dynatherm®

PP-RCT PIPE SYSTEMS

COMPANY INTRODUCTION

Based in New Zealand since 1995, the team at UPG have years of experience in supplying New Zealand with pipeline systems for both fluid and gas transfer. The Stream piping range is used widely throughout Australasia and the South Pacific

UPG remains independent and flexible, giving you a guarantee of excellent service and the assurance that the proprietors are fully involved in day-to-day company operations.

MARKET ORIENTATED

Our Dynatherm range (by Baenninger in Germany) offers a full range of Standard PP-R, PP-RCT, Faser and Stabi Polypropylene pipe systems. Dynatherm is suited to both cold and hot water applications and any installation where expansion/contraction is an issue. Dynatherm is more cost effective than Stream in the smaller sizes (90mm and down) for cold water lines. The new Dynatherm PP-RCT (Polypropylene - Random Copolymer Temperature enhanced) is a higher density polymer than the standard PP-R80 giving you higher efficiency at highest demands.

The advantages of the Dynatherm PP-RCT Pipe System are:

- Greater stability at higher temperatures
- Higher flow rates, and lower weight, due to reduced wall thickness of PP-RCT
- Higher temperature rating and longer life
- Suitable for potable water
- More rigid but less brittle
- Higher pressure load/rated
- **Fully Guaranteed**

UPG also supplies a number of other systems, including:

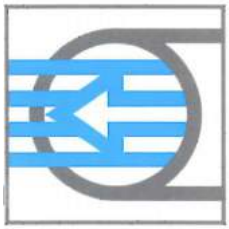
- Stream HDPE Drainage system for greasy or chemical wastes.
- PE100 Blue compressed air piping system.
- Acu-fire, a PE100 HDPE pipe system for use in below ground fire mains.
- Stream PE100 Pressure system for a broad range of applications in the industrial, mining, plumbing and utilities markets.

Why use dynatherm PP-RCT PIPE SYSTEMS

The **Dynatherm PP-RCT** Piping System offers the following advantages:

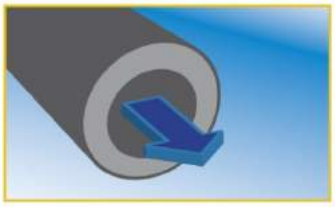
- **Quality:** High quality approved products, designed and manufactured to exacting International standards. The **Dynatherm** system is manufactured in Germany by Baenninger.

- **Guaranteed Product:** The **Dynatherm PP-RCT** Piping System is Guaranteed **for 10 years** – giving you total peace of mind that you are installing a pipe system that is going to go the distance.



- **Higher Flow: Dynatherm PP-RCT** pipe has high flow capacity due to its smooth bore and has a higher flow than other PP-R systems due to the fact that the pipe has a thinner wall for the same pressure rating. PP-RCT does not corrode or tuberculate, and maintains its flow capability over time.

PP-R Pipes



PP-RCT Pipes

- **Versatility:** The **Dynatherm** system has a huge range of fittings and valve options. This means there are many more installation options than with most other systems.

- **Joint Strength:** Fusion welded methods used by **Dynatherm** create a completely homogenous joint which is as strong as, or stronger than the pipe itself. This eliminates rubber seals which can fail over time, and labour intensive welds, and provides pipeline integrity where installed.

- **Less Expansion with Faser: Dynatherm PP-RCT** Faser pipe has a linear thermal expansion coefficient of only 0.35 whereas standard PP-R pipe has an expansion coefficient of 1.5. This seriously reduces the need of expansion loops and makes installation faster and easier.

- **Low Thermal Conductivity: Dynatherm PP-RCT** has an extremely low thermal conductivity of 0.24 W/m K @ 20degC. This feature maintains more uniform temperatures when transporting fluids in PP-RCT compared to metallic piping and other materials. Low thermal conductivity of the wall of PP-RCT piping eliminates or greatly reduces the need for pipe insulation.

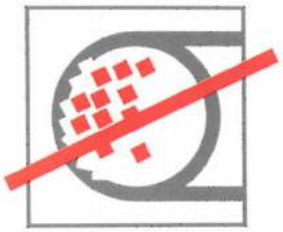
- **Cost Effective, Long Term and Permanent: Dynatherm PP-RCT** installations are cost effective and have long term cost advantages due to its physical properties, leak free joints and vastly reduced maintenance costs. This relates to savings in replacement costs for

generations to come. **Dynatherm** installations use minimal consumables compared to traditional piping systems.

- **Higher Stability at Higher Temperatures:** The **Dynatherm PP-RCT** system will sustain 12.9bar @ 70degC for 50 years. A special feature of the PP-RCT material is its increased pressure resistance at maximum temperatures.

PP-R

PP-RCT



- **Resistant to Corrosion and does not support bacterial growth: Dynatherm** does not rust, rot, pit or corrode when in contact with water or approved chemicals, and the smooth ID resists build up or scaling. **Dynatherm** does not support the growth of, nor is affected by, algae, bacteria or fungi.

- **Ease of installation: Dynatherm** welding techniques are very simple to learn and apply. Testing can begin 1 hour after the last weld has cooled, saving time. Pipe is stocked in 4 metre lengths from 20mm to 160mm OD. Up to 250mm is available indent. It is much easier to handle and install the lightweight **Dynatherm** pipe vs the heavier, rigid PVC or metallic pipe segments, allowing for cost advantages in the installation process. **Dynatherm** is also lighter than other PP-R systems due to its thinner wall.

- **Repairs and upgrades: Dynatherm** Systems are easily repaired in the event of accidental damage, and are simple to connect to for future upgrade works.

- **The Green Solution: Dynatherm PP-RCT** provides a sustainable solution, a material whose performance has been validated for many years. **Dynatherm** is a **Green Rated Product**. A lower environmental carbon footprint is the hallmark for **Dynatherm**, starting with its low energy requirements for manufacturing, and continuing through transportation and installation. The energy needed to completely install a **Dynatherm** pipe system, pales in comparison to the economic and environmental costs of pipe made from various metals and other materials.

upg PIPE SYSTEMS

Suppliers of

dynatherm® PP-RCT PIPE SYSTEMS

FREEPHONE: 0800 4PE100 (473100) - FREEFAX: 0800 767 190 - EMAIL: sales@upg.net.nz

Pipes and Fittings of PP-R
for hot and cold water as well as for heating installations

DIN EN ISO 15874	**Kunststoff-Rohrleitungssysteme für die Warm- und Kaltwasserinstallation – Polypropylen (PP) –**
DIN 8077	**Rohre aus Polypropylen (PP), Maße.** Nach dieser Norm werden die PP-R Rohre aus Polypropylen hergestellt.
DIN 8078	**Rohre aus Polypropylen (PP)** Allgemeine Güteanforderungen, Prüfung. Nach dieser Norm werden die PP-R Rohre aus Polypropylen geprüft.
DIN16962 Teil 6 - 9	**Rohrverbindungen und Rohrleitungsteile aus Polypropylen (PP), Formstücke aus Spritzguß für die Muffenschweißung, Maße.** Nach dieser Norm werden die gespritzten Formstücke aus PP-R hergestellt.
DIN 16962 Teil 5	**Rohrverbindungen und Rohrleitungsteile aus Polypropylen (PP).** Allgemeine Güteanforderungen, Prüfungen. Nach dieser Norm werden die gespritzten Formstücke aus PP-R geprüft.
DIN 1988	**Technische Regeln für die Trinkwasser-Installation (TRWI)** Technische Regeln des DVGW
DIN 4109	**Schallschutz im Hochbau** Schallschutz bei Wasserleitungen
DVGW W 534, W 542 W 544	**Rohrverbinder und Rohrverbindungen Verbundrohre in der Trinkwasserinstallation Kunststoffrohre in der Trinkwasserinstallation**
DVS 2207 Teil 11	**Heizelementschweißen** von thermoplastischen Kunststoff-Rohrleitungen aus Polypropylen (PP).
DVS 2208 Teil 1	**Maschinen und Geräte** zum Schweißen von thermoplastischen Kunststoffen für das Heizelementschweißen.
KTW Empfehlung	**Physiologische Unbedenklichkeit** nach Empfehlungen des Bundesgesundheitsamtes
VOB Teil C DIN 18381	**Gas- Wasser- und Abwasserinstallationsarbeiten innerhalb von Gebäuden.**
DIN 2999	**Withworth Rohrgewinde** Vorgeschrieben ist zylindrisches Innengewinde und kegliges Außengewinde.
DIN 16928	**Rohrverbindungen und Rohrleitungsteile** Verlegung Allgemeine Richtlinien

DVGW Zertifizierung *Certification*

GEPRÜFT ÜBERWACHT IKZ WÜRZBURG

Guarantee certificate no.

Owner _____
Streethouse no. Postale code / city

Building site address _____

Installation Company _____

Start-up _____
Date

The **Bänninger Kunststoff-Produkte GmbH** grants for the **PP-R** installation system:

For your security we have effected a product liability insurance with a renowned German insurance company.
The compliance with the valid DIN-standards and our way of planning and processing as well as the professional installation by licensed specialized business are preconditions for an indemnification.

In the event of damage, as far as exclusive BR pipes and Fittings were used and the cause of damage is provably due to a defect of fabrication or faulty material, costs are assumed up to the following amounts:

1. **Product liability:** **€ 5.000.000,--**
in case of personal injuries and damages to machines and buildings

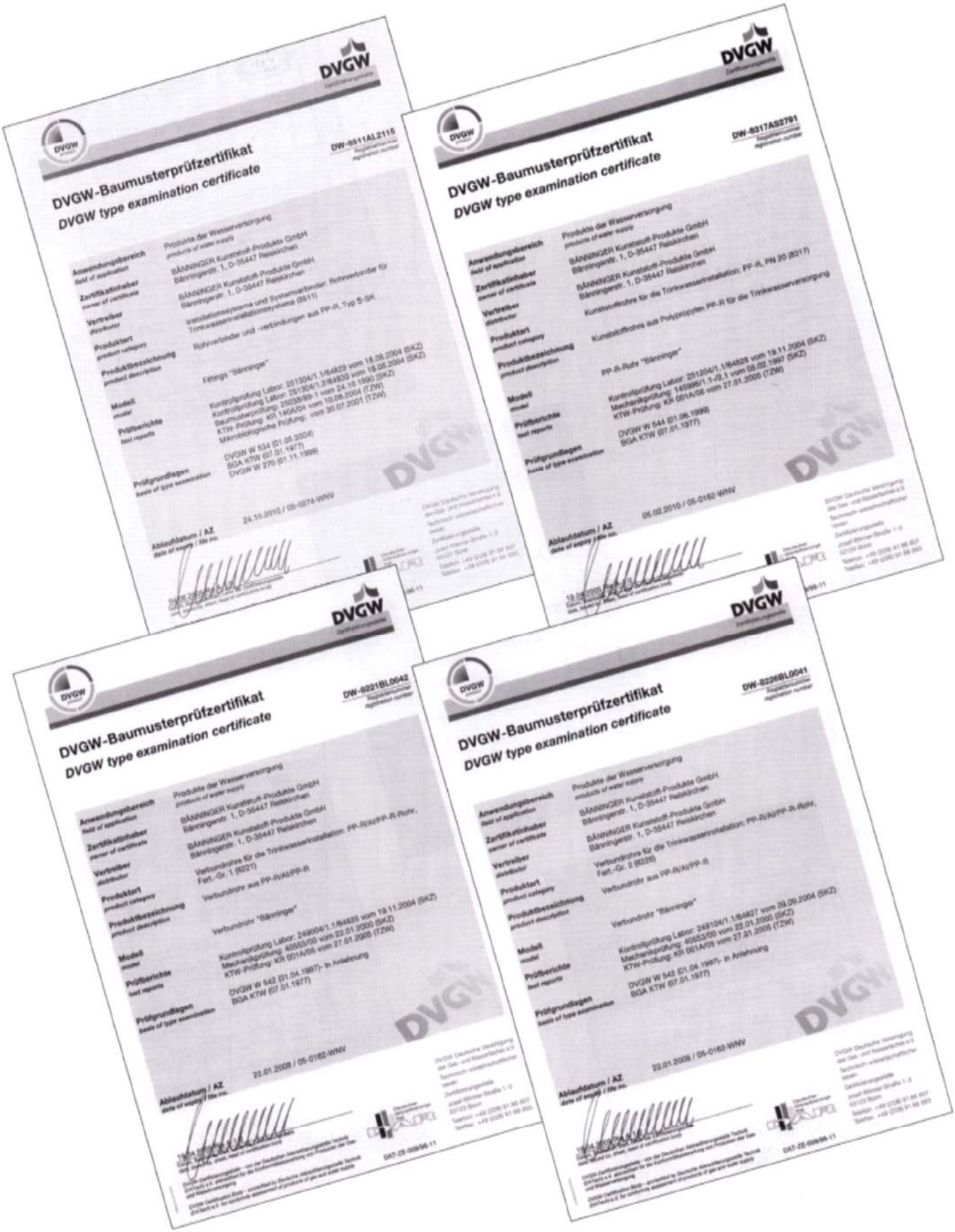
2. **Costs for building in and removal:** **€ 500.000,--**
without costs for consequential damages

3. **Damages to the environment:** **€ 5.000.000,--**
through products having impact on soil, air or water

The guarantee begins on the day of initial operating and ends 10 years after start-up of the installation or after end of insurance contract (ulterior liability).

Bänninger Kunststoff-Produkte GmbH
D-35447 Reiskirchen

This certificate is only valid if the carrying-out company confirms with stamp and signature the duly effected installation and countersigned by BÄNNINGER.

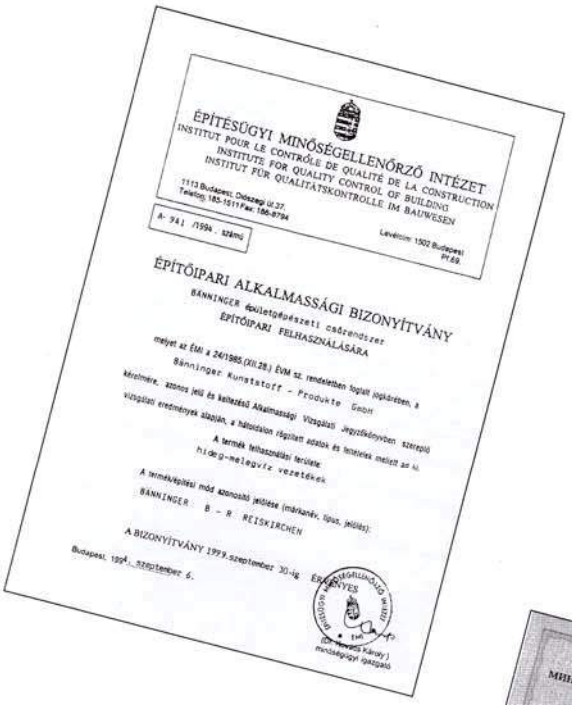


DVGW-Baumusterprüfzertifikat
DVGW type examination certificate

DVGW-Baumusterprüfzertifikat
DVGW type examination certificate

DVGW-Baumusterprüfzertifikat
DVGW type examination certificate

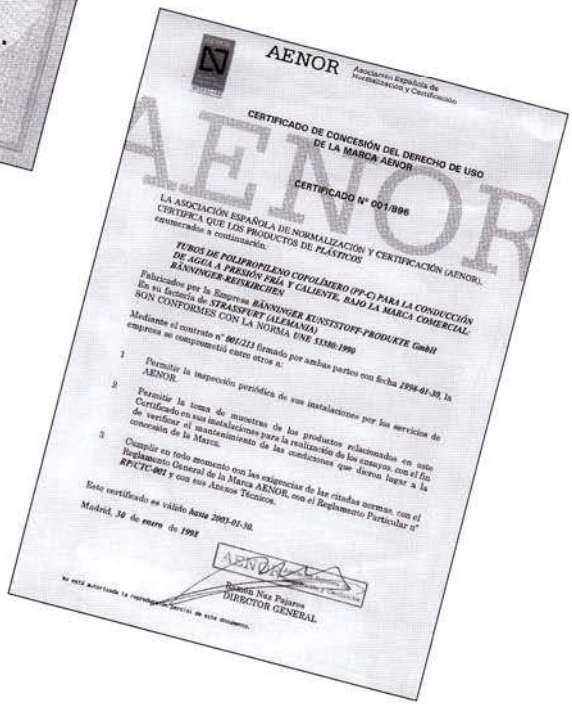
DVGW-Baumusterprüfzertifikat
DVGW type examination certificate


ÉPÍTÉSÜGYI MINŐSÉGELLENŐRZŐ INTÉZET
INSTITUT POUR LE CONTRÔLE DE QUALITÉ DE LA CONSTRUCTION
INSTITUTE FOR QUALITY CONTROL OF BUILDING
INSTITUT FÜR QUALITÄTSKONTROLLE IM BAUWESEN

ÉPÍTŐIPARI ALKALMASSÁGI BIZONYÍTVÁNY
BÄNNINGER épületgépészeti csőrendszer
ÉPÍTŐIPARI FELHASZNÁLÁSÁRA


APROBATA TECHNICZNA
Numer AT/2001-02-1118
A. AKCEPTACJA


МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
ДЕПАРТАМЕНТ ГОСУДАРСТВЕННОГО САНИТАРНО-ЭПИДЕМИОЛОГИЧЕСКОГО НАДЗОРА
СЕРТИФИКАТ


AENOR
CERTIFICADO DE CONCESIÓN DEL DERECHO DE USO DE LA MARCA AENOR
CERTIFICADO Nº 001/896


ÖN
BESTÄTIGUNG DER REGISTRIERUNG
gemäß § 3 (2) Normengesetz 1971

Index

Material:
PP-R (Polypropylene Random-Copolymerisate) of high molecular weight and stabilized to high temperature. The material corresponds to KTW-recommendation of the German Board of Health.

Jointing:
Welding joints
Socket-welding by heating-elements according to DVS (German Welding Inst.) specifications: leaflet 2207, part 11, section 3.2.
Tools and devices for socket-welding by heating-elements according to DVS leaflet 2208, part 1, section 5, schedule 2, type A.

Threaded joints:
The threaded joint of adaptor pipe-fittings correspond to the requirements of DIN 2999 resp. ISO 7, i. e. cylindrical female thread, conical male thread. Male threads for connecting backnuts correspond to the requirements of DIN-ISO 228, part 1.

Dimensions:
Pipes: According to DIN 8077 (Pipes of polypropylene PP).
Fittings: According to DIN 16962, part 6 to 9 (Pipe connections and fittings for polypropylene PP) injection moulded fittings, z-dimensions tolerance ± 3 mm, we reserve the right to modify dimensions without previous notice.

Quality:
Pipes: according to DIN 8078 for PP-R (polypropylene PP pipes).
General quality standards, test.
Fittings: according to DIN 16962 part 5 A (E type 3)
(Pipe connections and fittings for polypropylene PP pressure pipeline.)
General quality standards, test.

Operating pressure:
For cold water at 20° C: up to 20 bar[1)]
for hot water at 70° C: up to 10 bar[1)]
for heating at 70° C: up to 3 bar.
The regulations and guide-lines-dealing with the different fields of application are to be observed.

Chemical Resistance:
Detailed information on the chemical resistance of polypropylene pipes and pipelines is available in annex 1 to DIN 8078. Please note the explanations on page 1 of annex.

Orders:
When ordering, kindly always state the dimensions and the order number in addition to the designation of the piece required.
Example: Elbow 90°, d 32, No. 8090

Marking:
The fittings are marked as follows:
Example: **B•R**, d, PP-R, P

Signs and Symbols:
d = nominal size = pipe diameter
R = male thread-conical
Rp = female thread-cylindric
Rc = female thread-conical
G = male thread-cylindric
Stp = standard packing
® = registered trade mark
AL = number of screw holes

Utilization
The system of tubing of PP-R, as described in this catalogue, has primarly been developped for application in the sanitary field for cold and hot water.

This system can be applied as well in the industrial section.

Tubes and fittings are dimensioned in a way to assure, according to actual results of long-term tests a utilisation of at least 50 years, based on max. 10 bar and a constant temperature of 70 degrees Celsius.

For hot water piping, made according to DIN 1988, the tube row 6 (PN 20) according to DIN 8077 is valid, for dimensions according to table 1.

Tubes are available in lenghts of 4 m.

Plastic pipes and fittings of PP-R generally have all advantages which have been registered in all sections of industry and of installation technics. Most of all the excellent resistance of corrosion gives proof of an extensively long utilization of installation tubing in the building technic, without risk of damages known from metallic materials.
Therefore PP-R as installation-material represents an excellent choice for piping of cold and hot water.

