plastherm®

Technical Catalogue

American Quality Assessors
ISO 9001 REGISTERED COMPANY

DVGW

TSE

TZW

Company Profile

Plastherm has been the leader in the sector for over 12 years, producing PPR (polypropylene random copolymer) pipes and fittings with highest German technology agreeable to German DIN 8077-8078 standarts, with TYP-3 raw material and Borealis raw material which is accepted as one of the best raw materials in the world.

Our major concern has always been the quality and enviromentally harmless and non-polluting products, as well a satisfacting customer service even after the sales.

Exporting our products to more that 27 countries throughout the world, our vision is to expand and offer this quality and safety to many as we can.

Hoping that this catalogue will be a bright guideline for you to overview our company, our products, application areas, our quality and hygiene standarts, we would like to thank you for choosing PLASTHERM quality and service. We are looking for perfectionism...

General Manager   Quality Assurance Manager

A view of our production plant

plastherm®

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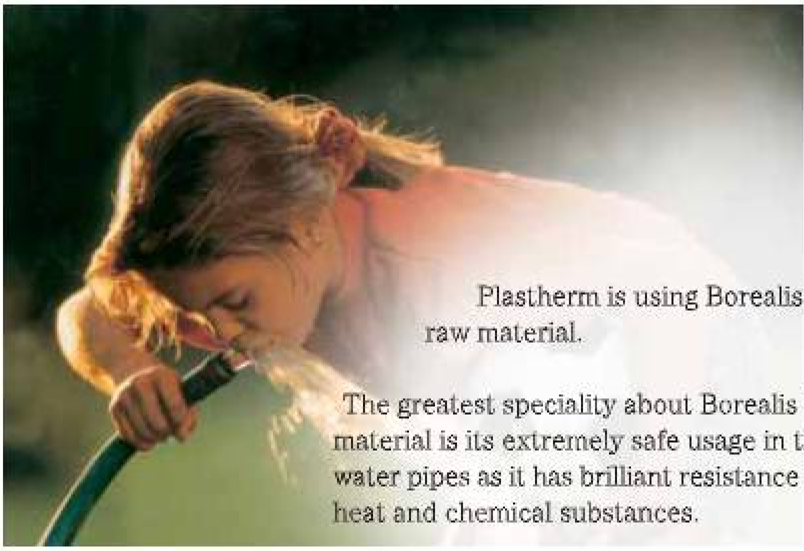
1. The Plastherm System



Plastherm is using Borealis TYP-3 raw material.

The greatest speciality about Borealis TPY-3 material is its extremely safe usage in the hot water pipes as it has brilliant resistance against heat and chemical substances.

The products which are produced from this raw material are hygienic and complies perfect with nutriment charter because it is not also affected by any biological substances.

Our system consists of a wide range of products with variety of application areas.

From the raw material itself, to the distribution stage of our products, every level of production remains with environment-friendly material.

2. The System Features

2. The System Features

• No abrasion
It is resistant to water and chemicals and to acids and alkalis.

• No crust formation
No deposit or lime formations which liquids leave in other type of pipes.

• Less condensation and heat loss
Like all plastic materials, PP-R is a weak conductor of heat but a good isolator.

• Resistant to ice formation
To the frozen liquids it resists on the extent of its elasticity by widening.

• Less presure loss
As surface roughness is less, the abrasion losses are much less.

• Less noise
Ear disturbing vibration and noises are not transmitted.

• High life duration and stability
Plastherm pipes are appropriate for water flowing with high speed without any corrosion problems. 50 years of warranty according to the pressure and temperature used.

• Hygenic and Healthy
All products in the Plastherm system are non toxic, hygenic and healthy.

3. Our Product Range

- Pipes
- Fittings
- Welding Machine
- Accesorries

4. Application Areas

- Clean water installations in all type of buildings
- Hotels, motels and holiday villages
- Hospital, thermal springs and dormitories
- City drinking water networks
- Sera, garden and agricultural administratings
- Combi, air pressure tank and geyzer connections
- Cold water radiator connections
- Can be used safely in acidic, alkaline, airy, salty and greasy environments.

5. Quality Standarts

In accordance with our company objectives, our quality management in conformity with DIN ISO 9001 is mainly directed towards our customers and the market. Our inner factory quality standarts include raw material testing, production survey, and testing finished products as prescribes in DIN standarts.

Tests are conducted continuously in our own laboratory , guaranteeing maximum safety. All results are filed to provide the proceeding surveys and individual data measurement.

We also get the collaboration of the independent testing institues to ensure that our products fits well with the other applicable specifications like DIN, Ö-Norm and ISO and that thier quality remains at a constant high level.

All pipes and fittings of our factory production undergo the following tests:

- Melting index test of raw materials
- Testing accurancy of dimensions and surface nature
- Interior long-term pressure test of 1 hour at 20°C and up to 80 bar depending on the nominal pressure degree
- Notched bar impact test
- Thermal test
- Welding index of processed materials
- Microscopic examination
- Continuous tube sheet thickness survey and measurement

Samples of all feeds are submitted to a long,term internat pressure test lasting 1,000 hours at 95°C and up to 18 bar.

It is our objective to carry out practice- oriented problem solving, by appliying scientific methods and to satisfy our customers by quality and depenable delivery.

6. Standarts

Here are some major standarts and their definitions

- DIN 8077 A1
Polypropylene pipes, dimensions

- DIN 8078
Polypropylene pipes, overall quality requirement test

- Insert 1 to DIN 8078
Polypropylene pipes- chemical resistance of pipes and pipe secitons

- DIN 16962
Pipe connections and pipe sections for polypropylene (PP) pressure pipe systems, Section 5-9, 12

- DIN 16928
Pipe connections, pipe sections, installation, general guidelines

- DIN 1988
Technical regulations for drinking water installations (TRW1)
Technical regulations of the DVGW

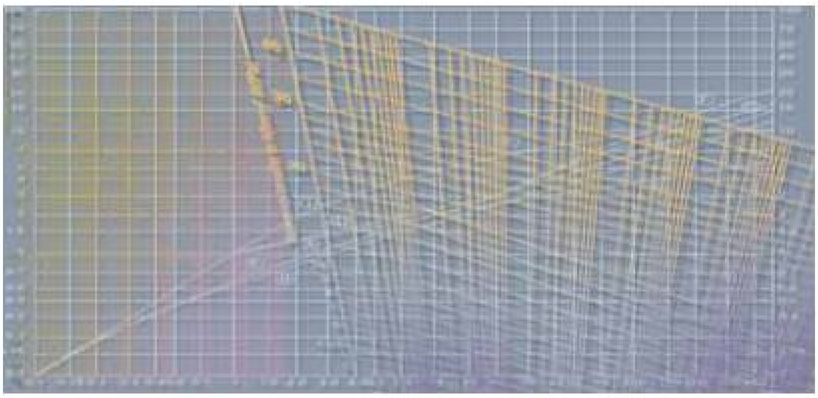
- DIN 4046
Water suuply, designations, technical regulations of the DVGW

