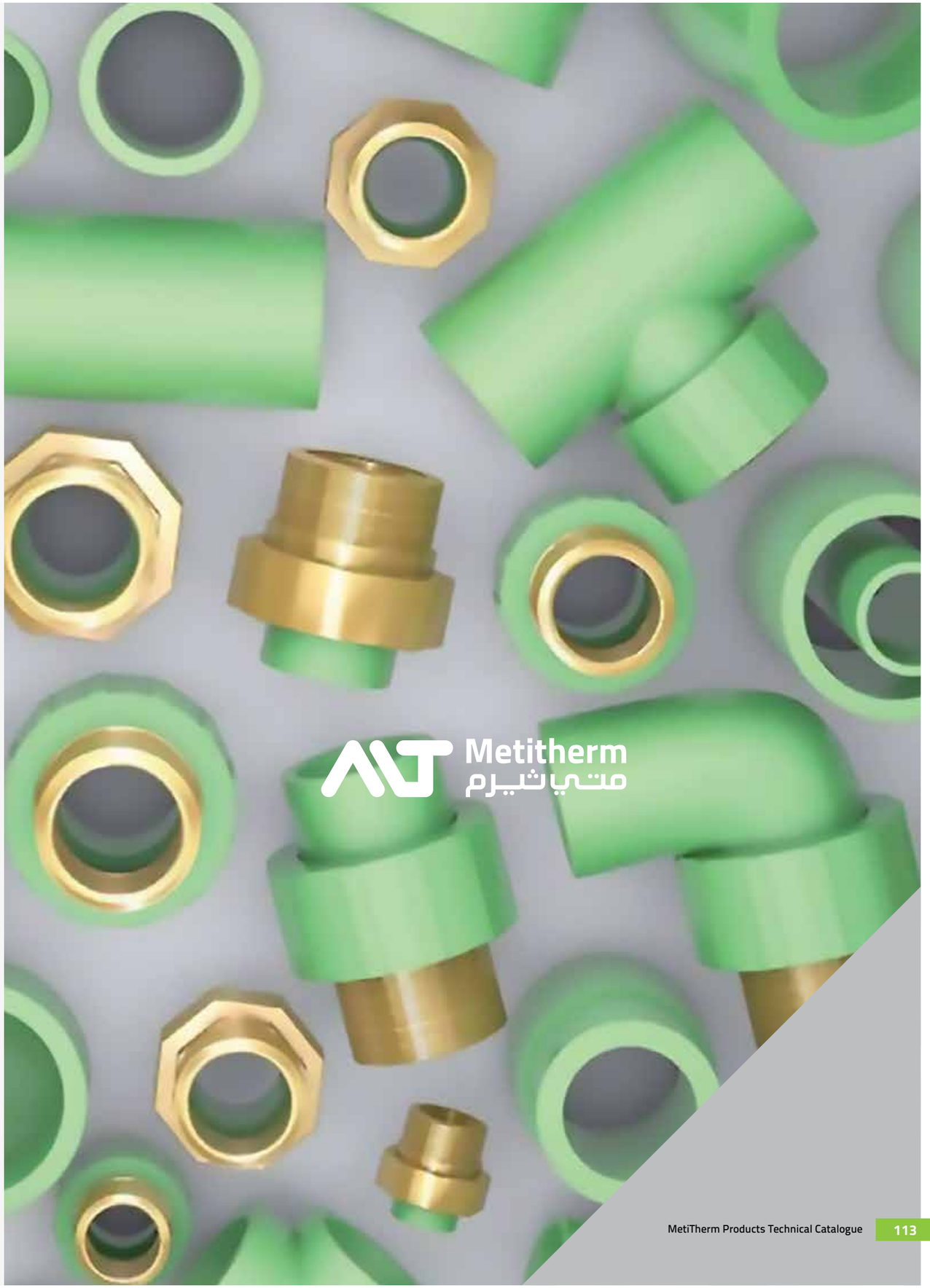
MINIMUM FLOW PRESSURE/CALCULATED FLOWS

CALCULATED FLOW OF COMMON WATER POINT

Minimum flow pressure P_{minF1}	Type of water point	Calculated Flow on Taking		
		Mixed Water		Either Cold or Hot Water
		Volume Flow Cold	Volume Flow Hot	Volume Flow
Bar	**Designation**	**l/s**	**l/s**	**l/s**
	Taps:			
0.5	w/o air inlet DN15	-	-	0.3
0.5	w/o air inlet DN20	-	-	0.5
0.5	w/o air inlet DN25	-	-	1.0
1.0	w/ air inlet DN10	-	-	0.15
1.0	w/ air inlet DN15	-	-	0.15
1.0	Shower Heads for purification	0.1	0.1	2.0
1.2	Flush valves DN15	-	-	0.7
1.2	Flush valves DN20	-	-	1.0
0.4	Flush valves DN25	-	-	1.0
1.0	Urinal Flush valves DN15	-	-	0.3
1.0	Dish washers DN15	-	-	0.15
1.0	Washing machine DN15	-	-	0.25
	Mixer Battery			
1.0	Shower bath DN15	0.15	0.15	-
1.0	Bath tubs DN15	0.15	0.15	-
1.0	Kitchen sink DN15	0.07	0.07	-
1.0	washer basins DN15	0.07	0.07	-

Comment: All other water points and apparatus of the above type with larger armature passages or minimum pressure of flow have to be considered on determining the pipe diameter according to the manufacturer's instructions.

- The calculated flows of mixed water points are based on 15 °C for cold potable water and 60 °C for warm potable water.
- In case of taps without air inlet (perlator) and with hose screw, the loss of pressure in the hose pipe (up to 10 m length) and in the connected apparatus (lawn sprinkler) is considered over the minimum pressure of flow. The minimum pressure of flow is increased by 1 .0 bar to 1.5 bar.



MEMO

MEMO

TEST CONTROL

TECHNICAL RULES FOR POTABLE WATER INSTALLATIONS DIN 1988