Properties	Measuring technique	Unit	Value
coefficient of viscosity J. Average molar weight	ISO 1191 solvent viscosity c = 0,001 g/cm³	cm³/g --	400 500.000
Melting index MFR 190/5 MFR 230/2,16	ISO / R 1133	 g/10 min. g/10 min.	 0,5 0,24 – 0,36
Density	ISO / R 1183	g/cm³	0,895
Melting range	polarizing microscope	°C	140 – 150
Yield stress Tensile strength Tensile expansion	ISO / R 527 feed speed Test bar	N/mm² N/mm² %	21 40 600
Bending stress at 3,5% Marginal fibre expansion	ISO 178 test specimen 5.1	N/mm²	20
Modulus of elasticity	ISO 178	N/mm²	800
Mechanical properties following impact bending test at 0° C	DIN 8078		no fracture
Expansion coefficient	VDE 0304 Part 1 § 4	K⁻¹	1,5 x 10⁻⁴
Thermal conductivity at 20° C	DIN 52612	W/m K	0,24
Specific heat at 20° C	adiabatic calorimeter	kJ/kg K	2,0
Pipe friction factor	--		0,007

	Conc. %	TEMPERATURE 20°C	60°C	100°C
Acetone	TR	+	+	
Alum	GL	+	+	
Alum of all kinds, hydr.	all	+	+	
Formic acid		+	•	
	85	+	•	–
	10	+	+	•
Ammonia, gaseous	TR	+	+	
Ammonia, hydr.	conc.	+	+	
Ammoniumacetate	GL	+	+	
Ammonium carbonate	GL	+	+	
Ammonium cloride	GL	+	+	
Ammonium nitrate	GL	+	+	+
Ammonium phosphate	GL	+	+	+
Ammonium sulphate	GL	+	+	+
Amylalcohol, pure	TR	+	+	+
Aniline	TR	•	•	
Apple juice	H	+	+	+
Batterie acid		+	+	
Barium salts	GL	+	+	+
Benzaldehyde	GL	+	+	
Benzine	H	•	–	–
Benzoic acid	GL	+	+	
Benzene	TR	•	–	–
Succinic acid, hydr.	GL	+	+	
Beer	H	+	+	+
Bleaching solution	20	•	•	–
Borax	L	+	+	
Boric acid	GL	+	+	+
Bromine, liquid	TR	–	–	–
Bromine, vapours	all	•	–	–
Bromine water	GL	•	–	–
Butane gas	TR	+	+	
Butyl acetate				
Calcium cloride	GL	+	+	+
Calcium nitrate	GL	+	+	
Corn oil	TR	+	•	
Chlor, liquid	TR	–	–	–
Chlorine, gaseous wet	1	–	–	–
Chlorobenzene	TR	•		
Chloride of lime	all	+	+	
Chloroform	TR	•	–	–
Chlorosulphonic acid	TR	–	–	–
Chlorine water	GL	•	–	–
Hydrogen chloride, gaseous	TR	+	+	
Chromic sulphuric acid		–	–	–
Cyclohexane	TR	+		
Cyclohexanol	TR	+	•	
Cyclohexanone	TR	•	–	–
Dekahydronaphtaline	TR	•	–	–
Dibutyl phthalate	TR	•	–	–
Diesel oil	H	+	•	
Diethylether	TR	+	•	
1,4-Dioxane	TR	•	•	
Peanut oil	TR	+	+	
Vinegar	H	+	+	+
Acetic acid (glacial acetic acid)	TR	+	•	–
Acetic acid, hydr.	50	+	+	•
Acetic acid anhydride	TR	+		

	Conc. %	TEMPERATURE 20°C	60°C	100°C
Ethyl acetate	TR	+	•	–
Butyl acetate	TR	•	–	–
Ether				
Ethyl benzene	TR	•	–	–
Ethyl chloride	TR	–	–	–
Pine needle oil	H	+	•	
Hydrofluoric acid solution	40	+	+	
Formaldehyde, hydr.	40	+	+	
Antifreezing solution (motor vehicles)	H	+	+	+
Fruit juices	H	+	+	+
Glycerine	TR	+	+	+
Urea, hydr.	GL	+	+	
Fuel oil	H	+	•	
Heptane	TR	+	•	–
Hexane	TR	+	•	
Iso-octane	TR	+	•	–
Jodine salution	H	+	•	
Caustic potash solution (potassium hydroxide)	50	+	+	+
Potassium carbonate (Potash)	GL	+	+	
Potassium chlorate	GL	+	+	
Potassium chloride	GL	+	+	
Bichromate of potash	GL	+	+	
Potassium iodide	GL	+	+	
Potassium nitrate, hydr.	GL	+	+	
Potassium permanganate	GL	+	–	
Potassium persulphate	GL	+	+	
Coconut oil	TR	+		
Cresol	90	+	+	
LANOLIN®	H	+	•	
Linseed oil	H	+	+	+
Lactic acid	90	+	+	
Magnesium salts	GL	+	+	
Menthol	TR	+	•	
Methanol	TR	+	+	
Methylene chloride	TR	•	–	–
Methyl ethyl ketone	TR	+	•	
Milk	H	+	+	+
Motor oil (motor vehicles)	TR	+	•	
Nickle salts, hydr.	GL	+	+	
Sodium carbonate	50	+	+	•
Sodium chlorate	GL	+	+	
Sodium chloride	VL	+	+	+
Sodium chlorite, hydr.	2 – 20	+	•	–
Sodium hydrochlorite, hyd.	10	+		
Sodium nitrate	GL	+	+	
Sodium nitrite	G	+	+	
Sodium phosphate	GL	+	+	+
Sodium sulphate	GL	+	+	
Sodium sulphide	GL	+	+	
Sodium sulphite	40	+	+	+
Sodium thiosulphate	GL	+	+	
Caustic soda solution	up to 60	+	+	+

Chemical resistance

	Conc. %	TEMPERATURE 20°C	60°C	100°C
Oleum	TR	–	–	–
Olive oil	TR	+	+	•
Oleic acid	GL	+	•	–
Oxalic	GL	+	+	•
Ozone	0,5 ppm	+	•	
Paraffin	H	+	+	
Paraffin oil	TR	+	•	–
Perchlorethylene				
Petroleum ether	TR	+	•	
Petroleum	TR	+	•	
Peppermint oil	TR	+		
Phenol (hydr. phase)	5	+	+	
Phosphoric acid	85	+	+	+
Photographic developer	H	+	+	
Propane, gaseous	TR	+	•	
Pyridine	TR	•	•	
Mercury	TR	+	+	
Mercury salts	GL	+	+	
Castor oil	TR	+	+	
Nitric acid, hydr.	10	+	•	–
Hydrochloric acid, hydr.	up to 20	+	+	
	20 – 36	+	•	
Sulphur dioxide	TR	+	+	
Carbonum disulphide	TR	–	–	–
Sulphuric acid, hydr.	80-TR	•	–	
	10 – 80	+	+	
	10	+	+	+
Hydrogen sulphide	TR	+	+	
Sea water	H	+	+	+
Silver salts	GL	+	+	
Silicone oil	TR	+	+	+
Sodium carbonate (soda)	50	+	+	•
Soybean oil	TR	+	•	
Starch solution, hydr.	all	+	+	
Turpentine oil	TR	–	–	–
Turpentine substitute	TR	+	•	–
Tetrachloroethane	TR	•	–	–
Tetrachloroethylene (Perchlorethylen)	TR	•	•	
Carbon Tetrachloride	TR	–	–	–
Tetrahydrofurane	TR	•	–	–
Tetrahydronaphtalene (Tetralin)	TR	–	–	–
Toluene	TR	•	–	–
Transformer oil	TR	•	–	
Trichloroethylene	TR	–	–	–
Petroleum jelly	TR	+	•	
Detergent	VL	+	+	
Water	H	+	+	+
Hydrogen peroxide, hydr.	30	+	•	
Tricresyl phosphate	TR	+	•	
Trioctyl phosphate	TR	+		
Wine	H	+	+	
Tartaric acid, hydr.	10	+	+	

	Conc. %	TEMPERATURE 20°C	60°C	100°C
Xylene	TR	•	–	–
Zinc salts, hydr.	GL	+	+	
Stannous chloride	GL	+	+	
Citric acid, hydr.	VL	+	+	+
Sugar sirup	H	+	+	

Signs and symbols:

VL = moderate loosening, mass-part ≤ 10%

L = moderate loosening, mass-part > 10%

GL = Saturated(with 20°C), hydrous solution

TR = medium rate flow is minimum-technical pure

H = usual in trade composition

\+ = resistant

• = limited resistant

– = inconstant

Application areas for fittings and pipes made of PP-R and PP-R CT according to DIN 8077

Cold water pipelines:
Continuous operation temperature up to 20°C
Continuous operation pressure up to 20 bar

Warm water pipelines:
Continuous operation temperature up to 70°C
Continuous operation pressure up to 10 bar

Heating pipelines:
Continuous operation temperature up to 70°C
Continuous operation pressure up to 3 bar
(Installation pressure according to DIN EN 12828)

		Operating years					
		1	5	10	25	50	100
	Temperature °C	Max. Operating pressure (bar) according to DIN 8077					
Field of application: Drinking water and sanitary installation							
G 8160 B **PP-R CT Pressure Pipe** 20° C/1,6 MPa, 60° C/0,8 MPa	20	16,6	16,0	15,8	15,5	15,3	15,1
	40	12,3	11,9	11,7	11,5	11,3	11,1
	60	8,9	8,6	8,4	8,2	8,1	–
	70	7,5	7,2	7,0	6,9	6,8	–
	80	6,2	6,0	5,9	5,7	–	–
	95	4,7	4,4	4,3	–	–	–
G 8200 B **PP-R CT Pressure Pipe** 20° C/2,0 MPa, 70° C/1,0 MPa	20	26,3	25,4	25,1	24,6	24,3	24,0
	40	19,6	18,9	18,6	18,2	17,9	17,6
	60	14,2	13,6	13,4	13,1	12,8	–
	70	11,9	11,4	11,2	10,9	10,7	–
	80	9,9	9,5	9,3	9,1	–	–
	95	7,4	7,1	6,9	–	–	–
G 8200 **PP-R Pressure Pipe** 20° C/2,0 MPa, 70° C/1,0 MPa	20	29,9	28,1	27,4	26,4	25,7	25,0
	40	21,6	20,2	19,6	18,8	18,3	17,8
	60	15,4	14,3	13,9	13,3	12,9	–
	70	12,9	12,0	11,6	10,0	8,5	–
	80	10,8	9,6	8,1	6,5	–	–
	95	7,6	5,2	4,3	–	–	–
G 8215 B **PP-R CT Stabi composite pipe** 20° C/2,0 MPa, 70° C/1,0 MPa	20	25,0	24,2	23,9	23,5	23,1	22,8
	40	18,6	18,0	17,7	17,3	17,1	16,8
	60	13,5	13,0	12,7	12,4	12,2	–
	70	11,3	10,9	10,7	10,4	10,2	–
	80	9,5	9,0	8,9	8,6	–	–
	95	7,1	6,7	6,6	–	–	–
G 8200 FW **PP-R CT Fiber composite pipe** **Watertec** 20° C/2,0 MPa, 70° C/1,0 MPa	20	25,0	24,2	23,9	23,5	23,1	22,8
	40	18,6	18,0	17,7	17,3	17,1	16,8
	60	13,5	13,0	12,7	12,4	12,2	–
	70	11,3	10,9	10,7	10,4	10,2	–
	80	9,5	9,0	8,9	8,6	–	–
	95	7,1	6,7	6,6	–	–	–
Field of application: Air conditioning, Industrial plants							
G 8160FC **PP-R CT Fiber composite pipe** **Climatec** 20° C/1,6 MPa, 70° C/0,8 MPa	20	19,9	19,3	19,0	18,6	18,4	18,1
	40	14,8	14,3	14,1	13,8	13,6	13,3
	60	10,7	10,3	10,1	9,9	9,7	–
	70	9,0	8,6	8,5	8,3	8,1	–
	80	7,5	7,2	7,0	6,9	–	–
	95	5,6	5,3	5,2	–	–	–

Classification of operating conditions according toDIN EN ISO 15874-1

The selection of a particular application class according to the following table should be agreed among the contracting parties.
For each application class allowable operating pressure p_D of 4 bar[2)], 6 bar, 8 bar or 10 bar applies, depending on the application.

Application class	Calculation-temperature T_D °C	Service life[b] at T_D Years	T_{max} °C	Service life at T_{max} Year(s)	T_{mal} °C	Service life at T_{mal} h	Typical application area	PP-R pipe system SDR 6	PP-R CT pipe system SDR 7,4
1[a]	60	49	80	1	95	100	Warm water supply (60°C)	10 bar	10 bar
2[a]	70	49	80	1	95	100	Warm water supply (70°C)	8 bar	10 bar
4[b]	20 Followed by 40 Followed by 60 Followed by (see next column)	2,5 20 25	70 Followed by (see next column)	2,5	100	100	Floor heating and Low temperatur radiator connections	10 bar	10 bar
5[b]	20 Followed by 60 Followed by 80 Followed by (see next column)	14 25 10	90 Followed by (see next column)	1	100	100	High temperature radiator connections	6 bar	8 bar

[a] Pertinent to the national regulations either application class 1 or application class 2 may be selected.
[b] If there is more than one operational temperature for one application area, the corresponding sevice life time should be summed (for example the temperature collective for class 5 for a period of 50 years consists of:

- 20°C over 14 years followed by
- 60°C over 25 years followed by
- 80°C over 10 years followed by
- 90°C over 1 year followed by
- 100°C over 100 h)

Explanation:
The column **T_{mal}** gives the highest allowed temperature (for example at disruption of the controlling), max 100° C
The column **Service life at T_{mal}** shows that this breakdown temperature allows a max period of 100 h (over 50 years) whereas single breakdown segments should not exceed 3 hours.

REMARK:
This norm does not apply when higher values are assigned to T_D, T_{max} and T_{mal} than those quoted on the table.

2) 1 bar = 10^5 N7m^2 = 0,1 MPa

			PP-R	PP-RCT		
Time-Temperature collective	Tempe-rature	Operating period (Years)	Allowed operating pressures • Nominal pressure			
			SDR 6[1] (bar)	SDR 7,4 (bar)	SDR 9 (bar)	SDR11 (bar)
Continuous temperature 70°C including **30 days per year with**	75°C	5	14,12	13,30	10,50	8,40
		10	13,66	13,00	10,30	8,20
		25	11,69	12,70	10,10	8,00
		45	10,13	12,50	9,90	7,90
	80°C	5	13,80	12,20	9,70	7,70
		10	13,36	12,00	9,50	7,50
		25	11,04	11,70	9,30	7,30
		42,5	9,70	11,50	9,10	7,20
	85°C	5	13,28	11,10	8,80	7,00
		10	12,53	10,90	8,70	6,90
		25	10,03	10,60	8,40	6,70
		37,5	9,09	10,50	8,30	6,60
	90°C	5	12,57	10,10	8,00	6,40
		10	10,94	9,90	7,90	6,20
		25	8,76	9,60	7,60	6,10
		35	8,07	9,50	7,60	6,00
Continuous temperature 70°C including **60 days per year with**	75°C	5	14,06	13,10	10,40	8,20
		10	13,32	12,80	10,20	8,10
		25	11,30	12,50	9,90	7,90
		45	9,83	12,30	9,80	7,80
	80°C	5	13,09	12,00	9,50	7,50
		10	12,44	11,70	9,30	7,40
		25	10,52	11,50	9,10	7,20
		40	9,31	11,30	9,00	7,10
	85°C	5	11,96	10,90	8,70	6,90
		10	11,33	10,40	8,30	6,60
		25	9,04	10,40	8,30	6,60
		35	8,32	10,30	8,20	6,50
	90°C	5	10,79	9,90	7,90	6,20
		10	9,66	9,70	7,70	6,10
		25	7,71	9,40	7,50	5,90
		30	7,39	9,40	7,40	5,90
Continuous temperature 70°C including **90 days per year with**	75°C	5	13,85	13,00	10,30	8,20
		10	13,40	12,70	10,10	8,00
		25	11,13	12,40	9,80	7,80
		45	9,65	12,20	9,70	7.70
	80°C	5	13,19	11,80	9,40	7,50
		10	12,32	11,60	9,20	7,30
		25	8,86	11,30	9,00	7,10
		37,5	8,94	11,20	8,90	7,00
	85°C	5	12,36	10,80	8,60	6,80
		10	10,52	10,60	8,40	6,60
		25	8,42	10,30	8,20	6,50
		32,5	7,90	10,20	8,10	6,40
	90°C	5	10,40	9,80	7,80	6,20
		10	8,79	9,60	7,60	6,00
		25	7,03	9,30	7,40	5,90

Allowed operating pressures

dynatherm®
PP-RCT PIPE SYSTEMS

			PP-R	PP-RCT		
Time-Temperature collective	Tempe-rature	Operating period (Years)	Allowed operating pressures • Nominal pressure			
			SDR 6[1)] (bar)	SDR 7,4 (bar)	SDR 9 (bar)	SDR11 (bar)
Continuous temperature 70°C including **120 days per year with**	75°C	5		12,90	10,20	8,10
		10		12,60	10,00	7,90
		25		12,30	9,70	7,70
		45		12,10	9,60	7,60
	80°C	5		11,70	9,30	7,40
		10		11,50	9,10	7,20
		25		11,20	8,90	7,10
		35		11,10	8,80	7,00
	85°C	5		10,70	8,50	6,70
		10		10,50	8,30	6,60
		25		10,20	8,10	6,40
		30		10,10	8,00	6,40
	90°C	5		9,70	7,70	6,10
		10		9,50	7,50	6,00
		25		9,20	7,30	5,80
Continuous temperature 70°C including **150 days per year with**	75°C	5		12,80	10,10	8,00
		10		12,50	10,00	7,90
		25		12,20	9,70	7,70
		40		12,10	9,60	7,60
	80°C	5		11,70	9,30	7,30
		10		11,40	9,10	7,20
		25		11,20	8,90	7,00
		35		11,10	8,80	7,00
	85°C	5		10,60	8,40	6,70
		10		10,40	8,20	6,50
		25		10,10	8,00	6,40
	90°C	5		9,60	7,60	6,00
		10		9,40	7,50	5,90
		20		9,30	7,30	5,80

Allowed operating pressures

			PP-R	PP-RCT		
Time-Temperature collective	Tempe-rature	Operating period (Years)	Allowed operating pressures • Nominal pressure			
			SDR 6[1)] (bar)	SDR 7,4 (bar)	SDR 9 (bar)	SDR11 (bar)
Continuous temperature 70°C including **180 days per year with**	75°C	5		12,70	10,10	8,00
		10		12,50	9,90	7,90
		25		12,20	9,70	7,70
		45		12,00	9,50	7,60
	80°C	5		11,60	9,20	7,30
		10		11,40	9,00	7,20
		25		11,10	8,80	7,00
		30		11,00	8,80	6,90
	85°C	5		10,50	8,40	6,60
		10		10,30	8,20	6,50
		25		10,10	8,00	6,30
	90°C	5		9,60	7,60	6,00
		10		9,40	7,40	5,90
		18		9,20	7,30	5,80
Continuous temperature 70°C including **210 days per year with**	75°C	5		12,70	10,10	8,00
		10		12,40	9,90	7,80
		25		12,10	9,60	7,60
		40		12,00	9,50	7,50
	80°C	5		11,60	9,20	7,30
		10		11,30	9,00	7,10
		25		11,10	8,80	7,00
		30		11,00	8,70	6,90
	85°C	5		10,50	8,30	6,60
		10		10,30	8,20	6,50
		25		10,00	8,00	6,30
	90°C	5		9,50	7,60	6,00
		10		9,30	7,40	5,90
		15		9,20	7,30	5,80

Allowed operating pressures

Permissible operation pressure for hot and cold water pipes PP-RCT (SDR7.4 to SDR11)

Time/Temperature Collective	Temperature	Operation Years	Operation Pressure SDR 7.4[1)]	Operation Pressure SDR 9[1)]	Operation Pressure SDR 11[1)]
Continuous Temperature of 70°C for 180 days a year with →	75°C	5	12.7	10.1	8.0
		10	12.5	9.9	7.9
		25	12.2	9.7	7.7
		40	12.0	9.5	7.6
	80°C	5	11.6	9.2	7.3
		10	11.4	9.0	7.2
		25	11.1	8.8	7.0
		30	11.0	8.8	6.9
	85°C	5	10.5	8.4	6.6
		10	10.3	8.2	6.5
		25	10.1	8.0	6.3
	90°C	5	9.6	7.6	6.0
		10	9.4	7.4	5.9
		18	9.2	7.3	5.8
Continuous Temperature of 70°C for 210 days a year with →	75°C	5	12.7	10.1	8.0
		10	12.4	9.9	7.8
		25	12.1	9.6	7.6
		40	12.0	9.5	7.5
	80°C	5	11.6	9.2	7.3
		10	11.3	9.0	7.1
		25	11.1	8.8	7.0
		30	11.0	8.7	6.9
	85°C	5	10.5	8.3	6.6
		10	10.3	8.2	6.5
		25	10.0	8.0	6.3
	90°C	5	9.5	7.6	6.0
		10	9.3	7.4	5.9
		15	9.2	7.3	5.8

[1)] SDR – Standard Dimension Ratio = diameter / wall thickness

Calculating Pipe Size

Friction Loss Characteristics

Sizing for any piping system consists of two basic components: fluid flow design and pressure integrity design. Fluid flow design determines the minimum acceptable diameter of pipe and pressure integrity design determines the minimum wall thickness required. For normal liquid service applications an acceptable velocity in pipes is 2.15 ±0.9 (m/s), with a maximum velocity of 2.15 (m/s) at discharge points.
Pressure drops throughout the piping network are designed to provide an optimum balance between the installed cost of the piping system and the operating cost of the pumps.
Pressure loss is caused by friction between the pipe wall and the fluid, minor losses due to obstructions, change in direction, etc. Fluid pressure head loss is added to elevation change to determine pump requirements.