- DVS 2207 T11
Heating elements for welding of thermoplastic synthetics, polypropylene (PP) piping

- DVS 2205 T1
Calculation of thermoplastic containers and devices, parameters

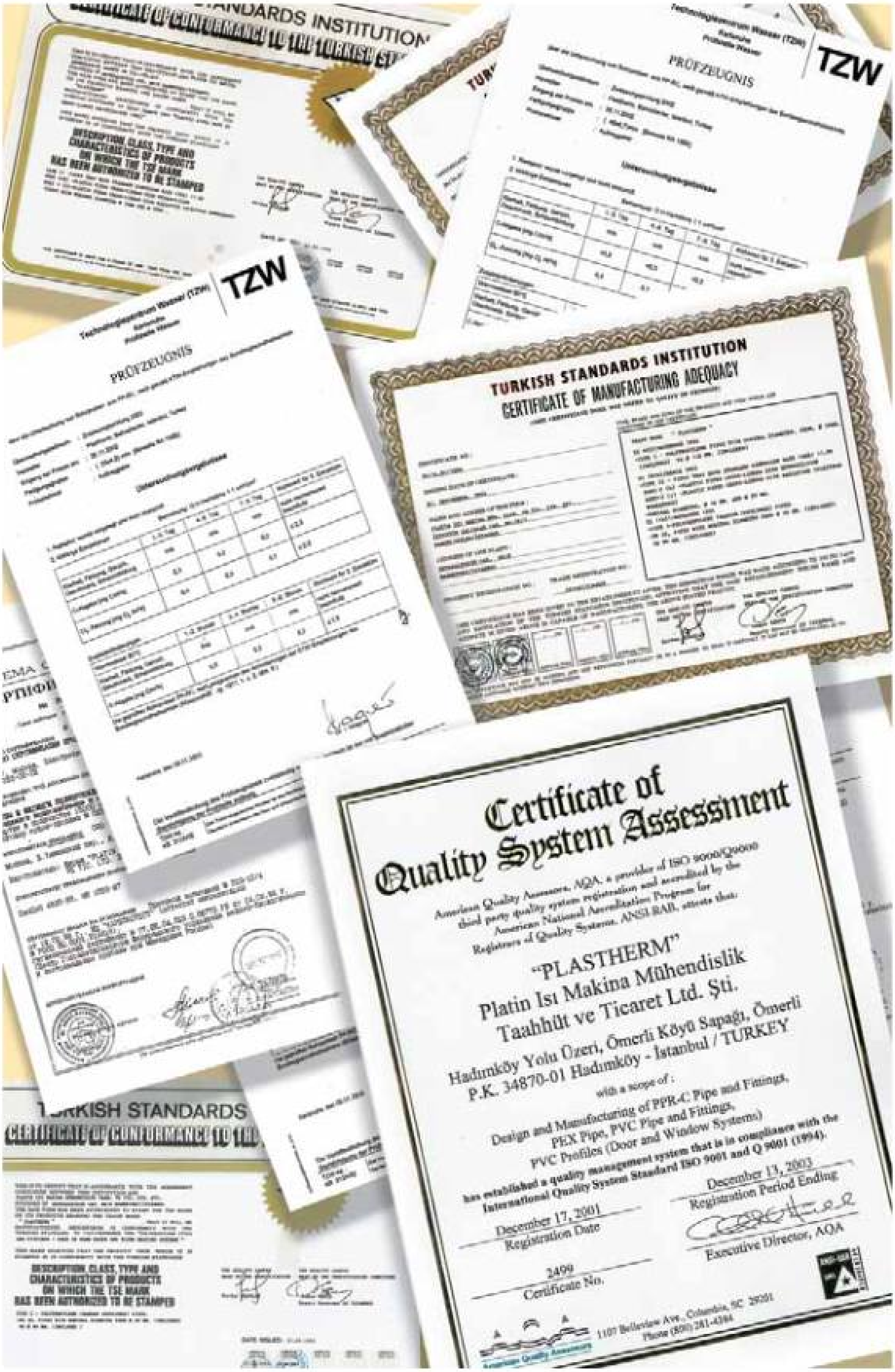
- Ö-NORM B5174
Polypropylene pipes, dimensions, requirements, tests, standart coefficients

- Ö-NORM B5157
Plastic compound pipe systems for hot and cold water, dimesions, requirements, tests, standart coefficients



DVGW : German Association of Gasavd Water Specialists.

7. Certificates



8. Technical Data

8.1. Material Properties

Property	Measuring technique	Unit	Value
Coefficient of viscosity J. Average molar weight	ISO 1191 Solvent viscosity c = 0.001 g/cm3	cm^3 /g -	400 470.000
Melting index MFI 190/5 MFI 230/S	ISO / R1133 Procedure 5 Procedure 14	 g/10 min g/10 min	 0.5 1.5
Density	ISO / R1183	g/cm^3	0.895
Melting range	Polarizing microscope	°C	140-150
Double voltage Ultimate tensile strenght Expansion at tear	ISO / R 527 Char Speed D test bar fig. 2	N/mm^2 N/mm^2 %	21 40 800
Ball-pressure hardness	ISO 2039 (H 358 / 30)	N/mm^2	40
Bending stress at 3,5 % Edge fibre expansion	ISO 178 Test specimen 5.1	N/mm^2	20
Modulus of elasticity	ISO 178	N/mm^2	800
Modulus of transverse elasticity -10 °C 0 °C 10°C 20°C 30 °C 40 °C 50 °C 60 °C	ISO / R 537 Method A	 N/mm^2 N/mm^2 N/mm^2 N/mm^2 N/mm^2 N/mm^2 N/mm^2 N/mm^2	 1,100 770 500 370 300 240 180 140
Tensile properties further to impact bending test at 0 °C	DIN 8078		No fracture
Impact strength (according to Charpy) RT 0 °C -10 °C	ISO / R179 Test bar in conformity with fig. 2	 mJ/mm^2 mJ/mm^2 mJ/mm^2	 No fracture No fracture No fracture
Notched bar impact value (according to Charpy) RT 0 °C -20 °C	ISO / R179 Test bar in conformity with fig. 2	 mJ/mm^2 mJ/mm^2 mJ/mm^2	 15 4.2 2.5
Expansion coefficient	VDE 0304 Part 1§ 4	K^{-1}	1.5×10^{-4}
Caloric conductibility at 20 °C	DIN 52612	W/m K	0.24
Specific heat at 20 °C	Adiabatic calorimeter	kJ/kg K	2.0