Have to be (while still visible) hydraulically pressure tested all pipelines. The test pressure has to be 1.5 times of the operating pressure.

Due to the material properties of **MetiTherm** pipes a pressurization causes an expansion of the pipe. Different temperatures of pipe and test medium lead to alterations of pressure. A temperature change of 10 K corresponds to a pressure difference of 0.5 to 1 bar.

The pressure test of **MetiTherm** pipe systems should be made with a constant temperature of the medium.

The hydraulic pressure test requires a preliminary, principal and final test.

In the preliminary test the system is pressurized with the 1.5 times of the maximum operating pressure. This test pressure has to be re-established twice within 30 minutes within an interval of 10 minutes.

After a test time of a further 30 minutes the test pressure must not drop more than 0.6 bar. No leakage may appear.

The preliminary test is to be followed directly by the principal test. Test time is 2 hours. Now the test pressure taken from the preliminary test may not fall more than 0.2 bar.

The final test is made with a changing pressure of 1 bar and 10 bars according to the diagramm on page 70 . The pipe system must be unpressurized between each test cycle.

Between each test course the pressure has to be released.

No leakage must appear at any point of the tested installation system.

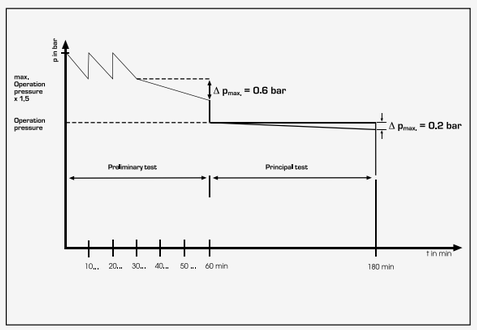
MEASURING OF THE TEST PRESSURES

Measuring has to be done with a manometer allowing a perfect reading of a pressure change of 0.1 bar. The manometer has to be placed at the deepest point of the installation.