Darcy–Weisbach equation

In fluid dynamics, the Darcy–Weisbach equation is a phenomenological equation, which relates the head loss — or pressure loss — due to friction along a given length of pipe to the average velocity of the fluid flow. The equation is named after Henry Darcy and Julius Weisbach.

Pressure loss form

The Darcy–Weisbach equation can be written in terms of pressure loss Δp:

$$\Delta p = f \cdot \frac{L}{D} \cdot \frac{\rho V^2}{2}$$

where the pressure loss due to friction Δp is a function of:

- L/D, the ratio of the length to diameter of the pipe;
- ρ, the density of the fluid;
- V, the mean velocity of the flow;
- f, a (dimensionless) coefficient of laminar, or turbulent flow.

Colebrook equation

The Colebrook equation is an implicit equation that combines experimental results of studies of turbulent flow in smooth and rough pipes. It was developed in 1939 by C. F. Colebrook. The 1937 paper by C. F. Colebrook and C. M. White is often erroneously cited as the source of the equation. This is partly because Colebrook in a footnote (from his 1939 paper) acknowledges his debt to White for suggesting the mathematical method by which the smooth and rough pipe correlations could be combined. The equation is used to iteratively solve for the Darcy–Weisbach friction factor f. This equation is also known as the Colebrook–White equation.

$$\frac{1}{\sqrt{f}} = -2 \cdot \log\left[\frac{2.51}{(R_e \cdot \sqrt{f})} + \frac{k}{3.72 \cdot d_i}\right]$$

where:

- f, is the Darcy friction factor;
- k, Roughness height, (m, ft);
- d_i, Hydraulic or inside diameter, (m, ft);
- Re is the Reynolds number.

Solving Colebrook Equation

Due to the implicit nature of the Colebrook equation, determination of a friction factor requires some iteration or a numerical solving method. Colebrook equations can be solved within a worksheet using circular reference. It is found that the Colebrook equation converges to its reasonably precise value within tens of iterations and it needs only 12 iterations for an 8 digit result. Within hundred iterations it reaches a maximum of fifteen-digit precision. However, the accuracy is limited by the accuracy of the experimental data which is at best about ±2%.

Approximations of the Colebrook equation

Goudar-Sonnad equation

The Goudar equation is the most accurate approximation to solve directly for the Darcy–Weisbach friction factor *f* for a full-flowing circular pipe. It is an approximation of the implicit Colebrook–White equation. The equation has the following form:

$$a = \frac{2}{ln(10)}$$

$$b = \frac{\varepsilon/D}{3.7}$$

$$d = \frac{ln(10)Re}{5.2}$$

$$s = bd + ln(d)$$

$$q = s^{(s\,/\,(s+1))}$$

$$g = bd + ln\frac{d}{q}$$

$$z = ln\frac{q}{g}$$

$$D_{LA} = \frac{g}{g+1}z$$

$$D_{CFA} = D_{LA}(1 + \frac{z/2}{(g+1)^2 + (z/3)(2g-1)})$$

$$\frac{1}{\sqrt{f}} = a[ln(\frac{d}{q}) + D_{CFA}]$$

where *f* is a function of:

- ε , Roughness height, (m, ft);
- *D* , Pipe diameter, (m, ft);
- Re, Reynolds number, (unitless).

Comparisons by the author's shows error compare to Colebrook-White equation of 1.04^{-10} %.

Reynolds Number

Reynolds number can be defined for a number of different situations where a fluid is in relative motion to a surface (the definition of the Reynolds number is not to be confused with the Reynolds Equation or lubrication equation). These definitions generally include the fluid properties of density and viscosity, plus a velocity and a *characteristic length* or *characteristic dimension*. This dimension is a matter of convention - for example a radius or diameter is equally valid for spheres or circles, but one is chosen by convention. For aircraft or ships, the length or width can be used. For flow in a pipe or a sphere moving in a fluid the internal diameter is generally used today. Other shapes (such as rectangular pipes or non-spherical objects) have an *equivalent diameter* defined. For fluids of variable density (e.g. compressible gases) or variable viscosity (non-Newtonian fluids) special rules apply. The velocity may also be a matter of convention in some circumstances, notably stirred vessels.

Flow in a pipe

$$\mathrm{Re} = \frac{QD_H}{\nu A}$$

where:

- D_H is a characteristic linear dimension, (traveled length of fluid) (m);
- ν is the kinematic viscosity, ($\nu = \mu / \rho$) (m^2/s);
- Q is the volumetric flow rate, (m^2/s);
- A is the pipe *cross-sectional* area, (m^2).

Due to the complexity of the Colebrook–White equation, the following tables on pages 48-67 have been derived from the Goudar-Sonnad equation. Values shown in these tables are rounded to two decimal places and figures shown can be up to +/- 1% of the actual values.
Getting the true value pressure losses is almost impossible to calculate due to the complexity of a pipe system with fittings, valves, internal beads, internal gaps between fitting joints etc, and the turbulent influences these all have on water flow.

Piping planning and execution.

All piping planning, calculation as well as thr execution and installation are done according to DIN 1988, the Technische Regeln für Trinkwasser-Installation (TRW), Planung und Ausführung; Bauteile; Apparate; Werkstoffe; Technische Regel des DVGW / Technical Regulations for Drinking Water Installation (TRWI), Planning and Execution; Building Components; Devices; Materials; Technical Regulations of the DVGW. For other fields of application may also be used DIN 16928, Rohrleitungen aus thermoplastischen Kunststoffen; Rohrverbindungen, Rohrleitungsteile, Verlegung, Allgemeine Richtlinien / Thermoplastic Plastics Pipes, Joints, Pipe Components, Laying, General Directives, or the DVS-Richtlinie 2210, Teil 1. Industrie-Rohrleitungen aus thermoplastischen Kunststoffen, Planung und Konstruktion für oberirdische Rohrleitungen /DVS-Directive 2210, Part 1. Industrial Thermoplastic Plastics Pipes, Planning and Construction for Aerial Pipes. The calculation of the required pipe cross sections is done according to the DIN 1988 indications, and for other kinds of application according to, for example, DVS-Directive 2210.

To establish the hydraulic losses for straight PP-R pipes DIN 8077 for all nominal diameters under pipe series 7, for PN 20 the respective values are given in the diagram given below fig. 1. For the temperature range 0 - 70° C multiply the value calculated or taken from pressure drop table with the corresponding temperature factor given in fig. 2.

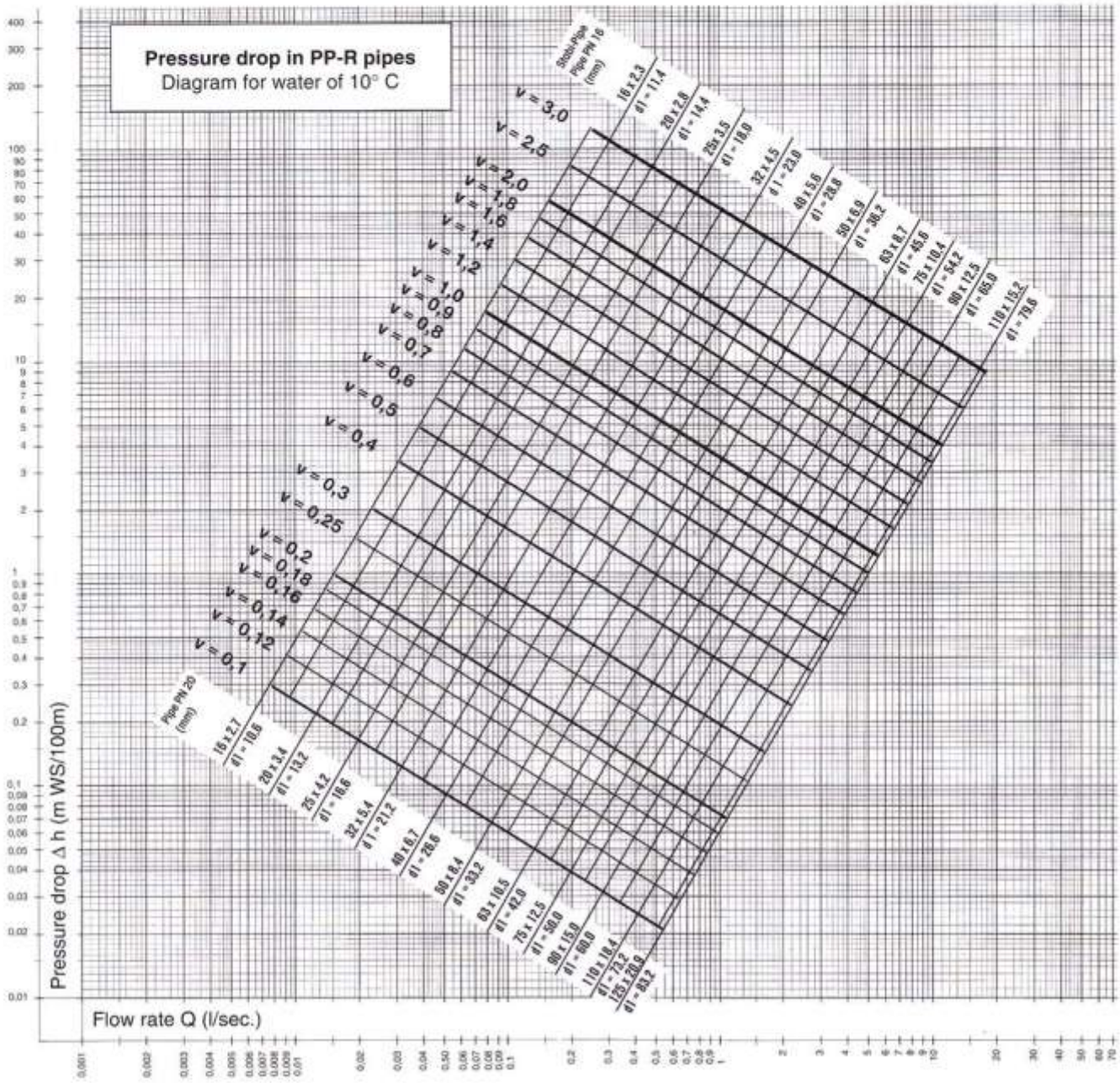


Fig. 1: Pressure drop in PP-R pipes

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Solid Wall D125 SDR11 (Cold Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.3	25x2.8	32x2.9	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x14.6	180x16.4	200x18.2	225x20.5
SDR		9	9	11	11	11	11	11	11	11	11	11	11	11	11
Q	ID →	15.4	19.4	26.2	32.6	40.8	51.4	61.8	73.6	90.0	102.2	130.8	147.2	163.6	184.0
0.05	v	0.27	0.17	0.09											
	R	0.93	0.31	0.08											
0.07	v	0.38	0.24	0.13	0.08										
	R	1.67	0.56	0.14	0.05										
0.09	v	0.48	0.30	0.17	0.11										
	R	2.58	0.86	0.21	0.08										
0.10	v	0.54	0.34	0.19	0.12	0.08									
	R	3.10	1.03	0.25	0.09	0.03									
0.12	v	0.64	0.41	0.22	0.14	0.09									
	R	4.26	1.42	0.34	0.12	0.04									
0.16	v	0.86	0.54	0.30	0.19	0.12	0.08								
	R	7.06	2.34	0.57	0.20	0.07	0.02								
0.18	v	0.97	0.61	0.33	0.22	0.14	0.09								
	R	8.69	2.88	0.69	0.25	0.09	0.03								
0.20	v	1.07	0.68	0.37	0.24	0.15	0.10								
	R	10.47	3.46	0.83	0.30	0.10	0.03								
0.30	v	1.61	1.02	0.56	0.36	0.23	0.14	0.10							
	R	21.57	7.09	1.70	0.60	0.21	0.07	0.03							
0.40	v	2.15	1.35	0.74	0.48	0.31	0.19	0.13	0.09						
	R	36.18	11.84	2.81	0.99	0.34	0.11	0.05	0.02						
0.50	v	2.69	1.69	0.93	0.60	0.38	0.24	0.17	0.12	0.08					
	R	54.20	17.67	4.15	1.46	0.50	0.17	0.07	0.03	0.01					
0.60	v	3.22	2.03	1.11	0.72	0.46	0.29	0.20	0.14	0.09					
	R	75.53	24.54	5.78	2.03	0.69	0.23	0.10	0.04	0.02					
0.70	v	3.76	2.37	1.30	0.84	0.54	0.34	0.23	0.16	0.11					
	R	100.14	32.44	7.61	2.66	0.91	0.30	0.13	0.05	0.02					
0.80	v	4.30	2.71	1.48	0.96	0.61	0.39	0.27	0.19	0.13	0.10				
	R	127.98	41.34	9.67	3.38	1.15	0.38	0.16	0.07	0.03	0.01				
0.90	v	4.83	3.05	1.67	1.08	0.69	0.43	0.30	0.21	0.14	0.11	0.07			
	R	159.03	51.24	11.95	4.17	1.42	0.47	0.20	0.08	0.03	0.02	0.01			
1.00	v	5.37	3.38	1.86	1.20	0.77	0.48	0.33	0.24	0.16	0.12	0.07	0.06		
	R	193.26	62.13	14.38	5.00	1.70	0.56	0.23	0.10	0.04	0.02	0.01	0.01		
1.20	v	6.45	4.06	2.23	1.44	0.92	0.58	0.40	0.28	0.19	0.15	0.09	0.07		
	R	271.20	86.82	20.01	6.94	2.35	0.78	0.32	0.14	0.05	0.03	0.01	0.01		
1.40	v	7.52	4.74	2.60	1.68	1.07	0.68	0.47	0.33	0.22	0.17	0.10	0.08	0.07	
	R	361.69	115.38	26.49	9.16	3.10	1.02	0.42	0.18	0.07	0.04	0.01	0.01	0.01	
1.60	v	8.59	5.42	2.97	1.92	1.22	0.77	0.53	0.38	0.25	0.20	0.12	0.09	0.08	
	R	464.66	147.75	33.80	11.67	3.94	1.30	0.54	0.23	0.09	0.05	0.01	0.01	0.01	
1.80	v	9.67	6.09	3.34	2.16	1.38	0.87	0.60	0.42	0.28	0.22	0.13	0.11	0.09	0.07
	R	580.06	183.92	41.94	14.45	4.87	1.60	0.66	0.29	0.11	0.06	0.02	0.01	0.01	0.01
2.00	v	10.74	6.77	3.71	2.40	1.53	0.96	0.67	0.47	0.31	0.24	0.15	0.12	0.10	0.08
	R	707.84	223.87	50.89	17.50	5.89	1.93	0.80	0.34	0.13	0.07	0.02	0.01	0.01	0.01
2.5	v	13.43	8.46	4.64	3.00	1.91	1.21	0.83	0.59	0.39	0.30	0.19	0.15	0.12	0.09
	R	1073.06	338.70	76.82	26.31	8.83	2.89	1.19	0.51	0.20	0.11	0.02	0.02	0.01	0.01
3.00	v	16.11	10.15	5.57	3.60	2.30	1.45	1.00	0.71	0.47	0.37	0.22	0.18	0.14	0.11
	R	1531.61	479.67	107.74	36.77	12.30	4.01	1.65	0.71	0.27	0.15	0.05	0.03	0.02	0.01
3.5	v	18.80	11.85	6.50	4.20	2.68	1.69	1.17	0.82	0.55	0.43	0.26	0.21	0.17	0.13
	R	2038.59	642.39	143.61	48.87	16.30	6.76	2.19	0.94	0.36	0.20	0.06	0.03	0.02	0.01
4.0	v	21.49	13.54	7.42	4.79	3.06	1.93	1.33	0.94	0.63	0.49	0.30	0.24	0.19	0.15
	R	2634.18	828.21	184.39	62.57	20.82	11.16	2.77	1.19	0.45	0.25	0.08	0.04	0.03	0.01
4.5	v	24.17	15.23	8.35	5.39	3.44	2.17	1.50	1.06	0.71	0.55	0.34	0.26	0.21	0.17
	R	3304.84	1037.07	230.06	77.87	25.85	14.18	3.44	1.48	0.56	0.31	0.09	0.05	0.03	0.02
5.0	v	26.86	16.92	9.28	5.99	3.83	2.41	1.67	1.18	0.79	0.61	0.37	0.29	0.24	0.19
	R	4050.49	1268.93	280.59	94.76	31.39	21.39	4.15	1.78	0.68	0.37	0.11	0.06	0.04	0.02
5.5	v	29.54	18.62	10.21	6.59	4.21	2.65	1.83	1.29	0.87	0.67	0.41	0.32	0.26	0.21
	R	4871.08	1523.77	335.98	113.23	37.44	29.97	4.96	2.13	0.81	0.44	0.13	0.08	0.05	0.03
6.0	v		20.31	11.14	7.19	4.59	2.89	2.00	1.41	0.94	0.73	0.45	0.35	0.29	0.23
	R		1801.56	396.20	133.28	43.99	36.44	5.78	2.48	0.94	0.51	0.16	0.09	0.05	0.03
6.5	v		22.00	12.06	7.79	4.97	3.13	2.17	1.53	1.02	0.79	0.48	0.38	0.31	0.24
	R		2102.29	461.26	154.89	51.04	16.47	6.72	2.88	1.09	0.59	0.18	0.10	0.06	0.04
7.0	v		23.69	12.99	8.39	5.36	3.38	2.33	1.65	1.10	0.85	0.52	0.41	0.33	0.26
	R		2425.95	531.13	178.07	58.58	18.87	7.69	3.29	1.25	0.67	0.21	0.12	0.07	0.04
7.5	v		25.39	13.92	8.99	5.74	3.62	2.50	1.76	1.18	0.91	0.56	0.44	0.36	0.28
	R		2772.51	605.83	202.81	66.62	21.39	8.69	3.72	1.40	0.76	0.23	0.13	0.08	0.05
8.0	v		27.08	14.85	9.59	6.12	3.86	2.67	1.88	1.26	0.98	0.60	0.47	0.38	0.30
	R		3141.98	685.33	229.10	75.15	24.13	9.81	4.20	1.59	0.86	0.26	0.15	0.09	0.05