8.2. Chemical Resistance

Chemicals		Conc. %	POLYPROPYLENE °C 20°	60°	100°
A					
Acetic acid	Δ	100	+	0	-
(glacial acedik acid)					
Acetic acid aq.	Δ	50	+	+	
(see also vinegar)		10	+	+	+
Acetic anhydride		100	+		
Acetone		100	+	0	
(Boiling point 56,3 °C)					
Alcoholic iodine			+		
Alum		sat.	+	+	
Alums aq.		any	+	+	
Aluminium salts aq.		any	+	+	+
Ammonia, gaseous		100	+	+	
Ammonia aq.		conc.	+	+	
		10	+	+	
Ammonium acetate aq.		any	+	+	+
Ammonium carbonate aq.		any	+	+	+
Ammonium chloride aq.		any	+	+	+
Ammonium nitrate aq.		any	+	+	+
Ammonium phosphate aq.		any	+	+	+
Ammonium sulphate aq.		any	+	+	+
Amyl alcohol, pure			+	+	
(fermentation amyl alcohol)					
Aniline		100	+	(+)	
Antifreeze agent (cars)**	Δ		+	+	
Apple juice			+	+	
Apple sauce			+	+	(+)
Aqua regia			+	-	
Asphalt**			+	0	
ASPIRIN®			+		
B					
Barium salts		any			
Beef suet					
Beer			+	+	+
Benzaldehyde		100	+	+	
Benzaldehylde aq.		sat.	+		
		(0.3)	+		
Benzene	□	100	+		
Benzoic acid		100	(-)	-	
benzoik acid aq.		sat.	+	+	
Bleaching solution			+	+	+
(12.5 %active chlorine)			0	0	
Bone oil					
Borax aq.		sat.	+	(+)	
Boric acid		100	+	+	
Boric acid aq.		sat.	+	+	
		(4.9)	+	+	
Brake Fluid**	Δ				
			+	+	
Brandy					
Bromine liquid		100	+		
bromina, vapours		high	-		
		low	-	-	
Bromine water		sat.	0	-	
Butane, gaseous		100	-	-	
Butane liquid	□	100	+	+	
			+		
Butter			+	+	
Buttermilk		100	+		
Butly acetate	Δ	100	+	0	
n- Butly alcohol (n-butanol)	Δ		+	+	

** Chemical resistance depends upon the composition

Chemicals		Conc. %	POLYPROPYLENE °C 20°	60°	100°
C					
Cake			+	+	(+)
Calcium chloride aq.		sat.	+	+	+
Calcium nitrate aq.		sat.	+	+	+
Camphor			+		
Carbon bisulphide		100	0		
(Boiling point 46,2 °C)					
Carbon tetrachloride	Δ	100	0	-	
Caustic potash solution		50	+	+	
		25	+	+	
		10	+	+	
Caustic soda solution	Δ	50	+	+	
		25	+	+	
		10	+	+	+
Cheese			+		
Chloride of lime			+	+	
(aqueous suspension)					
Chlorine, gas, dry		100	-	-	-
Chlorine, gas, humid		10	0	-	-
Chlorine liquid		100	-		
Chlorine water		sat.	0	-	
Chlorobenzene		100	(-)	-	
Chloroform	Δ	100	-	-	
Chlorosulphonic acid		100	+	+	
Chromic acid		sat.			
		20			
Chromic/sulfiric acid			+	+	
Chromium plating solution**			+		
			+		
			+	+	+
Chromium salts		sat.	+	0	
(bi-and trivalent) aq.					
Cinnamon (cane)			+		
Cinnamon (ground)			+		
Citric acid aq.		sat.	+	+	+
Clove oil			+	0	
Cloves					
Coca-cola®			+		
Cocoa (powdered)			+		
Cocoa (ready to drink)			+	+	(+)
Coconut oil			+	(+)	
Cod-liver oil			+	+	
Coffee (beans and ground)			+		
Coffee (ready to drink)			+	+	+
Common salt, dry			+	+	+
Copper salts aq.		sat.	+	+	+
Corn seed oil			+	0	
Cream, whipped cream			+		
Cresol solution			+		
Cresol		100	+	0	
Cresols aq.		sat.(0.25)	+	0	
Curds			+		
Cyclohexane	Δ□	100	+		
Cyclohexanol	Δ	100	+	+	
Cyclohexanone		100	+	-	

Resistances
+ = resistant
(+) = practically resistant
0 = of limited chemical resistance
(0) = poorly resistant
- = not resistant

Concentrations
aq. = aqueous
sat. = saturated at room temperature
c = coloured

Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
D				
Decahydrünaphthalene	100	0	-	-
Detergents, synthetic**	high	+	+	
(Without solvents, plasticizers	ready for			
and other additives)	use			
Dibutylphthalate				
(see palsticizers)				
Diesel oil, see Fuels				
Dimethylformarnide	100	+		
1,4-Dioxane	100	+	0	-
Dish -washing agents.**				
liquid	+	+	+	
DIXAN®	ready for			
	use			
E				
Eggs (uncooked and cooked)				
Ether (Diethyl etaher)** Δ	100			
Ethyl acetate	100			
Ethyl alcohol Δ	100			
not denatured				
Ethyl alcohol aq.				
not denatured				
Ethyl benezene Δ				
Ethyl chloride** Δ				
Ethylene chloride Δ				
2- Ethyl hexanol Δ				
F				
Fixing salt (see also Sodium	10	+	+	
thiosulphate)				
Floor wax**		+	0	
Flour		+		
Fluoric acid	40	+	+	
Formaldehyde aq. Ghc	40	+	+	
	30	+	+	
	10	+	+	
FORMALIN®		+	+	
Formic acid Δ	98	+	0	
	90	+		
	50	+	+	
	10	+	+	+
Fruit juice		+	+	
Fruit salad		+		
Fuel q				
Petrol, normal		+	0	
according to DIN 51635 q				
petrol, regular		(+)	-	
Petrol, super q		o	-	
Diesel oil** q		+	0	
Fuel oil** q		+	0	
Furniture polish**		+	0	-

** Chemical resistance depends upon the composition

Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
G				
Gin	40	+		
Glycerine	100	+	+	
Glycerine aq.	high	+	+	
	low	+	+	+
Glycol	100	+	+	
Glycol aq.	high	+	+	
	low	+	+	+
Grapefruit juice		+	+	
Gravy		+	+	(+)
H				
Hair shampoo**		+	+	
Heptane	100	+	o	
Hexane	100	+	o	
Honey		+	+	
Horse-radish, ready-to-eat		+		
Hydrochloric acid Δ	conc.	+	+	
	10	+	+	
Hydrogen chloride, gaseous (see	high	+	+	
also Hydrocloric acid)	low	+	+	
Hydrogen peroxide aq.	90			
	30	+	o	
	10	+	+	
	3	+	+	+
Hydrogen sulphide	low	+	+	
(Colouration with lead stabilizers)				
I				
Ink**		+	+	
Iron salts aq.	sat.	+	+	+
Isooctane	100	+	o	
Isopropyl alcohol	100	+	+	
J				
Jam		+	+	(+)
Jelly		+	+	(+)
L				
Lactic acid aq.	90	+	+	
	50	+	+	
	10	+	+	+
LANOLIN®		+	o	
Lard		+	+	o
Lemonades		+		
Lemon aroma			+	
Lemon juice		+	+	
Lemon peel		+		
Lemon peel oil		+		
Linseed oil		+	+	
LITEX®		+	+	
Liqueur	any	+		
LYSOL®		+	o	