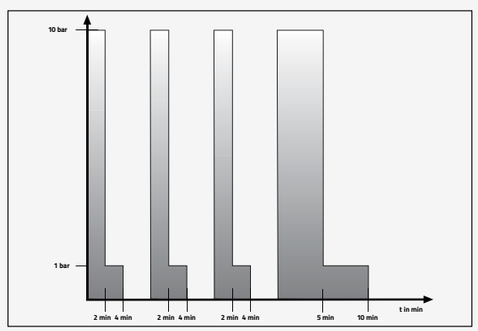
TEST RECORD

A record of the hydraulic pressure test has to be prepared and signed by the client and contractor stating place and date.

PRELIMINARY- AND PRINCIPAL TEST



FINAL TEST



TEST RECORD

Description of the installation

Place: _____

Object: _____

Pipe-lengths:

Ø 16 mm _____ m
Ø 20 mm _____ m
Ø 25 mm _____ m
Ø 32 mm _____ m
Ø 40 mm _____ m
Ø 50 mm _____ m
Ø 63 mm _____ m
Ø 75 mm _____ m
Ø 90 mm _____ m
Ø 110 mm _____ m
Ø 125 mm _____ m

Highest point:

_____ m
(over manometer)

Start of the test: _____

End of the test: _____

Test period: _____

Contractor: _____

Client: _____

Place: _____

Date: _____

_____
Stamp / Signature

Preliminary test

max. working pressure x 1.5
_____ bar

Pressure drop after 30 minutes:
_____ bar
(max. 0,6 bar)

Result preliminary test:
_____

Principal test

Working pressure:
_____ bar
(Ergebnis Vorprüfung)

Pressure after 2 hours:
_____ bar
(max. 0,2 bar)

Result principal test:

_____

Final test*

1. Working pressure 10 bar: _____ bar
   at least 2 minutes, then
   Working pressure 1 bar: _____ bar
   at least 2 minutes
2. Working pressure 10 bar: _____ bar
   at least 2 minutes, then
   Working pressure 1 bar: _____ bar
   at least 2 minutes
3. Working pressure 10 bar: _____ bar
   at least 2 minutes, then
   Working pressure 1 bar: _____ bar
   at least 2 minutes
4. Working pressure 10 bar: _____ bar
   at least 5 minutes, then
   Working pressure 1 bar: _____ bar
   at least 5 minutes

* Unpressurize the pipe between each cycle.

QUALITY CONTROL

THE HIGH QUALITY STANDARDS GUARANTEED BY THE METITHERM MARK ENSURES RIGID CONTROLS OF PRODUCTION PROCESSES.

Concerning **MetiTherm** products, MMp has built a modem and efficient laboratory, in order to test raw materials, it is very important to carry out density and fluidity (MFI) test on polypropylene deliveries.

In order to accept raw materials, it is very important to carry out density and fluidity (MFI) test on polypropylene deliveries.

Test results are carried out per hour, daily or weekly in accordance with the specifications and recorded on the relative production sheets.

The Audit quality manger checks all the results and give the approval to proceed with the production

Pressure Test Equipment

Charpy impact strength

Tensile test

- Product dimensional test of dimensional variation test after heat exposure
- Microscope check about the homogeneity of the modified material
- Temperature and pressure resistance tests as follow:
  - Melting from index
  - Density control
  - Tensile strengths tests
  - Shock tests
  - Heat resistance test

Test duration (h)	Temperature (̊C)	Applied stress (Mpa)
1000	95	3.5
165	95	3.8
1	20	16

Nominal Outside Diameter (mm)	SDR 6 S 2.5 PN 20	
	Wall Thickness (mm)	Weight kg/m
20	3.4	0.172
25	4.2	0.266
32	5.4	0.434
40	6.7	0.671
50	8.3	1.04
63	10.5	1.65
75	12.5	2.34
90	15.0	3.36
110	18.3	5.01
125	20.8	6.47
160	26.6	10.6

CERTIFICATES

SASO QUALITY MARK · TÜVRheinland® Precisely Right. · TÜV CERT · NSF · TÜV NORD · DVGW · SKZ · WRAS Water Regulations Advisory Scheme · ASHGHAL · SASO · FAHSS

Metitherm
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