PP-RCT Solid Wall D125 SDR11 (Cold Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.3	25x2.8	32x2.9	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x14.6	180x16.4	200x18.2	225x20.5
SDR		9	9	11	11	11	11	11	11	11	11	11	11	11	11
Q	ID →	15.4	19.4	26.2	32.6	40.8	51.4	61.8	73.6	90.0	102.2	130.8	147.2	163.6	184.0
9.0	v		30.46	16.70	10.79	6.89	4.34	3.00	2.12	1.42	1.10	0.67	0.53	0.43	0.34
	R		3949.62	858.74	286.34	93.69	29.97	12.15	5.18	1.95	1.06	0.32	0.18	0.11	0.06
10.0	v		33.85	18.56	11.99	7.65	4.82	3.34	2.35	1.57	1.22	0.74	0.59	0.48	0.38
	R		4848.81	1051.35	349.78	114.18	36.44	14.75	6.28	2.37	1.28	0.39	0.22	0.13	0.08
12.0	v			22.27	14.38	9.18	5.79	4.00	2.82	1.89	1.46	0.89	0.71	0.57	0.45
	R			1479.58	491.87	160.42	51.19	20.66	8.78	3.30	1.78	0.54	0.31	0.18	0.10
14.0	v			25.98	16.78	10.71	6.75	4.67	3.29	2.20	1.71	1.04	0.82	0.67	0.53
	R			1992.13	660.18	214.59	68.31	27.51	11.67	4.37	2.36	0.71	0.40	0.24	0.14
16.0	v			29.69	19.18	12.24	7.72	5.34	3.76	2.52	1.95	1.19	0.94	0.76	0.60
	R			2579.82	852.69	276.37	87.79	35.27	14.94	5.59	3.01	0.91	0.51	0.31	0.18
18.0	v			33.41	21.58	13.78	8.68	6.00	4.23	2.83	2.20	1.34	1.06	0.86	0.68
	R			3242.60	1069.35	345.74	109.62	43.96	18.58	6.94	3.73	1.13	0.64	0.38	0.22
20.0	v			37.12	23.97	15.31	9.64	6.67	4.70	3.15	2.44	1.49	1.18	0.95	0.75
	R			3980.43	1310.15	422.66	133.78	53.55	22.60	8.43	4.53	1.36	0.77	0.46	0.26
25.0	v				29.97	19.13	12.05	8.34	5.88	3.93	3.05	1.86	1.47	1.19	0.94
	R				2017.57	647.96	204.37	81.49	34.28	12.73	6.83	2.05	1.16	0.69	0.39
30.0	v				35.96	22.96	14.47	10.01	7.06	4.72	3.66	2.23	1.76	1.43	1.13
	R				2875.45	920.28	289.45	115.05	48.26	17.87	9.57	2.87	1.61	0.97	0.55
35.0	v				41.95	26.79	16.88	11.67	8.23	5.50	4.27	2.61	2.06	1.67	1.32
	R				3883.67	1239.53	388.97	154.20	64.52	23.83	12.74	3.81	2.14	1.28	0.72
40.0	v					30.61	19.29	13.34	9.41	6.29	4.88	2.98	2.35	1.90	1.51
	R					1605.66	499.01	197.85	82.79	30.58	16.35	4.89	2.75	1.64	0.93
45.0	v					34.44	21.70	15.01	10.58	7.08	5.49	3.35	2.65	2.14	1.69
	R					2018.63	625.92	247.69	103.45	38.13	20.37	6.07	3.41	2.04	1.15
50.0	v					38.26	24.11	16.68	11.76	7.86	6.10	3.72	2.94	2.38	1.88
	R					2478.41	766.98	302.98	126.33	46.48	24.80	7.38	4.14	2.48	1.40
55.0	v					42.09	26.52	18.35	12.93	8.65	6.71	4.10	3.23	2.62	2.07
	R					2985.00	922.16	363.72	151.43	55.62	29.64	8.81	4.94	2.95	1.66
60.0	v					45.92	28.93	20.01	14.11	9.44	7.32	4.47	3.53	2.86	2.26
	R					3538.38	1091.47	429.91	178.74	65.54	34.90	10.35	5.80	3.46	1.95
65.0	v					49.74	31.34	21.68	15.29	10.22	7.93	4.84	3.82	3.09	2.45
	R					4138.53	1274.89	501.53	208.25	76.26	40.57	12.01	6.73	4.02	2.26
70.0	v						33.75	23.35	16.46	11.01	8.54	5.21	4.12	3.33	2.63
	R						1472.41	578.59	239.98	87.76	46.65	13.79	7.72	4.60	2.59
75.0	v						36.16	25.02	17.64	11.80	9.15	5.58	4.41	3.57	2.82
	R						1684.04	661.08	273.90	100.04	53.14	15.69	8.78	5.23	2.95
80.0	v						38.58	26.68	18.81	12.58	9.76	5.96	4.70	3.81	3.01
	R						1909.76	748.99	310.03	113.10	60.04	17.70	9.90	5.90	3.32
85.0	v						40.99	28.35	19.99	13.37	10.37	6.33	5.00	4.05	3.20
	R						2149.58	842.33	348.35	126.94	67.34	19.83	11.09	6.60	3.71
90.0	v						43.40	30.02	21.17	14.15	10.98	6.70	5.29	4.28	3.39
	R						2403.49	941.09	388.87	141.56	75.05	22.08	12.33	7.34	4.13
95.0	v						45.81	31.69	22.34	14.94	11.59	7.07	5.59	4.52	3.57
	R						2671.49	1045.28	431.58	156.96	83.16	24.44	13.64	8.12	4.56
100.0	v						48.22	33.36	23.52	15.73	12.20	7.45	5.88	4.76	3.76
	R						2953.59	1154.88	476.49	173.14	91.68	26.91	15.02	8.93	5.02
105.0	v						50.63	35.02	24.69	16.51	12.81	7.82	6.17	5.00	3.95
	R						3249.76	1269.90	523.59	190.10	100.60	29.50	16.46	9.78	5.50
110.0	v						53.04	36.69	25.87	17.30	13.42	8.19	6.47	5.24	4.14
	R						3560.03	1390.33	572.89	207.82	109.92	32.20	17.96	10.67	5.99
115.0	v						55.45	38.36	27.05	18.09	14.03	8.56	6.76	5.47	4.33
	R						3884.38	1516.18	624.37	226.33	119.65	35.02	19.52	11.59	6.51
120.0	v						57.86	40.03	28.22	18.87	14.64	8.94	7.06	5.71	4.52
	R						4222.81	1647.45	678.04	245.61	129.78	37.95	21.14	12.56	7.05
125.0	v							41.69	29.40	19.66	15.25	9.31	7.35	5.95	4.70
	R							1784.13	733.91	265.67	140.32	40.99	22.83	13.55	7.60
130.0	v							43.36	30.57	20.45	15.86	9.68	7.64	6.19	4.89
	R							1926.22	791.96	286.49	151.25	44.15	24.58	14.59	8.18
135.0	v							45.03	31.75	21.23	16.47	10.05	7.94	6.43	5.08
	R							2073.72	852.21	308.10	162.59	47.42	26.39	15.66	8.78
140.0	v							46.70	32.92	22.02	17.08	10.42	8.23	6.66	5.27
	R							2226.64	914.64	330.47	174.33	50.80	28.26	16.76	9.39
145.0	v							48.37	34.10	22.81	17.69	10.80	8.53	6.90	5.46
	R							2384.97	979.26	353.62	186.47	54.30	30.20	17.90	10.03
150.0	v							50.03	35.28	23.59	18.30	11.17	8.82	7.14	5.64
	R							2548.71	1046.06	377.54	199.01	57.91	32.20	19.08	10.69

PP-RCT Solid Wall D121 SDR7.4 (Cold Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x3.5	32x4.4	40x5.5	50x6.9	63x8.6	75x10.3	90x12.3	110x15.1	125x17.1
SDR		7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Q	ID →	11.6	14.4	18	23.2	29.0	36.2	45.8	54.4	65.4	79.8	90.8
0.03	v	0.28	0.18	0.12	0.07							
	R	1.50	0.54	0.19	0.06							
0.05	v	0.47	0.31	0.20	0.12	0.08						
	R	3.58	1.28	0.45	0.14	0.05						
0.07	v	0.66	0.43	0.28	0.17	0.11	0.07					
	R	6.42	2.29	0.80	0.24	0.08	0.03					
0.09	v	0.85	0.55	0.35	0.21	0.14	0.09					
	R	9.96	3.55	1.23	0.37	0.13	0.05					
0.10	v	0.95	0.61	0.39	0.24	0.15	0.10	0.06				
	R	11.99	4.26	1.48	0.44	0.15	0.05	0.02				
0.12	v	1.14	0.74	0.47	0.28	0.18	0.12	0.07				
	R	16.53	5.87	2.03	0.61	0.21	0.07	0.02				
0.16	v	1.51	0.98	0.63	0.38	0.24	0.16	0.10	0.07			
	R	27.55	9.74	3.35	1.01	0.35	0.12	0.04	0.02			
0.18	v	1.70	1.11	0.71	0.43	0.27	0.17	0.11	0.08			
	R	34.00	12.00	4.12	1.24	0.43	0.15	0.05	0.02			
0.20	v	1.89	1.23	0.79	0.47	0.30	0.19	0.12	0.09	0.06		
	R	41.06	14.46	4.96	1.49	0.51	0.18	0.06	0.03	0.01		
0.30	v	2.84	1.84	1.18	0.71	0.45	0.29	0.18	0.13	0.09	0.06	
	R	85.33	29.85	10.17	3.03	1.04	0.36	0.12	0.05	0.02	0.01	
0.40	v	3.79	2.46	1.57	0.95	0.61	0.39	0.24	0.17	0.12	0.08	
	R	144.14	50.14	17.00	5.04	1.73	0.60	0.20	0.09	0.04	0.01	
0.50	v	4.73	3.07	1.97	1.18	0.76	0.49	0.30	0.22	0.15	0.10	0.08
	R	217.15	75.20	25.39	7.45	2.55	0.88	0.29	0.13	0.05	0.02	0.01
0.60	v	5.68	3.69	2.36	1.42	0.91	0.58	0.36	0.26	0.18	0.12	0.09
	R	304.17	104.92	35.31	10.38	3.55	1.23	0.40	0.18	0.07	0.03	0.02
0.70	v	6.63	4.30	2.75	1.66	1.06	0.68	0.43	0.30	0.21	0.14	0.11
	R	405.05	139.24	46.71	13.68	4.67	1.61	0.52	0.23	0.10	0.04	0.02
0.80	v	7.57	4.91	3.15	1.89	1.21	0.78	0.49	0.34	0.24	0.16	0.12
	R	519.70	178.11	59.58	17.40	5.93	2.04	0.66	0.29	0.12	0.05	0.03
0.90	v	8.52	5.53	3.54	2.13	1.36	0.87	0.55	0.39	0.27	0.18	0.14
	R	648.06	221.49	73.51	21.52	7.32	2.52	0.82	0.36	0.15	0.06	0.03
1.00	v	9.47	6.14	3.93	2.37	1.51	0.97	0.61	0.43	0.30	0.20	0.15
	R	790.06	269.36	89.67	25.96	8.80	3.02	0.98	0.43	0.18	0.07	0.04
1.20	v	11.36	7.37	4.72	2.84	1.82	1.17	0.73	0.52	0.36	0.24	0.19
	R	1114.88	378.48	125.48	36.18	12.23	4.19	1.35	0.59	0.25	0.09	0.05
1.40	v	13.25	8.60	5.50	3.31	2.12	1.36	0.85	0.60	0.42	0.28	0.22
	R	1493.92	505.32	166.94	47.96	16.16	5.52	1.78	0.78	0.32	0.12	0.07
1.60	v	15.15	9.83	6.29	3.79	2.42	1.56	0.97	0.69	0.48	0.32	0.25
	R	1927.04	649.81	214.00	61.28	20.60	7.03	2.26	0.99	0.41	0.16	0.09
1.80	v	17.04	11.06	7.08	4.26	2.73	1.75	1.09	0.77	0.54	0.36	0.28
	R	2414.14	811.87	266.62	76.13	25.54	8.69	2.79	1.22	0.50	0.19	0.10
2.00	v	18.93	12.29	7.86	4.73	3.03	1.94	1.21	0.86	0.60	0.40	0.31
	R	2955.16	991.46	324.79	92.49	30.97	10.52	3.37	1.47	0.61	0.23	0.13
2.5	v	23.67	15.36	9.83	5.92	3.79	2.43	1.52	1.08	0.74	0.50	0.39
	R	4489.83	1503.86	494.32	139.96	46.65	15.79	5.04	2.20	0.90	0.35	0.19
3.00	v		18.43	11.80	7.10	4.54	2.92	1.82	1.29	0.89	0.60	0.46
	R		2151.35	698.13	196.72	65.32	22.03	7.01	3.05	1.25	0.48	0.26
3.5	v		21.50	13.76	8.28	5.30	3.40	2.13	1.51	1.04	0.70	0.54
	R		2863.58	936.08	262.71	86.93	29.29	9.32	4.05	1.67	0.64	0.34
4.0	v		24.57	15.73	9.47	6.06	3.89	2.43	1.72	1.19	0.80	0.62
	R		3703.38	1208.07	337.86	111.47	37.39	11.85	5.13	2.11	0.81	0.43
4.5	v		27.65	17.69	10.65	6.82	4.37	2.73	1.94	1.34	0.90	0.70
	R		4649.64	1514.06	419.88	138.59	46.50	14.73	6.39	2.62	1.00	0.54
5.0	v			19.66	11.83	7.57	4.86	3.04	2.15	1.49	1.00	0.77
	R			1853.99	515.56	169.25	56.51	17.83	7.71	3.15	1.21	0.65
5.5	v			21.63	13.02	8.33	5.35	3.34	2.37	1.64	1.10	0.85
	R			2227.83	613.94	201.74	67.42	21.28	9.20	3.77	1.44	0.77
6.0	v			23.59	14.20	9.09	5.83	3.64	2.58	1.79	1.20	0.93
	R			2635.56	729.62	238.54	79.34	24.94	10.75	4.39	1.68	0.90
6.5	v			25.56	15.38	9.85	6.32	3.95	2.80	1.94	1.30	1.00
	R			2077.16	843.69	276.21	91.98	28.94	12.49	5.10	1.95	1.04
7.0	v			27.52	16.57	10.60	6.81	4.25	3.01	2.08	1.40	1.08
	R			3552.61	971.92	317.67	105.62	33.18	14.31	5.84	2.23	1.19
7.5	v			29.49	17.75	11.36	7.29	4.55	3.23	2.23	1.50	1.16
	R			4061.91	1118.65	363.91	120.46	37.68	16.20	6.60	2.51	1.34

PP-RCT Solid Wall D121 SDR7.4 (Cold Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x3.5	32x4.4	40x5.5	50x6.9	63x8.6	75x10.3	90x12.3	110x15.1	125x17.1
SDR		7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Q	ID →	11.6	14.4	18	23.2	29.0	36.2	45.8	54.4	65.4	79.8	90.8
8.0	v			31.46	18.93	12.12	7.78	4.86	3.44	2.38	1.60	1.24
	R			4605.05	1589.01	514.90	135.60	42.48	18.28	7.45	2.84	1.52
9.0	v				21.30	13.63	8.75	5.47	3.87	2.68	1.80	1.39
	R				1573.63	368.41	169.75	52.89	22.68	9.21	3.50	1.87
10.0	v				23.67	15.15	9.72	6.07	4.30	2.98	2.00	1.55
	R				1947.71	629.74	207.14	64.39	27.57	11.18	4.24	2.27
12.0	v				28.40	18.18	11.67	7.29	5.17	3.57	2.40	1.85
	R				2773.29	893.39	292.71	90.61	38.69	15.65	5.92	3.16
14.0	v				33.14	21.21	13.61	8.50	6.03	4.17	2.80	2.16
	R				3743.00	1202.24	392.62	121.12	51.59	20.82	7.86	4.19
16.0	v				37.87	24.24	15.55	9.72	6.89	4.77	3.20	2.47
	R				4856.78	1556.25	506.85	155.89	66.26	26.69	10.05	5.35
18.0	v					27.27	17.50	10.93	7.75	5.36	3.60	2.78
	R					1955.36	635.35	194.89	82.68	33.24	12.50	6.64
20.0	v					30.30	19.44	12.15	8.61	5.96	4.00	3.09
	R					2399.55	778.12	238.13	100.85	40.47	15.19	8.07
25.0	v					37.87	24.30	15.18	10.76	7.45	5.00	3.86
	R					3661.69	1197.33	364.67	153.88	61.52	23.00	12.19
30.0	v						29.16	18.22	12.91	8.94	6.00	4.64
	R						1687.42	517.48	217.73	86.77	32.34	17.11
35.0	v						34.03	21.26	15.07	10.42	7.00	5.41
	R						2276.27	696.52	292.35	116.20	43.19	22.81
40.0	v						38.89	24.29	17.22	11.91	8.00	6.18
	R						2952.33	893.45	375.08	149.10	55.42	29.27
45.0	v						43.75	27.33	19.37	13.40	9.00	6.95
	R						3715.55	1122.00	470.19	186.54	69.19	36.50
50.0	v						48.61	30.37	21.52	14.89	10.00	7.73
	R						4565.91	1376.25	575.85	228.05	84.43	44.48
55.0	v							33.40	23.68	16.38	11.00	8.50
	R							1656.19	692.04	273.64	101.14	53.23
60.0	v							36.44	25.83	17.87	12.00	9.27
	R							1961.81	818.76	323.29	119.30	62.72
65.0	v							39.48	27.98	19.36	13.00	10.04
	R							2293.10	956.00	377.00	138.92	72.97
70.0	v							42.51	30.13	20.85	14.00	10.82
	R							2650.05	1103.75	434.77	160.00	83.97
75.0	v							45.55	32.29	22.34	15.00	11.59
	R							3032.65	1262.01	496.59	182.53	95.72
80.0	v							48.59	34.44	23.83	16.00	12.36
	R							3440.91	1430.78	562.46	206.50	108.21
85.0	v							51.62	36.59	25.32	17.00	13.13
	R							3874.82	1610.05	632.37	231.93	121.45
90.0	v							54.66	38.74	26.81	18.00	13.91
	R							4334.37	1799.82	706.33	258.80	135.43
95.0	v								40.90	28.30	19.00	14.68
	R								2000.09	784.33	287.12	150.16
100.0	v								43.05	29.78	20.01	15.45
	R								2210.86	866.38	316.88	165.63
105.0	v								45.20	31.27	21.01	16.22
	R								2432.12	952.46	348.09	181.84
110.0	v								47.35	32.76	22.01	17.00
	R								2663.88	1042.58	380.74	198.79
115.0	v								49.50	34.25	23.01	17.77
	R								2906.12	1136.75	414.84	216.49
120.0	v								51.66	35.74	24.01	18.54
	R								3158.86	1234.95	450.37	234.92
125.0	v								53.81	37.23	25.01	19.31
	R								3422.10	1337.18	487.35	254.09
130.0	v								55.96	38.72	26.01	20.09
	R								3695.82	1443.46	525.76	274.01
135.0	v								58.11	40.21	27.01	20.86
	R								3980.03	1553.77	565.62	294.66
140.0	v								60.27	41.70	28.01	21.63
	R								4274.73	1668.11	606.92	316.05
145.0	v								62.42	43.19	29.01	22.40
	R								4579.92	1786.50	649.66	338.18

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Faser Watertec D101 (Hot Pressure Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14	160x14.6	180x16.4	200x18.2	225x20.5	250x22.7
SDR		7.4	7.4	9	9	9	9	9	9	9	9	11	11	11	11	11
Q	ID →	14.4	18	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0	130.8	147.2	163.6	184.0	204.6
0.05	v	0.31	0.20													
	R	1.28	0.45													
0.07	v	0.43	0.28	0.14												
	R	2.29	0.80	0.18												
0.09	v	0.55	0.35	0.19												
	R	3.55	1.23	0.27												
0.10	v	0.61	0.39	0.21	0.13	0.08										
	R	4.26	1.48	0.32	0.11	0.04										
0.12	v	0.74	0.47	0.25	0.16	0.10										
	R	5.87	2.03	0.45	0.16	0.05										
0.16	v	0.98	0.63	0.33	0.21	0.14	0.09									
	R	9.74	3.35	0.73	0.26	0.09	0.03									
0.18	v	1.11	0.71	0.37	0.24	0.15	0.10									
	R	12.00	4.12	0.90	0.31	0.11	0.04									
0.20	v	1.23	0.79	0.41	0.27	0.17	0.11									
	R	14.46	4.96	1.08	0.38	0.13	0.04									
0.30	v	1.84	1.18	0.62	0.40	0.25	0.16	0.11								
	R	29.85	10.17	2.20	0.76	0.26	0.09	0.04								
0.40	v	2.46	1.57	0.83	0.53	0.34	0.21	0.15	0.10							
	R	50.14	17.00	3.66	1.26	0.43	0.15	0.06	0.03							
0.50	v	3.07	1.97	1.04	0.66	0.42	0.27	0.19	0.13							
	R	75.20	25.39	5.41	1.85	0.67	0.21	0.09	0.04							
0.60	v	3.69	2.36	1.24	0.80	0.51	0.32	0.23	0.16	0.10						
	R	104.92	35.31	7.53	2.58	0.88	0.30	0.13	0.05	0.02						
0.70	v	4.30	2.75	1.45	0.93	0.59	0.37	0.26	0.18	0.12	0.09					
	R	139.24	46.71	9.92	3.39	1.16	0.39	0.17	0.07	0.03	0.01					
0.80	v	4.91	3.15	1.66	1.06	0.68	0.43	0.30	0.21	0.14	0.11					
	R	178.11	59.58	12.60	4.30	1.46	0.49	0.21	0.09	0.03	0.02					
0.90	v	5.53	3.54	1.86	1.19	0.76	0.48	0.34	0.24	0.16	0.12	0.07				
	R	221.49	73.51	15.58	5.31	1.81	0.60	0.26	0.11	0.04	0.02	0.01				
1.00	v	6.14	3.93	2.07	1.33	0.85	0.53	0.38	0.26	0.17	0.14	0.07	0.06			
	R	269.36	89.67	18.77	6.38	2.27	0.72	0.31	0.13	0.05	0.03	0.01	0.01			
1.20	v	7.37	4.72	2.49	1.59	1.02	0.64	0.45	0.31	0.21	0.16	0.09	0.07	0.06		
	R	378.48	125.48	26.14	8.85	3.15	1.00	0.43	0.18	0.07	0.04	0.01	0.01	0.01		
1.40	v	8.60	5.50	2.90	1.86	1.18	0.75	0.53	0.37	0.24	0.19	0.10	0.08	0.07		
	R	505.32	166.94	34.62	11.70	4.15	1.31	0.56	0.24	0.09	0.05	0.01	0.01	0.01		
1.60	v	9.83	6.29	3.31	2.12	1.35	0.86	0.60	0.42	0.28	0.22	0.12	0.09	0.08	0.06	
	R	649.81	214.00	44.21	14.90	5.28	1.66	0.71	0.30	0.11	0.06	0.01	0.01	0.01	0.01	
1.80	v	11.06	7.08	3.73	2.39	1.52	0.96	0.68	0.47	0.31	0.24	0.13	0.11	0.09	0.07	
	R	811.87	266.62	54.88	18.46	6.53	2.05	0.88	0.37	0.14	0.08	0.02	0.01	0.01	0.01	
2.00	v	12.29	7.86	4.14	2.65	1.69	1.07	0.75	0.52	0.35	0.27	0.15	0.12	0.10	0.08	0.06
	R	991.46	324.79	66.63	22.36	7.90	2.48	1.06	0.44	0.17	0.09	0.02	0.01	0.01	0.01	0.01
2.5	v	15.36	9.83	5.18	3.31	2.12	1.34	0.94	0.65	0.44	0.34	0.19	0.15	0.12	0.09	0.08
	R	1503.86	494.32	100.68	33.65	11.85	3.71	1.59	0.66	0.25	0.14	0.02	0.02	0.01	0.01	0.01
3.00	v	18.43	11.80	6.21	3.98	2.54	1.60	1.13	0.78	0.52	0.41	0.22	0.18	0.14	0.11	0.09
	R	2151.35	698.13	141.35	47.07	16.52	5.16	2.20	0.92	0.35	0.19	0.05	0.03	0.02	0.01	0.01
3.5	v	21.50	13.76	7.25	4.64	2.96	1.87	1.32	0.92	0.61	0.47	0.26	0.21	0.17	0.13	0.11
	R	2863.58	936.08	188.56	62.58	21.91	6.85	2.92	1.22	0.46	0.25	0.06	0.03	0.02	0.01	0.01
4.0	v	24.57	15.73	8.29	5.30	3.38	2.14	1.50	1.05	0.70	0.54	0.30	0.24	0.19	0.15	0.12
	R	3703.38	1208.07	242.29	80.18	28.00	8.70	3.70	1.54	0.58	0.32	0.08	0.04	0.03	0.01	0.01
4.5	v	27.65	17.69	9.32	5.97	3.81	2.41	1.69	1.18	0.79	0.61	0.34	0.26	0.21	0.17	0.14
	R	4649.64	1514.06	302.50	99.85	34.79	10.82	4.60	1.91	0.72	0.39	0.09	0.05	0.03	0.02	0.01
5.0	v		19.66	10.36	6.63	4.23	2.67	1.88	1.31	0.87	0.68	0.37	0.29	0.24	0.19	0.15
	R		1853.99	369.16	121.57	42.28	13.08	5.55	2.30	0.87	0.47	0.11	0.06	0.04	0.02	0.01
5.5	v		21.63	11.39	7.29	4.65	2.94	2.07	1.44	0.96	0.74	0.41	0.32	0.26	0.21	0.17
	R		2227.83	442.26	145.33	50.44	15.62	6.63	2.75	1.04	0.56	0.13	0.08	0.05	0.03	0.02
6.0	v		23.59	12.43	7.95	5.08	3.21	2.26	1.57	1.05	0.81	0.45	0.35	0.29	0.23	0.18
	R		2635.56	521.79	171.13	59.29	18.28	7.74	3.20	1.21	0.65	0.16	0.09	0.05	0.03	0.02
6.5	v		25.56	13.46	8.62	5.50	3.48	2.44	1.70	1.14	0.88	0.48	0.38	0.31	0.24	0.20
	R		2077.16	607.74	198.96	68.82	21.22	8.99	3.72	1.40	0.76	0.18	0.10	0.06	0.04	0.02
7.0	v		27.52	14.50	9.28	5.92	3.74	2.63	1.83	1.22	0.95	0.52	0.41	0.33	0.26	0.21
	R		3552.61	700.09	228.82	79.03	24.32	10.29	4.26	1.60	0.87	0.21	0.12	0.07	0.04	0.02
7.5	v		29.49	15.53	9.94	6.35	4.01	2.82	1.96	1.31	1.02	0.56	0.44	0.36	0.28	0.23
	R		4061.91	798.84	260.69	89.91	27.59	11.65	4.81	1.81	0.98	0.23	0.13	0.08	0.05	0.03
8.0	v		31.46	16.57	10.61	6.77	4.28	3.01	2.09	1.40	1.08	0.60	0.47	0.38	0.30	0.24
	R		4605.05	903.98	294.59	101.46	31.11	13.15	5.43	2.04	1.10	0.26	0.15	0.09	0.05	0.03