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Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
M				
Magnesium salts aq.	sat.	+	+	+
Margarine		+	+	
MARLIPAL® MG Δ	50	+	+	
MARLON® Δ		+	+	
(42% active detergent)	100	+		
MARLOPHEN® 83	20	+		
MARLOPHEN 89	100	+		
	5	+		
MARLOPHEN 810 Δ	100	+		
	20	+		
	5	+		
MARLOPHEN 820 Δ	100	+		
	20	+	+	
	5	+	+	
Mashed potatoes		+	+	(+)
Mayonnaise		+		
Menthol		+		
Mercuric salts aq.	sat.	+	+	
Mercury	100	+	+	
Methyl alcohol	100	+	+	
Methyl alcohol aq.	50	+	+	
Methylene chloride Δ	100	o		
(Boiling point 40.7 °C				
Methyl ethyl ketone	100	+	o	
Milk		+	+	(+)
Milk food		+	+	(+)
Mineral oil**		+	o	-
(without aromatic				
hydrocarbons)				
		+		
Moth balls**				
		+	o	-
Motor oil (cars)**				
(see also Two-stroke oil and oil				
according to ASTM)				
		+		
Mustard				
N				
Nail Polish		+	o	
(Boiling point 40.7 °C)				
Nail polish remover		+	o	
(Boiling point 40.7 °C)				
Naphtalene	100	+		
Nickel salts aq.	sat.	+	+	
Nitric acid	50	o	-	
	25	+	+	
	10	+	+	
Nitrobenzene	100	o	o	
O				
Octance (see Isooctane)				
Oil No.3 according to ASTM D	100	+	o	-
380-59				
Oil of bitter almonds		+		
Oleic acid	100	+		
Oleum	any	-	-	
Olive oil		+	+	
Orange juice		+	+	
Orange peel		+		
Orange peel oil		+		
Oxalic acid aq.	sat.	+	+	+
Ozone (<0.5 ppm)		(+)	(-)	

** Chemical resistance depends upon the composition

Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
P				
Palm oil		+	o	
Paprika		+	+	
Paraffin	100	+	+	-
Paraffin oil	100	+	o	-
Peanut oil		+	(+)	(-)
Pectin	sat.	+	+	
Pepper		+	+	
Peppermint oil		+		
Perchlorethylene				
(see Tetrachlorethylene)				
Perfume		+		
(The permeability for scents				
should be considered)				
Petrol (see Fuels)				
Petroleum	100	+	o	
Petroleum ether	100	+	o	
Phenol (aqueous phase)	sat.(appr. 9)	+	+	
(phenolic phase)	sat.(appr.70)	+		
Phosphoric acid	sat.(85)	+	o	
	50	+	+	
	10	+	+	+
Phosphorus pentoxide	100	+		
Photographic developers**	comm.	+	+	
	ready	+	+	
	for use			
Pickled cabbage, ready-to-eat		+	+	(+)
Pickled fish		+	+	(+)
Pickled hering				
Pineapple juice		+	+	
Pine needle oil	100	+	(+)	
Plasticizers				
Dibutylphthalate		+	o	
(VESTINOL®C Δ				
Dibutylsebecate		+		
Dihexylphthalate		+		
Dinonyladipate		+		
Diisononylphthalate		+		
(VESTINOL N) Δ				
Dioctyladipate				
(VESTINOL OA) Δ				
Dioctylphthalate		+		
(VESTINOL AH) Δ				
Tricesylphosphate		+		
Trictylphosphate		+		
Porridge		+	+	(+)
Potassium carbonate aq. (Potash)	sat.	+	+	
Potassium chlorate aq.	sat.	+	+	
	(7.3)			
Potassium chloride aq.	sat.	+	+	+
Potassium dichromate aq.	sat.	+	+	+
	(12)			
Potassium iodide aq.	sat.	+	+	
Potassium nitrate aq.	sat.	+	+	
Potassium permanganate aq.	sat.	+	(+)	
	(6.4)			
Potassium persulphate aq.	sat.	+		
	(0.5)			
Potassium sulphate aq.	sat.	+	+	+
Potato salad		+		
Propane,gaseous	100	+	+	
Propane, liquid	100	+		
Pudding		+	+	(+)
Pyridine	100	+	o	

Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
Q				
Qinine				
R				
Rum	40	+	+	
Rum aroma		+		
S				
SAGROTAN®		+	o	
Salad oil, animal	+	o		
Salad oil, vegetable	+	o		
Salted water	any	+	+	+
Sausage		+	+	
Sea water		+	+	+
Shoe polish**		+	o	
Silicone oil**		+	(+)	
Silver salts aq.	sat.	+	+	
Soap, cake soap		+	+	
Soap solution	sat.	+	+	
	10	+	+	+
Soda (see Sodium Carbonate)				
Soda water		+		
Sodium bicarbonate aq.	sat.	+	+	+
Sodium bisulphite aq.	sat.	+	+	
Sodium carbonate aq.	sat.	+	+	
	10	+	+	
Sodium chlorate aq.	25	+	+	
Sodium chloride aq.	sat.	+	+	+
(Common salt)				
Sodium chlorite aq.	5	+		
Sodium hydroxide				
(Caustic soda)				
Sodium hypochlorite aq.	5	+	+	
Sodium nitrate aq.	sat.	+	+	
Sodium nitrite aq.	sat.	+		
Sodium perborate aq.	sat.	+	+	+
	(1.4)			
Sodium phospates aq.	sat.	+	+	+
Sodium sulphate aq.	sat.	+	+	+
(Glauber's salt)				
Sodium sulphide aq.	sat.	+	+	
(Colouration with lead stabilizers)				
Sodium sulphide aq.	sat.	+	+	
Sodium thiosulphate aq.	sat.	+	+	+
(Photographic fixer)				
Soft soap		+	+	
Soybean oil		+	o	
Stannous chloride	sat.	+	+	
Starch, starch solution aq.	any	+	+	
Stearic acid	100	+		
Storage-battery acid		+		
Succinic acid aq.	sat.	+	+	
Sugar (dry)		+	+	
Sugar beet sirup		+	+	+
Sugar solution aq.	any	+	+	(+)
Sulphur	100	+	+	(+)
Sulphur dioxide	low	+	+	+
(Sulphurous anhydride)				
Sulphuric acid	96	+	o	
	50	+	+	
	25	+	+	
	10	+	+	+

Chemicals	Conc. %	POLYPROPYLENE °C 20°	60°	100°
Q				
Tar	sat.	+	o	
(Chemical resistance depends				
upon the composition)				
Tartaric acids aq.	100	+	+	
Tea (leaves)	100	+	+	
Tea (ready-to-drink)		+	+	(+)
Tetrachlorethane	100	(-)	-	
Tetrachlorethylene Δ	100	o	-	
(Perchlorethylene)				
Tetrahydrofuran GhC	100	o	-	
Tetrahydronapthalene Δ	100	o	-	
Thick (semolina) gruel		+	+	(+)
Thiophene		o	-	
Toluene		o	-	
Tomato juice	+	+	+	
Tomato ketchup		+	+	
Toothpastes		+	+	
Transformer oil**	100	o		
Trichlorethylene Δ		o	(-)	
Turpentine oil		o	-	
Two-stroke oil		o	o	
Typewriter oil		+	(+)	
U				
Urea aq.	sat.	+	+	
V				
Vanilla		+	+	
Vaseline		+	o	
Vegetables (ready-to-eat)		+	+	(+)
Vinegar	comm.	+	+	
Vinegar essence Δ	comm.	+	+	
(here is referred to a				
50% concentration)				
W				
Water	100	+	+	+
Water glass		+	+	
Whisky	40	+		
White spirit		+	o	
Wine, mulled claret		+	+	
X				
Xylene ❑	100	o	-	
Z				
Zinc salts aq.	sat.	+	+	

Resistances
+ = resistant
(+) = practically resistant
0 = of limited chemical resistance
(0) = poorly resistant
- = not resistant

Concentrations
aq. = aqueous
sat. = saturated at room temperature
c = coloured

8.3. Long-term Behaviour / Durability

By means of the long-term internal pressure diagram and the given formula for determination of the referance tension, it is rather simple to determine the durability.

$$\sigma_V = p \frac{(da-s)}{2s}$$

Explanation of the formula:

σ_V = referance tension [N/mm²]
p = internal pressure [N/mm²]
da = external diameter of the pipe [mm]
s = wall thickness of the pipe [mm]

Applicable :

1 bar = 0.1 N/mm²

Example :

Tube employed 20 X 3.4, nominal pressure degree PN 20, operational pressure 10 bar. The resulting referance tension will be:

$$\sigma_V = 1\ N/mm^2 \frac{(20\ mm - 3.4\ mm)}{6.8\ mm} = 2.44\ N/mm^2$$

If the referance tension is drawn as a straight line in the long-term internal pressure diagram and is caused to intersect with the isotherms of the corresponding operating temperature, the durability of the pipe to be anticipated in hours will result from the projection onto the X-axis.

In general, however, no point of intersection is reached under the operating conditions encountered in practice. Life > 50 years.

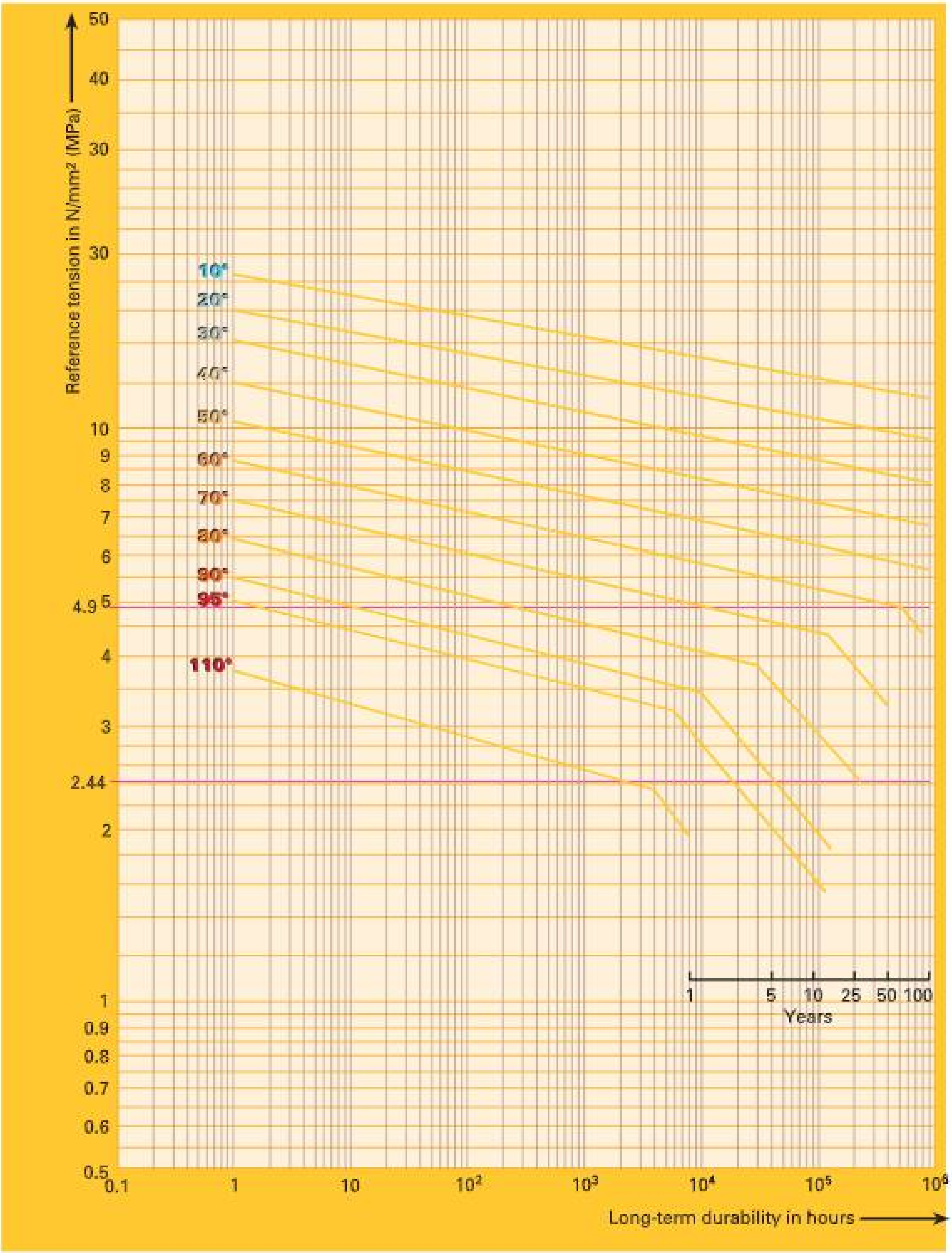
Calculating of security factor SF:

σ_V (e.g. 50 years, temp. 60 °C) = 4,9 N/mm² established from the diagram.

It becomes clear that **Plastherm** pipes present tremendous safety margins in real application situations.

In the planning phase, it is cunstomary to start from the peak temperatures to be anticipated; if we take into account the operationaş temperatures, which in most cases are considerably lower, and their effective periods, the safety margin is even higher.