PP-RCT Faser Watertec D101 (Hot Pressure Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14	160x14.6	180x16.4	200x18.2	225x20.5	250x22.7
SDR		7.4	7.4	9	9	9	9	9	9	9	9	11	11	11	11	11
Q	ID →	14.4	18	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0	130.8	147.2	163.6	184.0	204.6
9.0	v			18.64	11.93	7.62	4.81	3.38	2.35	1.57	1.22	0.67	0.53	0.43	0.34	0.27
	R			1133.43	368.41	126.58	38.69	16.29	6.71	2.52	1.36	0.32	0.18	0.11	0.06	0.04
10.0	v			20.71	13.26	8.46	5.35	3.76	2.61	1.75	1.35	0.74	0.59	0.48	0.38	0.30
	R			1388.40	450.27	154.36	47.07	19.79	8.14	3.05	1.65	0.39	0.22	0.13	0.08	0.05
12.0	v			24.86	15.91	10.15	6.42	4.51	3.14	2.10	1.62	0.89	0.71	0.57	0.45	0.37
	R			1954.24	633.29	206.00	66.17	27.75	11.38	4.26	2.29	0.54	0.31	0.18	0.10	0.06
14.0	v			29.00	18.56	11.85	7.49	5.27	3.66	2.45	1.90	1.04	0.82	0.67	0.53	0.43
	R			2633.16	850.63	275.78	88.37	36.97	15.13	5.65	3.04	0.71	0.40	0.24	0.14	0.08
16.0	v			33.14	21.21	13.54	8.56	6.02	4.18	2.79	2.17	1.19	0.94	0.76	0.60	0.49
	R			3412.05	1099.37	355.40	113.64	47.44	19.37	7.22	3.88	0.91	0.51	0.31	0.18	0.11
18.0	v			37.28	23.86	15.23	9.63	6.77	4.71	3.14	2.44	1.34	1.06	0.86	0.68	0.55
	R			4290.84	1379.46	444.85	141.97	59.15	24.12	8.97	4.81	1.13	0.64	0.38	0.22	0.13
20.0	v				26.51	16.92	10.70	7.52	5.23	3.49	2.71	1.49	1.18	0.95	0.75	0.61
	R				1690.87	544.10	173.36	72.10	29.35	10.89	5.84	1.36	0.77	0.46	0.26	0.16
25.0	v				33.14	21.16	13.37	9.40	6.54	4.37	3.38	1.86	1.47	1.19	0.94	0.76
	R				2606.31	835.00	265.12	109.86	44.55	16.47	8.82	2.05	1.16	0.69	0.39	0.24
30.0	v				39.77	25.39	16.05	11.28	7.84	5.24	4.06	2.23	1.76	1.43	1.13	0.91
	R				3717.15	1186.89	375.82	155.27	62.77	23.14	12.37	2.87	1.61	0.97	0.55	0.33
35.0	v					29.62	18.72	13.16	9.15	6.11	4.74	2.61	2.06	1.67	1.32	1.07
	R					1599.68	505.40	208.28	83.99	30.88	16.47	3.81	2.14	1.28	0.72	0.43
40.0	v					33.85	21.40	15.04	10.46	6.99	5.42	2.98	2.35	1.90	1.51	1.22
	R					2073.31	648.34	267.23	107.77	39.62	21.14	4.89	2.75	1.64	0.93	0.56
45.0	v					38.08	24.07	16.92	11.77	7.86	6.09	3.35	2.65	2.14	1.69	1.37
	R					2607.74	813.67	334.76	134.74	49.43	26.34	6.07	3.41	2.04	1.15	0.69
50.0	v					42.31	26.75	18.80	13.07	8.73	6.77	3.72	2.94	2.38	1.88	1.52
	R					3202.94	997.50	409.72	164.62	60.28	32.09	7.38	4.14	2.48	1.40	0.84
55.0	v					46.54	29.42	20.69	14.38	9.61	7.45	4.10	3.23	2.62	2.07	1.67
	R					3858.91	1199.82	492.11	197.42	72.17	38.37	8.81	4.94	2.95	1.66	0.99
60.0	v					50.77	32.10	22.57	15.69	10.48	8.12	4.47	3.53	2.86	2.26	1.83
	R					4575.62	1420.61	581.93	233.12	85.08	45.20	10.35	5.80	3.46	1.95	1.17
65.0	v						34.77	24.45	17.00	11.35	8.80	4.84	3.82	3.09	2.45	1.98
	R						1659.88	679.17	271.72	99.03	52.56	12.01	6.73	4.02	2.26	1.35
70.0	v						37.45	26.33	18.30	12.23	9.48	5.21	4.12	3.33	2.63	2.13
	R						1917.61	783.81	313.22	114.00	60.46	13.79	7.72	4.60	2.59	1.55
75.0	v						40.12	28.21	19.61	13.10	10.15	5.58	4.41	3.57	2.82	2.28
	R						2193.80	895.87	357.62	129.99	68.89	15.69	8.78	5.23	2.95	1.76
80.0	v						42.80	30.09	20.92	13.97	10.83	5.96	4.70	3.81	3.01	2.43
	R						2488.45	1015.33	404.91	147.01	77.85	17.70	9.90	5.90	3.32	1.98
85.0	v						45.47	31.97	22.23	14.85	11.51	6.33	5.00	4.05	3.20	2.59
	R						2801.55	1142.19	455.08	165.05	87.34	19.83	11.09	6.60	3.71	2.21
90.0	v						48.15	33.85	23.53	15.72	12.19	6.70	5.29	4.28	3.39	2.74
	R						3133.09	1276.45	508.15	184.11	97.36	22.08	12.33	7.34	4.13	2.46
95.0	v						50.82	35.73	24.84	16.59	12.86	7.07	5.59	4.52	3.57	2.89
	R						3483.08	1418.10	564.10	204.19	107.92	24.44	13.64	8.12	4.56	2.72
100.0	v						53.49	37.61	26.15	17.47	13.54	7.45	5.88	4.76	3.76	3.04
	R						3851.52	1567.16	622.94	225.29	119.00	26.91	15.02	8.93	5.02	2.99
105.0	v						56.17	39.49	27.46	18.34	14.22	7.82	6.17	5.00	3.95	3.20
	R						4238.40	1723.60	684.67	247.41	130.61	29.50	16.46	9.78	5.50	3.27
110.0	v						58.84	41.37	28.76	19.21	14.89	8.19	6.47	5.24	4.14	3.35
	R						4643.72	1887.44	749.27	270.54	142.74	32.20	17.96	10.67	5.99	3.56
115.0	v							43.25	30.07	20.09	15.57	8.56	6.76	5.47	4.33	3.50
	R							2058.68	816.76	294.69	155.41	35.02	19.52	11.59	6.51	3.87
120.0	v							45.13	31.38	20.96	16.25	8.94	7.06	5.71	4.52	3.65
	R							2237.30	887.14	319.86	168.60	37.95	21.14	12.56	7.05	4.19
125.0	v							47.01	32.68	21.83	16.92	9.31	7.35	5.95	4.70	3.80
	R							2423.32	960.39	346.04	182.32	40.99	22.83	13.55	7.60	4.52
130.0	v							48.89	33.99	22.71	17.60	9.68	7.64	6.19	4.89	3.96
	R							2616.72	1036.52	373.23	196.56	44.15	24.58	14.59	8.18	4.86
135.0	v							50.77	35.30	23.58	18.28	10.05	7.94	6.43	5.08	4.11
	R							2817.52	1115.54	401.44	211.33	47.42	26.39	15.66	8.78	5.21
140.0	v							52.65	36.61	24.45	18.96	10.42	8.23	6.66	5.27	4.26
	R							3025.70	1197.43	430.67	226.63	50.80	28.26	16.76	9.39	5.58
145.0	v							54.53	37.91	25.33	19.63	10.80	8.53	6.90	5.46	4.41
	R							3241.28	1282.20	460.90	242.45	54.30	30.20	17.90	10.03	5.95
150.0	v							56.41	39.22	26.20	20.31	11.17	8.82	7.14	5.64	4.56
	R							3464.24	1369.86	492.16	258.80	57.91	32.20	19.08	10.69	6.34

PP-RCT Faser Watertec D101 (Hot Pressure Pipe)

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14	160x14.6	180x16.4	200x18.2	225x20.5	250x22.7
SDR		7.4	7.4	9	9	9	9	9	9	9	9	11	11	11	11	11
Q	ID →	14.4	18	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0	130.8	147.2	163.6	184.0	204.6
0.05	v	0.31	0.20													
	R	1.06	0.36													
0.07	v	0.43	0.28	0.14												
	R	1.90	0.66	0.14												
0.09	v	0.55	0.35	0.19												
	R	2.97	1.02	0.22												
0.10	v	0.61	0.39	0.21	0.13	0.08										
	R	3.58	1.23	0.27	0.09	0.03										
0.12	v	0.74	0.47	0.25	0.16	0.10										
	R	4.95	1.69	0.37	0.13	0.04										
0.16	v	0.98	0.63	0.33	0.21	0.14	0.09									
	R	8.29	2.82	0.61	0.21	0.07	0.02									
0.18	v	1.11	0.71	0.37	0.24	0.15	0.10									
	R	10.25	3.48	0.75	0.26	0.09	0.03									
0.20	v	1.23	0.79	0.41	0.27	0.17	0.11									
	R	12.40	4.21	0.90	0.31	0.11	0.04									
0.30	v	1.84	1.18	0.62	0.40	0.25	0.16	0.11								
	R	25.93	8.73	1.85	0.63	0.22	0.07	0.03								
0.40	v	2.46	1.57	0.83	0.53	0.34	0.21	0.15	0.10							
	R	43.99	14.73	3.11	1.06	0.36	0.12	0.05	0.02							
0.50	v	3.07	1.97	1.04	0.66	0.42	0.27	0.19	0.13							
	R	66.49	22.17	4.65	1.58	0.54	0.18	0.08	0.03							
0.60	v	3.69	2.36	1.24	0.80	0.51	0.32	0.23	0.16	0.10						
	R	93.38	31.01	6.47	2.19	0.74	0.25	0.11	0.04	0.02						
0.70	v	4.30	2.75	1.45	0.93	0.59	0.37	0.26	0.18	0.12	0.09					
	R	124.63	41.24	8.57	2.90	0.98	0.32	0.14	0.06	0.02	0.01					
0.80	v	4.91	3.15	1.66	1.06	0.68	0.43	0.30	0.21	0.14	0.11					
	R	160.20	52.84	10.94	3.69	1.24	0.41	0.18	0.07	0.03	0.02					
0.90	v	5.53	3.54	1.86	1.19	0.76	0.48	0.34	0.24	0.16	0.12	0.07				
	R	200.09	65.82	13.57	4.57	1.54	0.51	0.22	0.09	0.03	0.02	0.00				
1.00	v	6.14	3.93	2.07	1.33	0.85	0.53	0.38	0.26	0.17	0.14	0.07	0.06			
	R	244.28	80.16	16.48	5.54	1.86	0.62	0.26	0.11	0.04	0.02	0.01	0.00			
1.20	v	7.37	4.72	2.49	1.59	1.02	0.64	0.45	0.31	0.21	0.16	0.09	0.07	0.06		
	R	345.53	112.90	23.07	7.73	2.59	0.85	0.37	0.15	0.06	0.03	0.01	0.00	0.00		
1.40	v	8.60	5.50	2.90	1.86	1.18	0.75	0.53	0.37	0.24	0.19	0.10	0.08	0.07		
	R	463.89	151.03	30.72	10.26	3.43	1.13	0.48	0.20	0.08	0.04	0.01	0.01	0.00		
1.60	v	9.83	6.29	3.31	2.12	1.35	0.86	0.60	0.42	0.28	0.22	0.12	0.09	0.08	0.06	
	R	599.33	194.54	39.39	13.12	4.38	1.44	0.61	0.26	0.10	0.05	0.01	0.01	0.00	0.00	
1.80	v	11.06	7.08	3.73	2.39	1.52	0.96	0.68	0.47	0.31	0.24	0.13	0.11	0.09	0.07	
	R	751.82	243.40	49.10	16.31	5.43	1.78	0.76	0.32	0.12	0.06	0.02	0.01	0.01	0.00	
2.00	v	12.29	7.86	4.14	2.65	1.69	1.07	0.75	0.52	0.35	0.27	0.15	0.12	0.10	0.08	0.06
	R	921.35	297.60	59.83	19.83	6.59	2.16	0.92	0.38	0.14	0.08	0.02	0.01	0.01	0.00	0.00
2.5	v	15.36	9.83	5.18	3.31	2.12	1.34	0.94	0.65	0.44	0.34	0.19	0.15	0.12	0.09	0.08
	R	1419.65	456.45	91.10	30.05	9.94	3.24	1.38	0.57	0.22	0.12	0.03	0.02	0.01	0.01	0.00
3.00	v	18.43	11.80	6.21	3.98	2.54	1.60	1.13	0.78	0.52	0.41	0.22	0.18	0.14	0.11	0.09
	R	2024.25	648.56	128.71	42.28	13.94	4.53	1.92	0.79	0.30	0.16	0.04	0.02	0.01	0.01	0.00
3.5	v	21.50	13.76	7.25	4.64	2.96	1.87	1.32	0.92	0.61	0.47	0.26	0.21	0.17	0.13	0.11
	R	2735.09	873.90	172.62	56.51	18.57	6.01	2.54	1.05	0.40	0.21	0.05	0.03	0.02	0.01	0.01
4.0	v	24.57	15.73	8.29	5.30	3.38	2.14	1.50	1.05	0.70	0.54	0.30	0.24	0.19	0.15	0.12
	R	3552.14	1132.44	222.81	72.73	23.83	7.70	3.25	1.34	0.50	0.27	0.06	0.04	0.02	0.01	0.01
4.5	v	27.65	17.69	9.32	5.97	3.81	2.41	1.69	1.18	0.79	0.61	0.34	0.26	0.21	0.17	0.14
	R	4475.38	1424.14	279.28	90.92	29.72	9.58	4.04	1.66	0.62	0.34	0.08	0.05	0.03	0.02	0.01
5.0	v		19.66	10.36	6.63	4.23	2.67	1.88	1.31	0.87	0.68	0.37	0.29	0.24	0.19	0.15
	R		1749.01	342.01	111.09	36.23	11.65	4.90	2.02	0.76	0.41	0.10	0.05	0.03	0.02	0.01
5.5	v		21.63	11.39	7.29	4.65	2.94	2.07	1.44	0.96	0.74	0.41	0.32	0.26	0.21	0.17
	R		2107.04	411.00	133.24	43.36	13.91	5.85	2.40	0.90	0.49	0.11	0.06	0.04	0.02	0.01
6.0	v		23.59	12.43	7.95	5.08	3.21	2.26	1.57	1.05	0.81	0.45	0.35	0.29	0.23	0.18
	R		2498.21	486.25	157.35	51.10	16.37	6.87	2.82	1.06	0.57	0.13	0.08	0.05	0.03	0.02
6.5	v		25.56	13.46	8.62	5.50	3.48	2.44	1.70	1.14	0.88	0.48	0.38	0.31	0.24	0.20
	R		2922.52	567.74	183.42	59.47	19.01	7.97	3.27	1.22	0.66	0.15	0.09	0.05	0.03	0.02
7.0	v		27.52	14.50	9.28	5.92	3.74	2.63	1.83	1.22	0.95	0.52	0.41	0.33	0.26	0.21
	R		3379.96	655.49	211.46	68.45	21.85	9.15	3.75	1.40	0.75	0.18	0.10	0.06	0.03	0.02
7.5	v		29.49	15.53	9.94	6.35	4.01	2.82	1.96	1.31	1.02	0.56	0.44	0.36	0.28	0.23
	R		3870.55	749.47	241.45	78.05	24.88	10.41	4.26	1.59	0.85	0.20	0.11	0.07	0.04	0.02
8.0	v		31.46	16.57	10.61	6.77	4.28	3.01	2.09	1.40	1.08	0.60	0.47	0.38	0.30	0.24
	R		4394.26	849.71	273.41	88.26	28.09	11.74	4.80	1.79	0.96	0.23	0.13	0.08	0.04	0.03

PP-RCT Faser Watertec D101 (Hot Pressure Pipe)