8.4. Behaviour Under Long Term Stress



8.5. Consistency Properties

From the requirements of the temperature/pressure ratio in accordance with DIN 1988 T2 and the long-term durability properties in accordance with DIN 16962 and DVS 2207, the **Plastherm** pipe with a pressure degree PN 20 meets the specified safety correction value of s=1.5 .

In accordance with DIN 1988 T2, the following requirements are stipulated as regards service on drinking water pipe systems.

Table 2 shows the admissible operational pressures depending on temperatures with a maximum number of years fo operation for the transport of water.

	Operational exess pressure bar	Temperature °C	Hours p.a. h
Cold water	0 to 10 Fluctuating	to 25	8760
Hot water	0 to 10 Fluctuating	to 60 up tu 85	8760 50

Table 1: Operational requirements for pipes

Temp (°C)	Max. op. (Years)	Adm. pressure
10	50	29.3
20	50	25.9
30	50	22.1
40	50	18.4
50	50	14.7
60	50	10.9
70	50	8.0

Table 2:Adminisible operational pressures

With regard to the demads of the temperature/pressure ratio in accordance with Din 1988 T2 and the long-term durability properties in accordance with DIN 16962 and DVS 2207, the **Plastherm** pipe with a pressure degree PN 25 meets the specified safety corection value of s=1.5 .

Table 4 demonstrates the admissible operational pressures depending on temperatures for the flow media water, taking into account a maximum number of years of operation.

	Operational exess pressure bar	Temperature °C	Hours p.a. h
Cold water	0 to 10 Fluctuating	to 25	8760
Hot water[1]	0 to 10 Fluctuating	to 60 up tu 85	8030 730

Table 3: Operational requirements for pipes

[1] *Reference for temp for long-term stress resistance 70 °C*

Temp (°C)	Max. op. (Years)	Adm. pressure
10	50	36.7
20	50	32.3
30	50	27.7
40	50	23.0
50	50	18.3
60	50	13.7
70	50	10.0

Table 4:Admissible operational pressures

The following items need to be taken into consideration when calculating modifications in length:

- Ambient and materials temperature upon installation
- Temperature difference between lowest and highest pipe wall temeperatures
- Expansion coefficient

Below the formula for the calculation of length alterations:

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

Explanation:

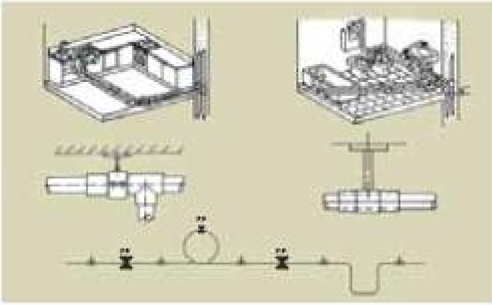
ΔL = Length alteration in mm
α = Expansion coeffizent in K^{-1}
polypropylene pipes $\alpha = 0.15$
prostab AL/PPR composite pipes $\alpha = 0.05$
L = Pipe length in m
ΔT = Difference in temperatures in K

Example:

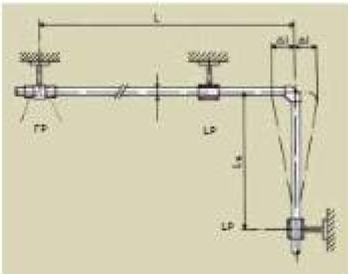
Pipe length= 6m	Temperature range	
	Pipe wall temperature Temp. at installation Difference in temp	60 °C 15 °C 45 K

ΔL_2=0.15·6·45= 40.5 mm

The alteration af length may be compensated by means of extension loops, bending legs, extension bows or appropriate adapters.



FP = Fixing point
LS = Length of bending leg
L = Length of pipe
LP = Gliding rail
$\Delta L = \Delta L_1 + \Delta L_2$

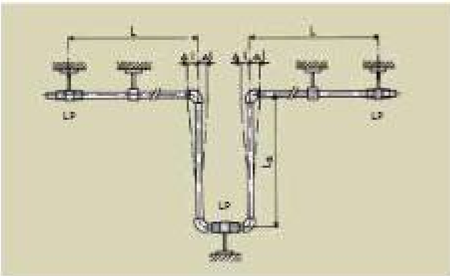


The minimum length of the bending leg results from:

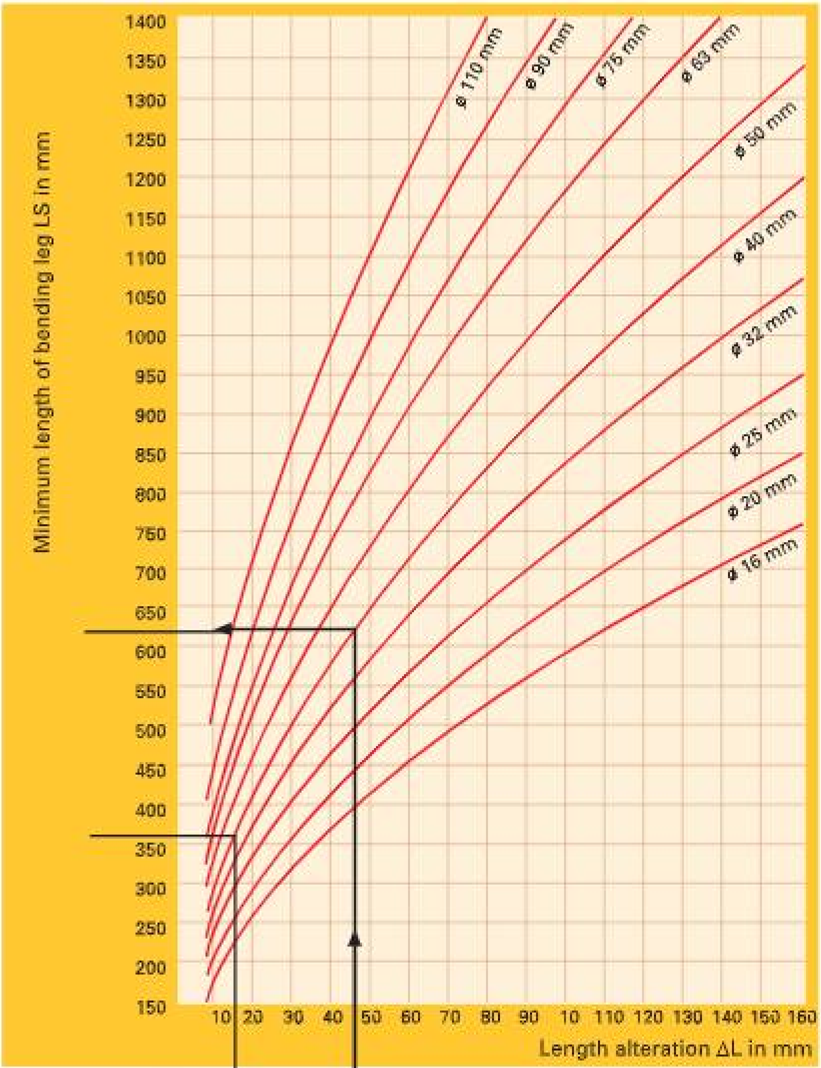
$$L_s = K \cdot \sqrt{d \cdot \Delta L}$$

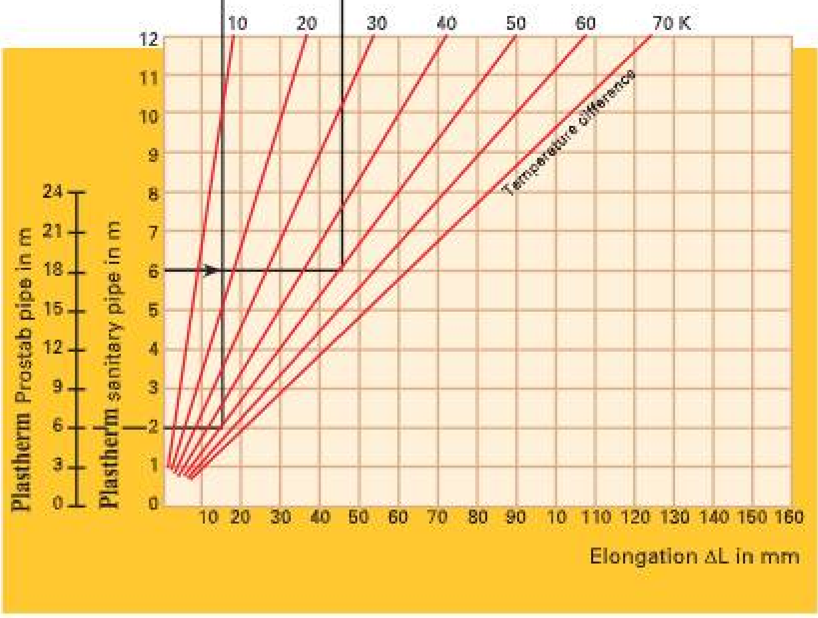
Explanation:

L_s = Length of bending leg in mm
K = Constant depending on material (K value for PP = 15)
d = Pipe diameter in mm
Δ = Elongation in mm, calculated by equation $\Delta L=\alpha \cdot L \cdot \Delta T$



Vide also following example of graphic and mathematical determination of the bending leg.





Example 1:
To be established:
Minimum bending leg for a **Plastherm** pipe ø=40, pipe length 6 m, ΔT= 50K

1.Expansion
ΔL= 0.15x6x50=45mm

2.Minimum bending leg length:
$L_s = 15\sqrt{40x45}$=636mm

Example 2:
To be established:
Minimum bending leg for a **Plastherm** prostab pipe

1.Expansion
ΔL= 0.05x5 x50=15mm

2.Minimum bending leg length:
$L_s = 15\sqrt{40x15}$=367mm

8.7. Bearing Distances / Fixed referance Point Version

Bearing Distances

Arrangement of fix points for horizontal piping

Bearing distances for Plastherm pipe PN 10 – PN 25

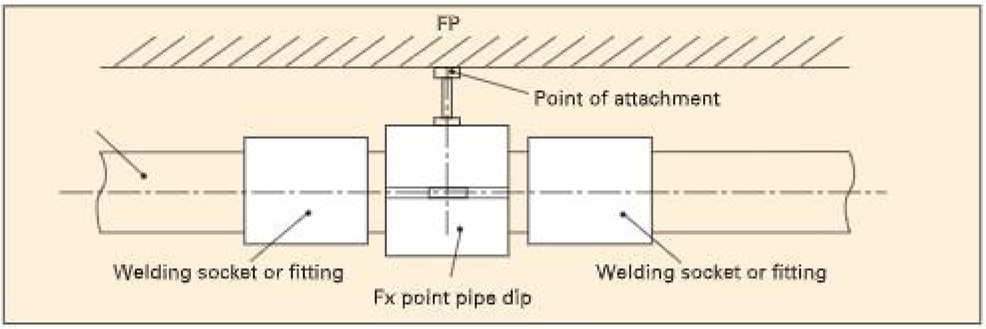
Temp. °C	External diameter pipe mm									
	16	20	25	32	40	50	63	75	90	110
	Fixing intervals cm									
0	70	85	105	125	140	165	190	205	220	225
20	50	60	75	90	100	120	140	160	160	220
30	50	60	75	90	100	120	140	150	160	215
40	50	60	70	80	90	110	130	140	150	210
50	50	60	70	80	90	110	130	140	150	200
60	50	55	65	75	85	100	115	125	140	180
70	50	50	60	70	80	95	105	115	125	175

Bearing distances for Plastherm prostab pipe

Temp. °C	External diameter pipe mm								
	16	20	25	32	40	50	63	75	90
	Fixing intervals cm								
0	130	155	170	195	220	245	270	285	300
20	100	120	130	150	170	190	210	220	230
30	100	120	130	150	170	190	210	220	230
40	100	110	120	130	160	180	200	210	230
50	100	110	120	140	160	180	200	210	220
60	80	100	110	130	150	170	190	200	210
70	70	90	100	120	140	160	180	190	200

Fixed Point Version

A fix point is established by welding sleeves or other moulded parts on either side of the pipe clip. Fixed points to be arranged in a line needto be so selected that alterations in direction in the pipe route are exploited.



8.8. Insulation

Installation sites	Installation layer thickness at L= 0.040 $Wm^{-1} K^{-1(*)}$
Piping in unheated sites, uncovered installation (e.g. basement)	4 mm
Piping in heated sites, uncovered installation	9 mm
Piping inserted into a channel witout heat conveying piping	4 mm
Piping inserted into a channel next to heat conveying piping	13 mm
piping in wall slots, ascending piping and piping installed on concrete floor	4 mm
Piping in wall chases next to heat conveying piping	13 mm
Piping on concrete flooring	4 mm in accordance with DIN 1988 Part 2

(*) When materials with different heat conducting capacity values are employed, the thickness of insulating layers, relating to a pipe diameter of d = 20 mm must be converted accordingly.

Nominal widths (NW) of piping/ fittings in mm	Uncovered piping	Pipes and fittings in wall and ceiling passages, in cross sections, at pipe connections, for central pipe net distributors, radiator connecting piping not exceeding 8 m in length. (in accordance with Heating Installations Decree of 22 March 1994)
up to NW 20	20 mm	10 mm
from NW 22 to NW 35	30 mm	15 mm
from NW 40 to NW 100	equal NW	1/2NW
over NW 100	100 mm	50 mm

8.9. Calculations acc. to DIN 1988

Planning and dimensioning systems to be installed are executed in accordance with DIN 1988. In section 3 of DIN 1988, a large number of calculation examples are demonstrated and all necessary tables and diagrams are explained in detail.

Below you will find diagrams and tables which are required for the establishment of calculation forms.