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14	160x14.6	180x16.4	200x18.2	225x20.5	250x22.7
SDR		7.4	7.4	9	9	9	9	9	9	9	9	11	11	11	11	11
Q	ID →	14.4	18	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0	130.8	147.2	163.6	184.0	204.6
9.0	v			18.64	11.93	7.62	4.81	3.38	2.35	1.57	1.22	0.67	0.53	0.43	0.34	0.27
	R			1068.89	343.20	110.52	35.09	14.63	5.97	2.22	1.19	0.28	0.16	0.09	0.05	0.03
10.0	v			20.71	13.26	8.46	5.35	3.76	2.61	1.75	1.35	0.74	0.59	0.48	0.38	0.30
	R			1313.04	420.82	135.22	42.83	17.83	7.27	2.70	1.45	0.34	0.19	0.11	0.07	0.04
12.0	v			24.86	15.91	10.15	6.42	4.51	3.14	2.10	1.62	0.89	0.71	0.57	0.45	0.37
	R			1876.19	599.51	191.96	60.56	25.14	10.21	3.78	2.03	0.47	0.27	0.16	0.09	0.05
14.0	v			29.00	18.56	11.85	7.49	5.27	3.66	2.45	1.90	1.04	0.82	0.67	0.53	0.43
	R			2539.12	809.46	258.45	81.28	33.66	13.64	5.04	2.70	0.63	0.35	0.21	0.12	0.07
16.0	v			33.14	21.21	13.54	8.56	6.02	4.18	2.79	2.17	1.19	0.94	0.76	0.60	0.49
	R			3301.81	1050.66	334.69	104.97	43.38	17.54	6.46	3.45	0.80	0.45	0.27	0.15	0.09
18.0	v			37.28	23.86	15.23	9.63	6.77	4.71	3.14	2.44	1.34	1.06	0.86	0.68	0.55
	R			4164.26	1323.09	420.67	131.63	54.29	21.91	8.06	4.30	0.99	0.56	0.33	0.19	0.11
20.0	v				26.51	16.92	10.70	7.52	5.23	3.49	2.71	1.49	1.18	0.95	0.75	0.61
	R				1626.75	516.37	161.26	66.39	26.74	9.82	5.24	1.21	0.68	0.41	0.23	0.14
25.0	v				33.14	21.16	13.37	9.40	6.54	4.37	3.38	1.86	1.47	1.19	0.94	0.76
	R				2522.49	798.17	248.27	101.87	40.88	14.95	7.95	1.83	1.02	0.61	0.35	0.21
30.0	v				39.77	25.39	16.05	11.28	7.84	5.24	4.06	2.23	1.76	1.43	1.13	0.91
	R				3613.34	1140.72	353.77	144.77	57.93	21.12	11.21	2.56	1.44	0.86	0.48	0.29
35.0	v					29.62	18.72	13.16	9.15	6.11	4.74	2.61	2.06	1.67	1.32	1.07
	R					1544.00	477.73	195.08	77.87	28.31	15.00	3.42	1.91	1.14	0.64	0.38
40.0	v					33.85	21.40	15.04	10.46	6.99	5.42	2.98	2.35	1.90	1.51	1.22
	R					2008.00	620.15	252.80	100.71	36.52	19.32	4.39	2.45	1.46	0.82	0.49
45.0	v					38.08	24.07	16.92	11.77	7.86	6.09	3.35	2.65	2.14	1.69	1.37
	R					2532.71	781.01	317.92	126.44	45.75	24.18	5.47	3.06	1.82	1.02	0.61
50.0	v					42.31	26.75	18.80	13.07	8.73	6.77	3.72	2.94	2.38	1.88	1.52
	R					3118.12	960.32	390.43	155.05	56.01	29.56	6.67	3.72	2.21	1.24	0.74
55.0	v					46.54	29.42	20.69	14.38	9.61	7.45	4.10	3.23	2.62	2.07	1.67
	R					3764.24	1158.07	470.34	186.54	67.28	35.47	7.99	4.45	2.64	1.48	0.88
60.0	v					50.77	32.10	22.57	15.69	10.48	8.12	4.47	3.53	2.86	2.26	1.83
	R					4471.05	1374.26	557.63	220.91	79.56	41.90	9.41	5.24	3.11	1.74	1.04
65.0	v						34.77	24.45	17.00	11.35	8.80	4.84	3.82	3.09	2.45	1.98
	R						1608.89	652.32	258.17	92.86	48.87	10.96	6.10	3.61	2.03	1.20
70.0	v						37.45	26.33	18.30	12.23	9.48	5.21	4.12	3.33	2.63	2.13
	R						1861.96	754.40	298.31	107.17	56.35	12.61	7.01	4.16	2.33	1.38
75.0	v						40.12	28.21	19.61	13.10	10.15	5.58	4.41	3.57	2.82	2.28
	R						2133.46	863.86	341.32	122.50	64.37	14.38	7.99	4.73	2.65	1.57
80.0	v						42.80	30.09	20.92	13.97	10.83	5.96	4.70	3.81	3.01	2.43
	R						2423.40	980.71	387.21	138.84	72.90	16.26	9.03	5.34	2.99	1.77
85.0	v						45.47	31.97	22.23	14.85	11.51	6.33	5.00	4.05	3.20	2.59
	R						2731.77	1104.95	435.98	156.19	81.97	18.25	10.13	5.99	3.35	1.98
90.0	v						48.15	33.85	23.53	15.72	12.19	6.70	5.29	4.28	3.39	2.74
	R						3058.58	1236.57	487.63	174.55	91.55	20.35	11.29	6.68	3.73	2.21
95.0	v						50.82	35.73	24.84	16.59	12.86	7.07	5.59	4.52	3.57	2.89
	R						3403.82	1375.58	542.15	193.93	101.66	22.57	12.51	7.39	4.13	2.44
100.0	v						53.49	37.61	26.15	17.47	13.54	7.45	5.88	4.76	3.76	3.04
	R						3767.50	1521.97	599.55	214.31	112.29	24.90	13.79	8.15	4.55	2.69
105.0	v						56.17	39.49	27.46	18.34	14.22	7.82	6.17	5.00	3.95	3.20
	R						4149.60	1675.76	659.83	235.71	123.45	27.34	15.14	8.94	4.99	2.95
110.0	v						58.84	41.37	28.76	19.21	14.89	8.19	6.47	5.24	4.14	3.35
	R						4550.15	1836.92	722.99	258.12	135.12	29.89	16.54	9.77	5.45	3.22
115.0	v							43.25	30.07	20.09	15.57	8.56	6.76	5.47	4.33	3.50
	R							2005.47	789.02	281.54	147.33	32.56	18.01	10.63	5.92	3.50
120.0	v							45.13	31.38	20.96	16.25	8.94	7.06	5.71	4.52	3.65
	R							2181.41	857.92	305.98	160.05	35.33	19.54	11.52	6.42	3.79
125.0	v							47.01	32.68	21.83	16.92	9.31	7.35	5.95	4.70	3.80
	R							2364.73	929.71	331.42	173.30	38.22	21.12	12.46	6.94	4.10
130.0	v							48.89	33.99	22.71	17.60	9.68	7.64	6.19	4.89	3.96
	R							2555.43	1004.36	357.87	187.07	41.22	22.77	13.42	7.47	4.41
135.0	v							50.77	35.30	23.58	18.28	10.05	7.94	6.43	5.08	4.11
	R							2753.52	1081.90	385.34	201.36	44.33	24.48	14.43	8.03	4.74
140.0	v							52.65	36.61	24.45	18.96	10.42	8.23	6.66	5.27	4.26
	R							2959.00	1162.31	413.81	216.18	47.56	26.25	15.47	8.60	5.08
145.0	v							54.53	37.91	25.33	19.63	10.80	8.53	6.90	5.46	4.41
	R							3171.85	1245.59	443.30	231.51	50.89	28.08	16.54	9.20	5.43
150.0	v							56.41	39.22	26.20	20.31	11.17	8.82	7.14	5.64	4.56
	R							3392.10	1331.75	473.80	247.37	54.33	29.98	17.65	9.81	5.79

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Faser-Climatec D111 (Hot Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x9.5	180x10.7	200x11.9	225x13.4	250x14.8
SDR		7.4	7.4	9	11	11	11	11	11	11	11	17	17	17	17	17
Q	ID →	14.4	18	24.8	32.6	40.8	51.4	61.8	73.6	90.0	102.2	141.0	158.6	176.2	198.2	220.4
0.05	v	0.31	0.20													
	R	1.28	0.45													
0.07	v	0.43	0.28	0.14												
	R	2.29	0.80	0.18												
0.09	v	0.55	0.35	0.19												
	R	3.55	1.23	0.27												
0.10	v	0.61	0.39	0.21	0.12											
	R	4.26	1.48	0.32	0.09											
0.12	v	0.74	0.47	0.25	0.14	0.09										
	R	5.87	2.03	0.45	0.12	0.04										
0.16	v	0.98	0.63	0.33	0.19	0.12	0.08									
	R	9.74	3.35	0.73	0.20	0.07	0.02									
0.18	v	1.11	0.71	0.37	0.22	0.14	0.09									
	R	12.00	4.12	0.90	0.25	0.09	0.03									
0.20	v	1.23	0.79	0.41	0.24	0.15	0.10									
	R	14.46	4.96	1.08	0.30	0.10	0.03									
0.30	v	1.84	1.18	0.62	0.36	0.23	0.14	0.10								
	R	29.85	10.17	2.20	0.60	0.21	0.07	0.03								
0.40	v	2.46	1.57	0.83	0.48	0.31	0.19	0.13	0.09							
	R	50.14	17.00	3.66	0.99	0.34	0.11	0.05	0.02							
0.50	v	3.07	1.97	1.04	0.60	0.38	0.24	0.17	0.12							
	R	75.20	25.39	5.41	1.46	0.50	0.17	0.07	0.03							
0.60	v	3.69	2.36	1.24	0.72	0.46	0.29	0.20	0.14	0.09						
	R	104.92	35.31	7.53	2.03	0.69	0.23	0.10	0.04	0.02						
0.70	v	4.30	2.75	1.45	0.84	0.54	0.34	0.23	0.16	0.11	0.09					
	R	139.24	46.71	9.92	2.66	0.91	0.30	0.13	0.05	0.02	0.01					
0.80	v	4.91	3.15	1.66	0.96	0.61	0.39	0.27	0.19	0.13	0.10					
	R	178.11	59.58	12.60	3.38	1.15	0.38	0.16	0.07	0.03	0.01					
0.90	v	5.53	3.54	1.86	1.08	0.69	0.43	0.30	0.21	0.14	0.11					
	R	221.49	73.51	15.58	4.17	1.42	0.47	0.20	0.08	0.03	0.02					
1.00	v	6.14	3.93	2.07	1.20	0.77	0.48	0.33	0.24	0.16	0.12	0.06				
	R	269.36	89.67	18.77	5.00	1.70	0.56	0.23	0.10	0.04	0.02	0.01				
1.20	v	7.37	4.72	2.49	1.44	0.92	0.58	0.40	0.28	0.19	0.15	0.08	0.06			
	R	378.48	125.48	26.14	6.94	2.35	0.78	0.32	0.14	0.05	0.03	0.01	0.01			
1.40	v	8.60	5.50	2.90	1.68	1.07	0.68	0.47	0.33	0.22	0.17	0.09	0.07	0.06		
	R	505.32	166.94	34.62	9.16	3.10	1.02	0.42	0.18	0.07	0.04	0.01	0.01	0.01		
1.60	v	9.83	6.29	3.31	1.92	1.22	0.77	0.53	0.38	0.25	0.20	0.10	0.08	0.07		
	R	649.81	214.00	44.21	11.67	3.94	1.30	0.54	0.23	0.09	0.05	0.01	0.01	0.01		
1.80	v	11.06	7.08	3.73	2.16	1.38	0.87	0.60	0.42	0.28	0.22	0.12	0.09	0.07	0.06	
	R	811.87	266.62	54.88	14.45	4.87	1.60	0.66	0.29	0.11	0.06	0.02	0.01	0.01	0.01	
2.00	v	12.29	7.86	4.14	2.40	1.53	0.96	0.67	0.47	0.31	0.24	0.13	0.10	0.08	0.06	
	R	991.46	324.79	66.63	17.50	5.89	1.93	0.80	0.34	0.13	0.07	0.02	0.01	0.01	0.01	
2.5	v	15.36	9.83	5.18	3.00	1.91	1.21	0.83	0.59	0.39	0.30	0.16	0.13	0.10	0.08	0.07
	R	1503.86	491.71	100.68	26.31	8.83	2.89	1.19	0.51	0.20	0.11	0.02	0.01	0.01	0.01	0.01
3.00	v	18.43	11.80	6.21	3.60	2.30	1.45	1.00	0.71	0.47	0.37	0.19	0.15	0.12	0.10	0.08
	R	2151.35	698.13	141.35	36.77	12.30	4.01	1.65	0.71	0.27	0.15	0.03	0.02	0.01	0.01	0.01
3.5	v	21.50	13.76	7.25	4.20	2.68	1.69	1.17	0.82	0.55	0.43	0.22	0.18	0.14	0.11	0.09
	R	2863.58	936.08	188.56	48.87	16.30	5.33	2.19	0.94	0.36	0.20	0.04	0.02	0.01	0.01	0.00
4.0	v	24.57	15.73	8.29	4.79	3.06	1.93	1.33	0.94	0.63	0.49	0.26	0.20	0.16	0.13	0.10
	R	3703.38	1208.07	242.29	62.57	20.82	6.76	2.77	1.19	0.45	0.25	0.05	0.03	0.02	0.01	0.01
4.5	v	27.65	17.69	9.32	5.39	3.44	2.17	1.50	1.06	0.71	0.55	0.29	0.23	0.18	0.15	0.12
	R	4649.64	1514.06	302.50	77.87	25.85	8.41	3.44	1.48	0.56	0.31	0.07	0.04	0.02	0.01	0.01
5.0	v		19.66	10.36	5.99	3.83	2.41	1.67	1.18	0.79	0.61	0.32	0.25	0.21	0.16	0.13
	R		1853.99	369.16	94.76	31.39	11.16	4.15	1.78	0.68	0.37	0.08	0.04	0.04	0.02	0.01
5.5	v		21.63	11.39	6.59	4.21	2.65	1.83	1.29	0.87	0.67	0.35	0.28	0.23	0.18	0.14
	R		2227.83	442.26	113.23	37.44	12.13	4.96	2.13	0.81	0.44	0.09	0.05	0.03	0.02	0.01
6.0	v		23.59	12.43	7.19	4.59	2.89	2.00	1.41	0.94	0.73	0.38	0.30	0.25	0.19	0.16
	R		2635.56	521.79	133.28	43.99	14.18	5.78	2.48	0.94	0.51	0.11	0.06	0.04	0.02	0.01
6.5	v		25.56	13.46	7.79	4.97	3.13	2.17	1.53	1.02	0.79	0.42	0.33	0.27	0.21	0.17
	R		2077.16	607.74	154.89	51.04	16.47	6.72	2.88	1.09	0.59	0.13	0.07	0.04	0.02	0.01
7.0	v		27.52	14.50	8.39	5.36	3.38	2.33	1.65	1.10	0.85	0.45	0.35	0.29	0.23	0.18
	R		3552.61	700.09	178.07	58.58	18.87	7.69	3.29	1.25	0.67	0.14	0.08	0.05	0.03	0.02
7.5	v		29.49	15.53	8.99	5.74	3.62	2.50	1.76	1.18	0.91	0.48	0.38	0.31	0.24	0.20
	R		4061.91	798.84	202.81	66.62	21.39	8.69	3.72	1.40	0.76	0.16	0.09	0.06	0.03	0.02
8.0	v		31.46	16.57	9.59	6.12	3.86	2.67	1.88	1.26	0.98	0.51	0.41	0.33	0.26	0.21
	R		4605.05	903.98	229.10	75.15	24.13	9.81	4.20	1.59	0.86	0.18	0.10	0.06	0.04	0.02

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Faser-Climatec D111 (Hot Pipe)

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x9.5	180x10.7	200x11.9	225x13.4	250x14.8
SDR		7.4	7.4	9	11	11	11	11	11	11	11	17	17	17	17	17
Q	ID →	14.4	18	24.8	32.6	40.8	51.4	61.8	73.6	90.0	102.2	141.0	158.6	176.2	198.2	220.4
9.0	v			18.64	10.79	6.89	4.34	3.00	2.12	1.42	1.10	0.58	0.46	0.37	0.29	0.24
	R			1133.43	286.34	93.69	29.97	12.15	5.18	1.95	1.06	0.22	0.13	0.08	0.04	0.03
10.0	v			20.71	11.99	7.65	4.82	3.34	2.35	1.57	1.22	0.64	0.51	0.41	0.32	0.26
	R			1388.40	349.78	114.18	36.44	14.75	6.28	2.37	1.28	0.27	0.15	0.09	0.05	0.03
12.0	v			24.86	14.38	9.18	5.79	4.00	2.82	1.89	1.46	0.77	0.61	0.49	0.39	0.31
	R			1954.24	491.87	160.42	51.19	20.66	8.78	3.30	1.78	0.38	0.21	0.13	0.07	0.04
14.0	v			29.00	16.78	10.71	6.75	4.67	3.29	2.20	1.71	0.90	0.71	0.57	0.45	0.37
	R			2633.16	660.18	214.59	68.31	27.51	11.67	4.37	2.36	0.50	0.28	0.17	0.10	0.06
16.0	v			33.14	19.18	12.24	7.72	5.34	3.76	2.52	1.95	1.03	0.81	0.66	0.52	0.42
	R			3412.05	852.69	276.37	87.79	35.27	14.94	5.59	3.01	0.63	0.36	0.22	0.12	0.07
18.0	v			37.28	21.58	13.78	8.68	6.00	4.23	2.83	2.20	1.15	0.91	0.74	0.58	0.47
	R			4290.84	1069.35	345.74	109.62	43.96	18.58	6.94	3.73	0.78	0.44	0.27	0.15	0.09
20.0	v				23.97	15.31	9.64	6.67	4.70	3.15	2.44	1.28	1.01	0.82	0.65	0.52
	R				1310.15	422.66	133.78	53.55	22.60	8.43	4.53	0.95	0.54	0.32	0.18	0.11
25.0	v				29.97	19.13	12.05	8.34	5.88	3.93	3.05	1.60	1.27	1.03	0.81	0.66
	R				2017.57	647.96	204.37	81.49	34.28	12.73	6.83	1.43	0.81	0.48	0.27	0.16
30.0	v				35.96	22.96	14.47	10.01	7.06	4.72	3.66	1.92	1.52	1.23	0.97	0.79
	R				2875.45	920.28	289.45	115.05	48.26	17.87	9.57	1.99	1.12	0.67	0.38	0.23
35.0	v				41.95	26.79	16.88	11.67	8.23	5.50	4.27	2.24	1.77	1.44	1.14	0.92
	R				3883.67	1239.53	388.97	154.20	64.52	23.83	12.74	2.64	1.49	0.89	0.51	0.30
40.0	v					30.61	19.29	13.34	9.41	6.29	4.88	2.56	2.03	1.64	1.30	1.05
	R					1605.66	499.01	197.85	82.79	30.58	16.35	3.39	1.91	1.15	0.65	0.39
45.0	v					34.44	21.70	15.01	10.58	7.08	5.49	2.88	2.28	1.85	1.46	1.18
	R					2018.63	625.92	247.69	103.45	38.13	20.37	4.21	2.37	1.42	0.80	0.48
50.0	v					38.26	24.11	16.68	11.76	7.86	6.10	3.20	2.53	2.05	1.62	1.31
	R					2478.41	766.98	302.98	126.33	46.48	24.80	5.11	2.88	1.73	0.97	0.58
55.0	v					42.09	26.52	18.35	12.93	8.65	6.71	3.52	2.79	2.26	1.78	1.44
	R					2985.00	922.16	363.72	151.43	55.62	29.64	6.10	3.43	2.06	1.16	0.69
60.0	v					45.92	28.93	20.01	14.11	9.44	7.32	3.84	3.04	2.46	1.95	1.57
	R					3538.38	1091.47	429.91	178.74	65.54	34.90	7.16	4.03	2.41	1.36	0.81
65.0	v					49.74	31.34	21.68	15.29	10.22	7.93	4.17	3.29	2.67	2.11	1.70
	R					4138.53	1274.89	501.53	208.25	76.26	40.57	8.31	4.67	2.80	1.58	0.94
70.0	v						33.75	23.35	16.46	11.01	8.54	4.49	3.55	2.87	2.27	1.84
	R						1472.41	578.59	239.98	87.76	46.65	9.54	5.36	3.21	1.81	1.08
75.0	v						36.16	25.02	17.64	11.80	9.15	4.81	3.80	3.08	2.43	1.97
	R						1684.04	661.08	273.90	100.04	53.14	10.85	6.09	3.64	2.05	1.22
80.0	v						38.58	26.68	18.81	12.58	9.76	5.13	4.05	3.28	2.59	2.10
	R						1909.76	748.99	310.03	113.10	60.04	12.23	6.87	4.10	2.31	1.38
85.0	v						40.99	28.35	19.99	13.37	10.37	5.45	4.30	3.49	2.76	2.23
	R						2149.58	842.33	348.35	126.94	67.34	13.70	7.69	4.59	2.58	1.54
90.0	v						43.40	30.02	21.17	14.15	10.98	5.77	4.56	3.69	2.92	2.36
	R						2403.49	941.09	388.87	141.56	75.05	15.24	8.55	5.10	2.87	1.71
95.0	v						45.81	31.69	22.34	14.94	11.59	6.09	4.81	3.90	3.08	2.49
	R						2671.49	1045.28	431.58	156.96	83.16	16.87	9.45	5.64	3.17	1.89
100.0	v						48.22	33.36	23.52	15.73	12.20	6.41	5.06	4.10	3.24	2.62
	R						2953.59	1154.88	476.49	173.14	91.68	18.57	10.40	6.21	3.49	2.08
105.0	v						50.63	35.02	24.69	16.51	12.81	6.73	5.32	4.31	3.41	2.75
	R						3249.76	1269.90	523.59	190.10	100.60	20.35	11.40	6.80	3.82	2.27
110.0	v						53.04	36.69	25.87	17.30	13.42	7.05	5.57	4.51	3.57	2.88
	R						3560.03	1390.33	572.89	207.82	109.92	22.21	12.43	7.41	4.16	2.48
115.0	v						55.45	38.36	27.05	18.09	14.03	7.37	5.82	4.72	3.73	3.02
	R						3884.38	1516.18	624.37	226.33	119.65	24.14	13.51	8.05	4.52	2.69
120.0	v						57.86	40.03	28.22	18.87	14.64	7.69	6.08	4.92	3.89	3.15
	R						4222.81	1647.45	678.04	245.61	129.78	26.16	14.63	8.72	4.89	2.91
125.0	v							41.69	29.40	19.66	15.25	8.01	6.33	5.13	4.05	3.28
	R							1784.13	733.91	265.67	140.32	28.25	15.79	9.41	5.28	3.14
130.0	v							43.36	30.57	20.45	15.86	8.33	6.58	5.33	4.22	3.41
	R							1926.22	791.96	286.49	151.25	30.42	17.00	10.12	5.68	3.38
135.0	v							45.03	31.75	21.23	16.47	8.65	6.84	5.54	4.38	3.54
	R							2073.72	852.21	308.10	162.59	32.66	18.25	10.86	6.09	3.62
140.0	v							46.70	32.92	22.02	17.08	8.97	7.09	5.74	4.54	3.67
	R							2226.64	914.64	330.47	174.33	34.99	19.54	11.63	6.52	3.87
145.0	v							48.37	34.10	22.81	17.69	9.29	7.34	5.95	4.70	3.80
	R							2384.97	979.26	353.62	186.47	37.38	20.87	12.42	6.96	4.13
150.0	v							50.03	35.28	23.59	18.30	9.61	7.60	6.15	4.86	3.93
	R							2548.71	1046.06	377.54	199.01	39.86	22.25	13.23	7.41	4.40