8.9.1. Minimum flow Pressures

Recommended values for minimum flow pressures and calculated flow at standart drinking water tapping spots.

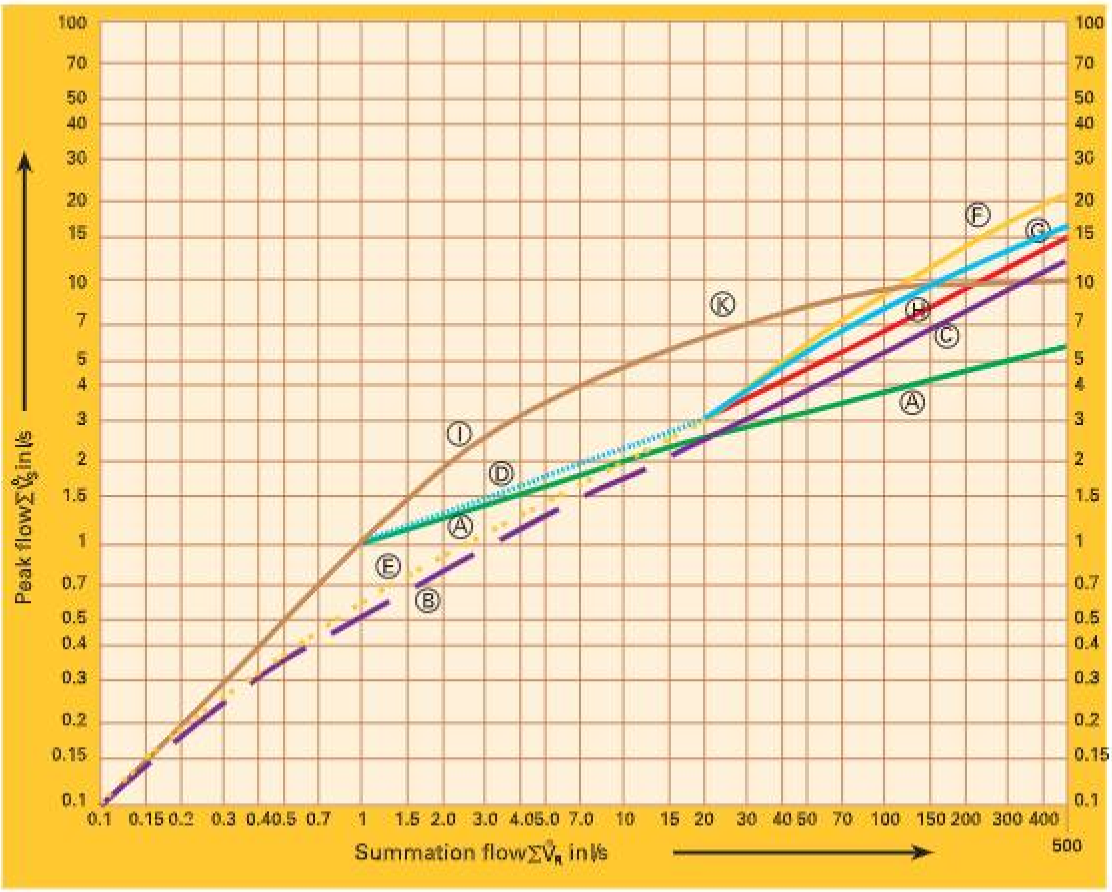
Minimum flow pressure $P_{min\,fl}$ bar	Type of drinking water tapping point		Calculation flow for a tapping: Mixed water – Volume flow cold l/s	Mixed water – Volume flow hot l/s	Only cold or hot water – Volume flow l/s
	Draw-off taps				
0.5	witout air whirler	DN 15	-	-	0.30
0.5		DN20	-	-	0.50
0.5		DN 25	-	-	1.00
1.0	With air whirler	DN10	-	-	1.15
1.0		DN 15	-		0.15
1.0	Shower heads	DN 15	0.10	0.10	0.20
1,2	Pressure rinser in acc, with DIN 3265 Teil 1	DN 15	-	-	0.70
1,2	Pressure rinser in acc, with DIN 3265 Teil 1	DN 20	-	-	1.00
0.4	Pressure rinser in acc, with DIN 3265 Teil 1	DN 25	-	-	1.00
1.0	Pressure rinser For urinal basin	DN 15	-	-	0.30
0.5	Corner valve for urinal basin	DN 15	-	-	0.30
1.0	Household dish washer	DN 15	-	-	0.15
1.0	Household washing machine	DN 15			0.25
	Combination set for				
1.0	shower tubs	DN 15	0.15	0.15	-
1.0	bath tubs	DN 15	0.15	0.15	-
1.0	kitchen sinks	DN 15	0.07	0.07	-
1.0	washstands	DN 15	0.07	0.07	-
1.0	pedestal bidet	DN 15	0.07	0.07	-
1.0	combination set	DN 20	0.30	0.30	-
0.5	Flussing box in acc. with DIN 19542	DN 15	-	-	013
	Drinking water heather for supply of a tapping point (inclusive of combinend tap fittings)				
1.0	Electro water-boiler	DN 15	-	-	0.10*)
	Electro Hot-water tank and boiler				
1.1**)	with nominal contents of 5 to 15 l	DN 15	-	-	0.10
1.2**)	with noinal contents of 30 to 150 l	DN 15	-	-	0.20
	Electro flow water-heater, hydraulic control, without flow limination				
1.5	Nominal capasity	12kW	-	-	0.06
1.9		18kW	-	-	0.08
2.1		21 kW	-	-	0.09
2.4		24 kW	-	-	0.10
1.0	Gas flow water heater	12kW	-	-	0.10

*) with fully open throttle
**) values under unfavourable conditions (shower)
Not : Tapping points which are not included in the table and devices of identical nature with larger fittings flows than indicated are to be treated in accordance with manufacturer's recommendations when determining pipe diameters.

8.9.2. Peak Flow

Peak flow $\dot{V}_S$ depending on summation flow $\sum\dot{V}_R$

Area of application [$\dot{V}_R \le 20$ l/s]		
	[$\dot{V}_R \ge 0.5$ l/s]	[$\dot{V}_S < 0.5$ l/s]
Rdesidential buildings	Ⓐ	Ⓑ
Ofice and admini-strative buildings	Ⓐ	Ⓑ
Hotel buildings	Ⓓ	Ⓔ
Deportment stores	Ⓓ	Ⓔ
Hospitals (only ward sections)	Ⓓ	Ⓔ
Schools $\sum\dot{V}_R = \dot{V}_S$ von 0.1 bis 1.5 l/s		
$\sum\dot{V}_R > 1.5$ l/s] Ⓘ		



Area of application [$\dot{V}_R > 20$ l/s]	
Rdesidential buildings	Ⓐ
Office and admini-strative buildings	Ⓒ
Hotel buildings	Ⓕ
Deportment stores	Ⓖ
Hospitals (only ward sections)	Ⓗ
Schools	Ⓚ