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Faser-Climatec D111 (Hot Pipe)

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x9.5	180x10.7	200x11.9	225x13.4	250x14.8
SDR		7.4	7.4	9	11	11	11	11	11	11	11	17	17	17	17	17
Q	ID →	14.4	18	24.8	32.6	40.8	51.4	61.8	73.6	90.0	102.2	141.0	158.6	176.2	198.2	220.4
0.05	v	0.31	0.20													
	R	1.06	0.36													
0.07	v	0.43	0.28	0.14												
	R	1.90	0.66	0.14												
0.09	v	0.55	0.35	0.19												
	R	2.97	1.02	0.22												
0.10	v	0.61	0.39	0.21	0.12											
	R	3.58	1.23	0.27	0.07											
0.12	v	0.74	0.47	0.25	0.14	0.09										
	R	4.95	1.69	0.37	0.10	0.03										
0.16	v	0.98	0.63	0.33	0.19	0.12	0.08									
	R	8.29	2.82	0.61	0.16	0.06	0.02									
0.18	v	1.11	0.71	0.37	0.22	0.14	0.09									
	R	10.25	3.48	0.75	0.20	0.07	0.02									
0.20	v	1.23	0.79	0.41	0.24	0.15	0.10									
	R	12.40	4.21	0.90	0.24	0.08	0.03									
0.30	v	1.84	1.18	0.62	0.36	0.23	0.14	0.10								
	R	25.93	8.73	1.85	0.50	0.17	0.06	0.02								
0.40	v	2.46	1.57	0.83	0.48	0.31	0.19	0.13	0.09							
	R	43.99	14.73	3.11	0.83	0.28	0.09	0.04	0.02							
0.50	v	3.07	1.97	1.04	0.60	0.38	0.24	0.17	0.12							
	R	66.49	22.17	4.65	1.24	0.42	0.14	0.06	0.03							
0.60	v	3.69	2.36	1.24	0.72	0.46	0.29	0.20	0.14	0.09						
	R	93.38	31.01	6.47	1.72	0.58	0.19	0.08	0.03	0.01						
0.70	v	4.30	2.75	1.45	0.84	0.54	0.34	0.23	0.16	0.11	0.09					
	R	124.63	41.24	8.57	2.27	0.77	0.25	0.10	0.05	0.02	0.01					
0.80	v	4.91	3.15	1.66	0.96	0.61	0.39	0.27	0.19	0.13	0.10					
	R	160.20	52.84	10.94	2.89	0.98	0.32	0.13	0.06	0.02	0.01					
0.90	v	5.53	3.54	1.86	1.08	0.69	0.43	0.30	0.21	0.14	0.11					
	R	200.09	65.82	13.57	3.58	1.21	0.40	0.16	0.07	0.03	0.01					
1.00	v	6.14	3.93	2.07	1.20	0.77	0.48	0.33	0.24	0.16	0.12	0.06				
	R	244.28	80.16	16.48	4.33	1.46	0.48	0.20	0.09	0.03	0.02	0.00				
1.20	v	7.37	4.72	2.49	1.44	0.92	0.58	0.40	0.28	0.19	0.15	0.08	0.06			
	R	345.53	112.90	23.07	6.04	2.03	0.66	0.27	0.12	0.05	0.02	0.01	0.00			
1.40	v	8.60	5.50	2.90	1.68	1.07	0.68	0.47	0.33	0.22	0.17	0.09	0.07	0.06		
	R	463.89	151.03	30.72	8.02	2.69	0.88	0.36	0.16	0.06	0.03	0.01	0.00	0.00		
1.60	v	9.83	6.29	3.31	1.92	1.22	0.77	0.53	0.38	0.25	0.20	0.10	0.08	0.07		
	R	599.33	194.54	39.39	10.25	3.43	1.12	0.46	0.20	0.08	0.04	0.01	0.01	0.00		
1.80	v	11.06	7.08	3.73	2.16	1.38	0.87	0.60	0.42	0.28	0.22	0.12	0.09	0.07	0.06	
	R	751.82	243.40	49.10	12.74	4.25	1.38	0.57	0.24	0.09	0.05	0.01	0.01	0.00	0.00	
2.00	v	12.29	7.86	4.14	2.40	1.53	0.96	0.67	0.47	0.31	0.24	0.13	0.10	0.08	0.06	
	R	921.35	297.60	59.83	15.48	5.15	1.68	0.69	0.30	0.11	0.06	0.01	0.01	0.00	0.00	
2.5	v	15.36	9.83	5.18	3.00	1.91	1.21	0.83	0.59	0.39	0.30	0.16	0.13	0.10	0.08	0.07
	R	1419.65	456.45	91.10	23.43	7.77	2.52	1.03	0.44	0.17	0.09	0.02	0.01	0.01	0.00	0.00
3.00	v	18.43	11.80	6.21	3.60	2.30	1.45	1.00	0.71	0.47	0.37	0.19	0.15	0.12	0.10	0.08
	R	2024.25	648.56	128.71	32.94	10.89	3.51	1.43	0.61	0.23	0.13	0.03	0.02	0.01	0.01	0.00
3.5	v	21.50	13.76	7.25	4.20	2.68	1.69	1.17	0.82	0.55	0.43	0.22	0.18	0.14	0.11	0.09
	R	2735.09	873.90	172.62	43.99	14.49	4.66	1.90	0.81	0.31	0.17	0.04	0.02	0.01	0.01	0.00
4.0	v	24.57	15.73	8.29	4.79	3.06	1.93	1.33	0.94	0.63	0.49	0.26	0.20	0.16	0.13	0.10
	R	3552.14	1132.44	222.81	56.58	18.59	5.97	2.42	1.04	0.39	0.21	0.04	0.03	0.02	0.01	0.01
4.5	v	27.65	17.69	9.32	5.39	3.44	2.17	1.50	1.06	0.71	0.55	0.29	0.23	0.18	0.15	0.12
	R	4475.38	1424.14	279.28	70.69	23.16	7.42	3.01	1.29	0.48	0.26	0.06	0.03	0.02	0.01	0.01
5.0	v		19.66	10.36	5.99	3.83	2.41	1.67	1.18	0.79	0.61	0.32	0.25	0.21	0.16	0.13
	R		1749.01	342.01	86.33	28.23	9.02	3.65	1.56	0.59	0.32	0.07	0.04	0.02	0.01	0.01
5.5	v		21.63	11.39	6.59	4.21	2.65	1.83	1.29	0.87	0.67	0.35	0.28	0.23	0.18	0.14
	R		2107.04	411.00	103.49	33.76	10.77	4.36	1.86	0.70	0.38	0.08	0.05	0.03	0.02	0.01
6.0	v		23.59	12.43	7.19	4.59	2.89	2.00	1.41	0.94	0.73	0.38	0.30	0.25	0.19	0.16
	R		2498.21	486.25	122.17	39.78	12.67	5.12	2.18	0.82	0.44	0.09	0.05	0.03	0.02	0.01
6.5	v		25.56	13.46	7.79	4.97	3.13	2.17	1.53	1.02	0.79	0.42	0.33	0.27	0.21	0.17
	R		2922.52	567.74	142.36	46.28	14.71	5.94	2.52	0.95	0.51	0.11	0.06	0.04	0.02	0.01
7.0	v		27.52	14.50	8.39	5.36	3.38	2.33	1.65	1.10	0.85	0.45	0.35	0.29	0.23	0.18
	R		3379.96	655.49	164.06	53.25	16.90	6.81	2.89	1.08	0.58	0.12	0.07	0.04	0.02	0.01
7.5	v		29.49	15.53	8.99	5.74	3.62	2.50	1.76	1.18	0.91	0.48	0.38	0.31	0.24	0.20
	R		3870.55	749.47	187.27	60.69	19.23	7.74	3.28	1.23	0.66	0.14	0.08	0.05	0.03	0.02
8.0	v		31.46	16.57	9.59	6.12	3.86	2.67	1.88	1.26	0.98	0.51	0.41	0.33	0.26	0.21
	R		4394.26	849.71	211.99	68.61	21.71	8.73	3.70	1.38	0.75	0.16	0.09	0.05	0.03	0.02

Pipe Flow rates Q - Velocity v- Pressure Drops R

PP-RCT Faser-Climatec D111 (Hot Pipe)

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		20x2.8	25x3.5	32x3.6	40x3.7	50x4.6	63x5.8	75x6.8	90x8.2	110x10	125x11.4	160x9.5	180x10.7	200x11.9	225x13.4	250x14.8
SDR		7.4	7.4	9	11	11	11	11	11	11	11	17	17	17	17	17
Q	ID →	14.4	18	24.8	32.6	40.8	51.4	61.8	73.6	90.0	102.2	141.0	158.6	176.2	198.2	220.4
9.0	v			18.64	10.79	6.89	4.34	3.00	2.12	1.42	1.10	0.58	0.46	0.37	0.29	0.24
	R			1068.89	265.96	85.86	27.10	10.88	4.60	1.72	0.93	0.19	0.11	0.07	0.04	0.02
10.0	v			20.71	11.99	7.65	4.82	3.34	2.35	1.57	1.22	0.64	0.51	0.41	0.32	0.26
	R			1313.04	325.96	105.01	33.06	13.25	5.60	2.09	1.12	0.24	0.13	0.08	0.05	0.03
12.0	v			24.86	14.38	9.18	5.79	4.00	2.82	1.89	1.46	0.77	0.61	0.49	0.39	0.31
	R			1876.19	464.03	148.94	46.71	18.66	7.86	2.93	1.57	0.33	0.19	0.11	0.06	0.04
14.0	v			29.00	16.78	10.71	6.75	4.67	3.29	2.20	1.71	0.90	0.71	0.57	0.45	0.37
	R			2539.12	626.16	200.40	62.65	24.96	10.49	3.89	2.09	0.44	0.25	0.15	0.08	0.05
16.0	v			33.14	19.18	12.24	7.72	5.34	3.76	2.52	1.95	1.03	0.81	0.66	0.52	0.42
	R			3301.81	812.35	259.36	80.85	32.14	13.48	4.99	2.67	0.56	0.31	0.19	0.11	0.06
18.0	v			37.28	21.58	13.78	8.68	6.00	4.23	2.83	2.20	1.15	0.91	0.74	0.58	0.47
	R			4164.26	1022.59	325.83	101.33	40.20	16.83	6.22	3.33	0.69	0.39	0.23	0.13	0.08
20.0	v				23.97	15.31	9.64	6.67	4.70	3.15	2.44	1.28	1.01	0.82	0.65	0.52
	R				1256.86	399.79	124.08	49.14	20.54	7.58	4.05	0.84	0.47	0.28	0.16	0.10
25.0	v				29.97	19.13	12.05	8.34	5.88	3.93	3.05	1.60	1.27	1.03	0.81	0.66
	R				1947.68	617.47	190.84	75.30	31.36	11.52	6.14	1.26	0.71	0.43	0.24	0.14
30.0	v				35.96	22.96	14.47	10.01	7.06	4.72	3.66	1.92	1.52	1.23	0.97	0.79
	R				2788.67	881.94	271.73	106.91	44.40	16.26	8.65	1.77	1.00	0.60	0.34	0.20
35.0	v				41.95	26.79	16.88	11.67	8.23	5.50	4.27	2.24	1.77	1.44	1.14	0.92
	R				3779.81	1193.18	366.72	143.96	59.64	21.78	11.57	2.36	1.33	0.79	0.45	0.27
40.0	v					30.61	19.29	13.34	9.41	6.29	4.88	2.56	2.03	1.64	1.30	1.05
	R					1551.18	475.81	186.43	77.09	28.09	14.90	3.03	1.70	1.01	0.57	0.34
45.0	v					34.44	21.70	15.01	10.58	7.08	5.49	2.88	2.28	1.85	1.46	1.18
	R					1955.93	599.00	234.32	96.73	35.17	18.63	3.78	2.12	1.26	0.71	0.42
50.0	v					38.26	24.11	16.68	11.76	7.86	6.10	3.20	2.53	2.05	1.62	1.31
	R					2407.44	736.27	287.63	118.56	43.03	22.76	4.60	2.58	1.54	0.86	0.51
55.0	v					42.09	26.52	18.35	12.93	8.65	6.71	3.52	2.79	2.26	1.78	1.44
	R					2905.69	887.63	346.36	142.58	51.66	27.30	5.51	3.08	1.83	1.03	0.61
60.0	v					45.92	28.93	20.01	14.11	9.44	7.32	3.84	3.04	2.46	1.95	1.57
	R					3450.69	1053.07	410.50	168.80	61.07	32.25	6.49	3.63	2.16	1.21	0.72
65.0	v					49.74	31.34	21.68	15.29	10.22	7.93	4.17	3.29	2.67	2.11	1.70
	R					4042.42	1232.59	480.06	197.20	71.26	37.59	7.54	4.21	2.51	1.41	0.84
70.0	v						33.75	23.35	16.46	11.01	8.54	4.49	3.55	2.87	2.27	1.84
	R						1426.20	555.02	227.79	82.21	43.34	8.68	4.84	2.88	1.61	0.96
75.0	v						36.16	25.02	17.64	11.80	9.15	4.81	3.80	3.08	2.43	1.97
	R						1633.88	635.40	260.57	93.94	49.48	9.89	5.52	3.28	1.84	1.09
80.0	v						38.58	26.68	18.81	12.58	9.76	5.13	4.05	3.28	2.59	2.10
	R						1855.65	721.19	295.54	106.44	56.03	11.18	6.23	3.70	2.07	1.23
85.0	v						40.99	28.35	19.99	13.37	10.37	5.45	4.30	3.49	2.76	2.23
	R						2091.49	812.39	332.69	119.72	62.98	12.55	6.99	4.15	2.32	1.38
90.0	v						43.40	30.02	21.17	14.15	10.98	5.77	4.56	3.69	2.92	2.36
	R						2341.41	909.00	372.03	133.76	70.32	13.99	7.79	4.62	2.58	1.53
95.0	v						45.81	31.69	22.34	14.94	11.59	6.09	4.81	3.90	3.08	2.49
	R						2605.41	1011.02	413.56	148.58	78.07	15.51	8.63	5.12	2.86	1.69
100.0	v						48.22	33.36	23.52	15.73	12.20	6.41	5.06	4.10	3.24	2.62
	R						2883.49	1118.44	457.27	164.17	86.22	17.10	9.51	5.64	3.15	1.87
105.0	v						50.63	35.02	24.69	16.51	12.81	6.73	5.32	4.31	3.41	2.75
	R						3175.64	1231.28	503.16	180.53	94.76	18.77	10.43	6.18	3.45	2.04
110.0	v						53.04	36.69	25.87	17.30	13.42	7.05	5.57	4.51	3.57	2.88
	R						3481.87	1349.53	551.24	197.65	103.71	20.52	11.40	6.75	3.77	2.23
115.0	v						55.45	38.36	27.05	18.09	14.03	7.37	5.82	4.72	3.73	3.02
	R						3802.18	1473.18	601.51	215.55	113.05	22.34	12.41	7.35	4.10	2.42
120.0	v						57.86	40.03	28.22	18.87	14.64	7.69	6.08	4.92	3.89	3.15
	R						4136.57	1602.24	653.96	234.22	122.80	24.24	13.46	7.96	4.44	2.63
125.0	v							41.69	29.40	19.66	15.25	8.01	6.33	5.13	4.05	3.28
	R							1736.71	708.59	253.67	132.94	26.21	14.55	8.61	4.80	2.84
130.0	v							43.36	30.57	20.45	15.86	8.33	6.58	5.33	4.22	3.41
	R							1876.59	765.41	273.88	143.48	28.26	15.68	9.27	5.17	3.05
135.0	v							45.03	31.75	21.23	16.47	8.65	6.84	5.54	4.38	3.54
	R							2021.87	824.42	294.86	154.42	30.39	16.85	9.96	5.55	3.28
140.0	v							46.70	32.92	22.02	17.08	8.97	7.09	5.74	4.54	3.67
	R							2172.57	885.61	316.61	165.76	32.59	18.06	10.68	5.95	3.51
145.0	v							48.37	34.10	22.81	17.69	9.29	7.34	5.95	4.70	3.80
	R							2328.67	948.98	339.13	177.50	34.87	19.32	11.42	6.35	3.75
150.0	v							50.03	35.28	23.59	18.30	9.61	7.60	6.15	4.86	3.93
	R							2490.18	1014.54	362.42	189.64	37.22	20.62	12.18	6.78	4.00

Dynatherm PP-RCT Stabi Pipe D140

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x2.8	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14
SDR		7.4	7.4	9	9	9	9	9	9	9	9	9
Q	ID →	11.6	14.4	19.4	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0
0.03	v	0.28	0.18	0.10								
	R	1.50	0.54	0.13								
0.05	v	0.47	0.31	0.17	0.10							
	R	3.58	1.28	0.32	0.10							
0.07	v	0.66	0.43	0.24	0.14	0.09						
	R	6.42	2.29	0.56	0.18	0.06						
0.09	v	0.85	0.55	0.30	0.19	0.12	0.08					
	R	9.96	3.55	0.87	0.27	0.10	0.03					
0.10	v	0.95	0.61	0.34	0.21	0.13	0.08					
	R	11.99	4.26	1.03	0.32	0.11	0.04					
0.12	v	1.14	0.74	0.41	0.25	0.16	0.10					
	R	16.53	5.87	1.43	0.45	0.16	0.05					
0.16	v	1.51	0.98	0.54	0.33	0.21	0.14	0.09				
	R	27.55	9.74	2.36	0.73	0.26	0.09	0.03				
0.18	v	1.70	1.11	0.61	0.37	0.24	0.15	0.10				
	R	34.00	12.00	2.90	0.90	0.31	0.11	0.04				
0.20	v	1.89	1.23	0.68	0.41	0.27	0.17	0.11				
	R	41.06	14.46	3.49	1.08	0.38	0.13	0.04				
0.30	v	2.84	1.84	1.02	0.62	0.40	0.25	0.16	0.11			
	R	85.33	29.85	7.14	2.20	0.76	0.26	0.09	0.04			
0.40	v	3.79	2.46	1.35	0.83	0.53	0.34	0.21	0.15	0.10		
	R	144.14	50.14	11.90	3.66	1.26	0.43	0.15	0.06	0.03		
0.50	v	4.73	3.07	1.69	1.04	0.66	0.42	0.27	0.19	0.13	0.09	
	R	217.15	75.20	17.67	5.41	1.85	0.67	0.21	0.09	0.04	0.02	
0.60	v	5.68	3.69	2.03	1.24	0.80	0.51	0.32	0.23	0.16	0.10	
	R	304.17	104.92	24.63	7.53	2.58	0.88	0.30	0.13	0.05	0.02	
0.70	v	6.63	4.30	2.37	1.45	0.93	0.59	0.37	0.26	0.18	0.12	0.09
	R	405.05	139.24	32.53	9.92	3.39	1.16	0.39	0.17	0.07	0.03	0.01
0.80	v	7.57	4.91	2.71	1.66	1.06	0.68	0.43	0.30	0.21	0.14	0.11
	R	519.70	178.11	41.43	12.60	4.30	1.46	0.49	0.21	0.09	0.03	0.02
0.90	v	8.52	5.53	3.05	1.86	1.19	0.76	0.48	0.34	0.24	0.16	0.12
	R	648.06	221.49	51.33	15.58	5.31	1.81	0.60	0.26	0.11	0.04	0.02
1.00	v	9.47	6.14	3.38	2.07	1.33	0.85	0.53	0.38	0.26	0.17	0.14
	R	790.06	269.36	62.13	18.77	6.38	2.27	0.72	0.31	0.13	0.05	0.03
1.20	v	11.36	7.37	4.06	2.49	1.59	1.02	0.64	0.45	0.31	0.21	0.16
	R	1114.88	378.48	86.82	26.14	8.85	3.15	1.00	0.43	0.18	0.07	0.04
1.40	v	13.25	8.60	4.74	2.90	1.86	1.18	0.75	0.53	0.37	0.24	0.19
	R	1493.92	505.32	115.38	34.62	11.70	4.15	1.31	0.56	0.24	0.09	0.05
1.60	v	15.15	9.83	5.42	3.31	2.12	1.35	0.86	0.60	0.42	0.28	0.22
	R	1927.04	649.81	147.75	44.21	14.90	5.28	1.66	0.71	0.30	0.11	0.06
1.80	v	17.04	11.06	6.09	3.73	2.39	1.52	0.96	0.68	0.47	0.31	0.24
	R	2414.14	811.87	183.92	54.88	18.46	6.53	2.05	0.88	0.37	0.14	0.08
2.00	v	18.93	12.29	6.77	4.14	2.65	1.69	1.07	0.75	0.52	0.35	0.27
	R	2955.16	991.46	223.87	66.63	22.36	7.90	2.48	1.06	0.44	0.17	0.09
2.5	v	23.67	15.36	8.46	5.18	3.31	2.12	1.34	0.94	0.65	0.44	0.34
	R	4489.83	494.32	340.12	100.68	33.65	11.85	3.71	1.59	0.66	0.25	0.14
3.00	v		18.43	10.15	6.21	3.98	2.54	1.60	1.13	0.78	0.52	0.41
	R		2151.35	479.67	141.35	47.07	16.52	5.16	2.20	0.92	0.35	0.19
3.5	v		21.50	11.85	7.25	4.64	2.96	1.87	1.32	0.92	0.61	0.47
	R		936.08	642.39	188.56	62.58	21.91	6.85	2.92	1.22	0.46	0.25
4.0	v		24.57	13.54	8.29	5.30	3.38	2.14	1.50	1.05	0.70	0.54
	R		1208.07	828.21	242.29	80.18	28.00	8.70	3.70	1.54	0.58	0.32
4.5	v		27.65	15.23	9.32	5.97	3.81	2.41	1.69	1.18	0.79	0.61
	R		1514.06	1037.07	302.50	99.85	34.79	10.82	4.60	1.91	0.72	0.39
5.0	v		30.72	16.92	10.36	6.63	4.23	2.67	1.88	1.31	0.87	0.68
	R		1853.99	1268.93	369.16	121.57	42.28	13.08	5.55	2.30	0.87	0.47
5.5	v		33.79	18.62	11.39	7.29	4.65	2.94	2.07	1.44	0.96	0.74
	R		2227.83	1523.77	442.26	145.33	50.44	15.62	6.63	2.75	1.04	0.56
6.0	v		36.86	20.31	12.43	7.95	5.08	3.21	2.26	1.57	1.05	0.81
	R		2635.56	1801.56	521.79	171.13	59.29	18.28	7.74	3.20	1.21	0.65
6.5	v		39.93	22.00	13.46	8.62	5.50	3.48	2.44	1.70	1.14	0.88
	R		2077.16	2102.29	607.74	198.96	68.82	21.22	8.99	3.72	1.40	0.76
7.0	v		43.01	23.69	14.50	9.28	5.92	3.74	2.63	1.83	1.22	0.95
	R		3552.61	2425.95	700.09	228.82	79.03	24.32	10.29	4.26	1.60	0.87
7.5	v		46.08	25.39	15.53	9.94	6.35	4.01	2.82	1.96	1.31	1.02
	R		4061.91	2772.51	798.84	260.69	89.91	27.59	11.65	4.81	1.81	0.98

Dynatherm PP-RCT Stabi Pipe D140

Temperature: 20 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x2.8	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14
SDR		7.4	7.4	9	9	9	9	9	9	9	9	9
Q	ID →	11.6	14.4	19.4	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0
8.0	v		49.15	27.08	16.57	10.61	6.77	4.28	3.01	2.09	1.40	1.08
	R		4605.05	3141.98	903.98	294.59	101.46	31.11	13.15	5.43	2.04	1.10
9.0	v			30.46	18.64	11.93	7.62	4.81	3.38	2.35	1.57	1.22
	R			3949.62	1133.43	368.41	126.58	38.69	16.29	6.71	2.52	1.36
10.0	v			33.85	20.71	13.26	8.46	5.35	3.76	2.61	1.75	1.35
	R			4848.81	1388.40	450.27	154.36	47.07	19.79	8.14	3.05	1.65
12.0	v				24.86	15.91	10.15	6.42	4.51	3.14	2.10	1.62
	R				1954.24	633.29	206.00	66.17	27.75	11.38	4.26	2.29
14.0	v				29.00	18.56	11.85	7.49	5.27	3.66	2.45	1.90
	R				2633.16	850.63	275.78	88.37	36.97	15.13	5.65	3.04
16.0	v				33.14	21.21	13.54	8.56	6.02	4.18	2.79	2.17
	R				3412.05	1099.37	355.40	113.64	47.44	19.37	7.22	3.88
18.0	v				37.28	23.86	15.23	9.63	6.77	4.71	3.14	2.44
	R				4290.84	1379.46	444.85	141.97	59.15	24.12	8.97	4.81
20.0	v					26.51	16.92	10.70	7.52	5.23	3.49	2.71
	R					1690.87	544.10	173.36	72.10	29.35	10.89	5.84
25.0	v					33.14	21.16	13.37	9.40	6.54	4.37	3.38
	R					2606.31	835.00	265.12	109.86	44.55	16.47	8.82
30.0	v					39.77	25.39	16.05	11.28	7.84	5.24	4.06
	R					3717.15	517.48	375.82	155.27	62.77	23.14	12.37
35.0	v						29.62	18.72	13.16	9.15	6.11	4.74
	R						1599.68	505.40	208.28	83.99	30.88	16.47
40.0	v						33.85	21.40	15.04	10.46	6.99	5.42
	R						2073.31	648.34	267.23	107.77	39.62	21.14
45.0	v						38.08	24.07	16.92	11.77	7.86	6.09
	R						2607.74	813.67	334.76	134.74	49.43	26.34
50.0	v						42.31	26.75	18.80	13.07	8.73	6.77
	R						3202.94	997.50	409.72	164.62	60.28	32.09
55.0	v						46.54	29.42	20.69	14.38	9.61	7.45
	R						3858.91	1199.82	492.11	197.42	72.17	38.37
60.0	v						50.77	32.10	22.57	15.69	10.48	8.12
	R						4575.62	1420.61	581.93	233.12	85.08	45.20
65.0	v							34.77	24.45	17.00	11.35	8.80
	R							1659.88	679.17	271.72	99.03	52.56
70.0	v							37.45	26.33	18.30	12.23	9.48
	R							1917.61	783.81	313.22	114.00	60.46
75.0	v							40.12	28.21	19.61	13.10	10.15
	R							2193.80	895.87	357.62	129.99	68.89
80.0	v							42.80	30.09	20.92	13.97	10.83
	R							2488.45	1015.33	404.91	147.01	77.85
85.0	v							45.47	31.97	22.23	14.85	11.51
	R							2801.55	1142.19	455.08	165.05	87.34
90.0	v							48.15	33.85	23.53	15.72	12.19
	R							3133.09	1276.45	508.15	184.11	97.36
95.0	v							50.82	35.73	24.84	16.59	12.86
	R							3483.08	1418.10	564.10	204.19	107.92
100.0	v							53.49	37.61	26.15	17.47	13.54
	R							3851.52	1567.16	622.94	225.29	119.00
105.0	v							56.17	39.49	27.46	18.34	14.22
	R							4238.40	1723.60	684.67	247.41	130.61
110.0	v							58.84	41.37	28.76	19.21	14.89
	R							4643.72	1887.44	749.27	270.54	142.74
115.0	v								43.25	30.07	20.09	15.57
	R								2058.68	816.76	294.69	155.41
120.0	v								45.13	31.38	20.96	16.25
	R								2237.30	887.14	319.86	168.60
125.0	v								47.01	32.68	21.83	16.92
	R								2423.32	960.39	346.04	182.32
130.0	v								48.89	33.99	22.71	17.60
	R								2616.72	1036.52	373.23	196.56
135.0	v								50.77	35.30	23.58	18.28
	R								2817.52	1115.54	401.44	211.33
140.0	v								52.65	36.61	24.45	18.96
	R								3025.70	1197.43	430.67	226.63
145.0	v								54.53	37.91	25.33	19.63
	R								3241.28	1282.20	460.90	242.45

Dynatherm PP-RCT Stabi Pipe D140

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x2.8	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14
SDR		7.4	7.4	9	9	9	9	9	9	9	9	9
Q	ID →	11.6	14.4	19.4	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0
0.03	v	0.28	0.18	0.10								
	R	1.21	0.43	0.11								
0.05	v	0.47	0.31	0.17	0.10							
	R	2.96	1.06	0.26	0.08							
0.07	v	0.66	0.43	0.24	0.14	0.09						
	R	5.37	1.90	0.46	0.14	0.05						
0.09	v	0.85	0.55	0.30	0.19	0.12						
	R	8.41	2.97	0.71	0.22	0.08						
0.10	v	0.95	0.61	0.34	0.21	0.13	0.08					
	R	10.15	3.58	0.86	0.27	0.09	0.03					
0.12	v	1.14	0.74	0.41	0.25	0.16	0.10					
	R	14.09	4.95	1.18	0.37	0.13	0.04					
0.16	v	1.51	0.98	0.54	0.33	0.21	0.14	0.09				
	R	23.71	8.29	1.97	0.61	0.21	0.07	0.02				
0.18	v	1.70	1.11	0.61	0.37	0.24	0.15	0.10				
	R	29.37	10.25	2.43	0.75	0.26	0.09	0.03				
0.20	v	1.89	1.23	0.68	0.41	0.27	0.17	0.11				
	R	35.60	12.40	2.93	0.90	0.31	0.11	0.04				
0.30	v	2.84	1.84	1.02	0.62	0.40	0.25	0.16	0.11			
	R	75.06	25.93	6.07	1.85	0.63	0.22	0.07	0.03			
0.40	v	3.79	2.46	1.35	0.83	0.53	0.34	0.21	0.15	0.10		
	R	128.16	43.99	10.23	3.11	1.06	0.36	0.12	0.05	0.02		
0.50	v	4.73	3.07	1.69	1.04	0.66	0.42	0.27	0.19	0.13		
	R	194.71	66.49	15.36	4.65	1.58	0.54	0.18	0.08	0.03		
0.60	v	5.68	3.69	2.03	1.24	0.80	0.51	0.32	0.23	0.16	0.10	
	R	274.62	93.38	21.46	6.47	2.19	0.74	0.25	0.11	0.04	0.02	
0.70	v	6.63	4.30	2.37	1.45	0.93	0.59	0.37	0.26	0.18	0.12	
	R	367.82	124.63	28.51	8.57	2.90	0.98	0.32	0.14	0.06	0.02	
0.80	v	7.57	4.91	2.71	1.66	1.06	0.68	0.43	0.30	0.21	0.14	0.11
	R	474.28	160.20	36.50	10.94	3.69	1.24	0.41	0.18	0.07	0.03	0.02
0.90	v	8.52	5.53	3.05	1.86	1.19	0.76	0.48	0.34	0.24	0.16	0.12
	R	593.97	200.09	45.43	13.57	4.57	1.54	0.51	0.22	0.09	0.03	0.02
1.00	v	9.47	6.14	3.38	2.07	1.33	0.85	0.53	0.38	0.26	0.17	0.14
	R	726.87	244.28	55.28	16.48	5.54	1.86	0.62	0.26	0.11	0.04	0.02
1.20	v	11.36	7.37	4.06	2.49	1.59	1.02	0.64	0.45	0.31	0.21	0.16
	R	1032.25	345.53	77.75	23.07	7.73	2.59	0.85	0.37	0.15	0.06	0.03
1.40	v	13.25	8.60	4.74	2.90	1.86	1.18	0.75	0.53	0.37	0.24	0.19
	R	1390.33	463.89	103.89	30.72	10.26	3.43	1.13	0.48	0.20	0.08	0.04
1.60	v	15.15	9.83	5.42	3.31	2.12	1.35	0.86	0.60	0.42	0.28	0.22
	R	1801.06	599.33	133.67	39.39	13.12	4.38	1.44	0.61	0.26	0.10	0.05
1.80	v	17.04	11.06	6.09	3.73	2.39	1.52	0.96	0.68	0.47	0.31	0.24
	R	2264.42	751.82	167.09	49.10	16.31	5.43	1.78	0.76	0.32	0.12	0.06
2.00	v	18.93	12.29	6.77	4.14	2.65	1.69	1.07	0.75	0.52	0.35	0.27
	R	2780.39	921.35	204.14	59.83	19.83	6.59	2.16	0.92	0.38	0.14	0.08
2.5	v	23.67	15.36	8.46	5.18	3.31	2.12	1.34	0.94	0.65	0.44	0.34
	R	4300.38	1419.65	312.58	91.10	30.05	9.94	3.24	1.38	0.57	0.22	0.12
3.00	v		18.43	10.15	6.21	3.98	2.54	1.60	1.13	0.78	0.52	0.41
	R		2024.25	443.58	128.71	42.28	13.94	4.53	1.92	0.79	0.30	0.16
3.5	v		21.50	11.85	7.25	4.64	2.96	1.87	1.32	0.92	0.61	0.47
	R		2735.09	597.07	172.62	56.51	18.57	6.01	2.54	1.05	0.40	0.21
4.0	v		24.57	13.54	8.29	5.30	3.38	2.14	1.50	1.05	0.70	0.54
	R		3552.14	773.05	222.81	72.73	23.83	7.70	3.25	1.34	0.50	0.27
4.5	v		27.65	15.23	9.32	5.97	3.81	2.41	1.69	1.18	0.79	0.61
	R		4475.38	971.50	279.28	90.92	29.72	9.58	4.04	1.66	0.62	0.34
5.0	v			16.92	10.36	6.63	4.23	2.67	1.88	1.31	0.87	0.68
	R			1192.39	342.01	111.09	36.23	11.65	4.90	2.02	0.76	0.41
5.5	v			18.62	11.39	7.29	4.65	2.94	2.07	1.44	0.96	0.74
	R			1435.72	411.00	133.24	43.36	13.91	5.85	2.40	0.90	0.49
6.0	v			20.31	12.43	7.95	5.08	3.21	2.26	1.57	1.05	0.81
	R			1701.49	486.25	157.35	51.10	16.37	6.87	2.82	1.06	0.57
6.5	v			22.00	13.46	8.62	5.50	3.48	2.44	1.70	1.14	0.88
	R			1989.69	567.74	183.42	59.47	19.01	7.97	3.27	1.22	0.66
7.0	v			23.69	14.50	9.28	5.92	3.74	2.63	1.83	1.22	0.95
	R			2300.32	655.49	211.46	68.45	21.85	9.15	3.75	1.40	0.75
7.5	v			25.39	15.53	9.94	6.35	4.01	2.82	1.96	1.31	1.02
	R			2633.38	749.47	241.45	78.05	24.88	10.41	4.26	1.59	0.85

Dynatherm PP-RCT Stabi Pipe D140

Temperature: 60 °C
Pipe Friction Factor: 0.007
Pipe Roughness: 0.0070 mm

dynatherm PP-RCT PIPE SYSTEMS

Q = Flow rate (l/s) v = Flow Velocity (m/s) R = Pressure Drop (mbar/Mtr)

d x s		16x2.2	20x2.8	25x2.8	32x3.6	40x4.5	50x5.6	63x7.1	75x8.4	90x10.1	110x12.3	125x14
SDR		7.4	7.4	9	9	9	9	9	9	9	9	9
Q	ID →	11.6	14.4	19.4	24.8	31.0	38.8	48.8	58.2	69.8	85.4	97.0
8.0	v			27.08	16.57	10.61	6.77	4.28	3.01	2.09	1.40	1.08
	R			2988.85	849.71	273.41	88.26	28.09	11.74	4.80	1.79	0.96
9.0	v			30.46	18.64	11.93	7.62	4.81	3.38	2.35	1.57	1.22
	R			3767.07	1068.89	343.20	110.52	35.09	14.63	5.97	2.22	1.19
10.0	v			33.85	20.71	13.26	8.46	5.35	3.76	2.61	1.75	1.35
	R			4634.96	1313.04	420.82	135.22	42.83	17.83	7.27	2.70	1.45
12.0	v				24.86	15.91	10.15	6.42	4.51	3.14	2.10	1.62
	R				1876.19	599.51	191.96	60.56	25.14	10.21	3.78	2.03
14.0	v				29.00	18.56	11.85	7.49	5.27	3.66	2.45	1.90
	R				2539.12	809.46	258.45	81.28	33.66	13.64	5.04	2.70
16.0	v				33.14	21.21	13.54	8.56	6.02	4.18	2.79	2.17
	R				3301.81	1050.66	334.69	104.97	43.38	17.54	6.46	3.45
18.0	v				37.28	23.86	15.23	9.63	6.77	4.71	3.14	2.44
	R				4164.26	1323.09	420.67	131.63	54.29	21.91	8.06	4.30
20.0	v					26.51	16.92	10.70	7.52	5.23	3.49	2.71
	R					1626.75	516.37	161.26	66.39	26.74	9.82	5.24
25.0	v					33.14	21.16	13.37	9.40	6.54	4.37	3.38
	R					2522.49	798.17	248.27	101.87	40.88	14.95	7.95
30.0	v					39.77	25.39	16.05	11.28	7.84	5.24	4.06
	R					3613.34	1140.72	353.77	144.77	57.93	21.12	11.21
35.0	v						29.62	18.72	13.16	9.15	6.11	4.74
	R						1544.00	477.73	195.08	77.87	28.31	15.00
40.0	v						33.85	21.40	15.04	10.46	6.99	5.42
	R						2008.00	620.15	252.80	100.71	36.52	19.32
45.0	v						38.08	24.07	16.92	11.77	7.86	6.09
	R						2532.71	781.01	317.92	126.44	45.75	24.18
50.0	v						42.31	26.75	18.80	13.07	8.73	6.77
	R						3118.12	960.32	390.43	155.05	56.01	29.56
55.0	v						46.54	29.42	20.69	14.38	9.61	7.45
	R						3764.24	1158.07	470.34	186.54	67.28	35.47
60.0	v						50.77	32.10	22.57	15.69	10.48	8.12
	R						4471.05	1374.26	557.63	220.91	79.56	41.90
65.0	v							34.77	24.45	17.00	11.35	8.80
	R							1608.89	652.32	258.17	92.86	48.87
70.0	v							37.45	26.33	18.30	12.23	9.48
	R							1861.96	754.40	298.31	107.17	56.35
75.0	v							40.12	28.21	19.61	13.10	10.15
	R							2133.46	863.86	341.32	122.50	64.37
80.0	v							42.80	30.09	20.92	13.97	10.83
	R							2423.40	980.71	387.21	138.84	72.90
85.0	v							45.47	31.97	22.23	14.85	11.51
	R							2731.77	1104.95	435.98	156.19	81.97
90.0	v							48.15	33.85	23.53	15.72	12.19
	R							3058.58	1236.57	487.63	174.55	91.55
95.0	v							50.82	35.73	24.84	16.59	12.86
	R							3403.82	1375.58	542.15	193.93	101.66
100.0	v							53.49	37.61	26.15	17.47	13.54
	R							3767.50	1521.97	599.55	214.31	112.29
105.0	v							56.17	39.49	27.46	18.34	14.22
	R							4149.60	1675.76	659.83	235.71	123.45
110.0	v							58.84	41.37	28.76	19.21	14.89
	R							4550.15	1836.92	722.99	258.12	135.12
115.0	v								43.25	30.07	20.09	15.57
	R								2005.47	789.02	281.54	147.33
120.0	v								45.13	31.38	20.96	16.25
	R								2181.41	857.92	305.98	160.05
125.0	v								47.01	32.68	21.83	16.92
	R								2364.73	929.71	331.42	173.30
130.0	v								48.89	33.99	22.71	17.60
	R								2555.43	1004.36	357.87	187.07
135.0	v								50.77	35.30	23.58	18.28
	R								2753.52	1081.90	385.34	201.36
140.0	v								52.65	36.61	24.45	18.96
	R								2959.00	1162.31	413.81	216.18
145.0	v								54.53	37.91	25.33	19.63
	R								3171.85	1245.59	443.30	231.51

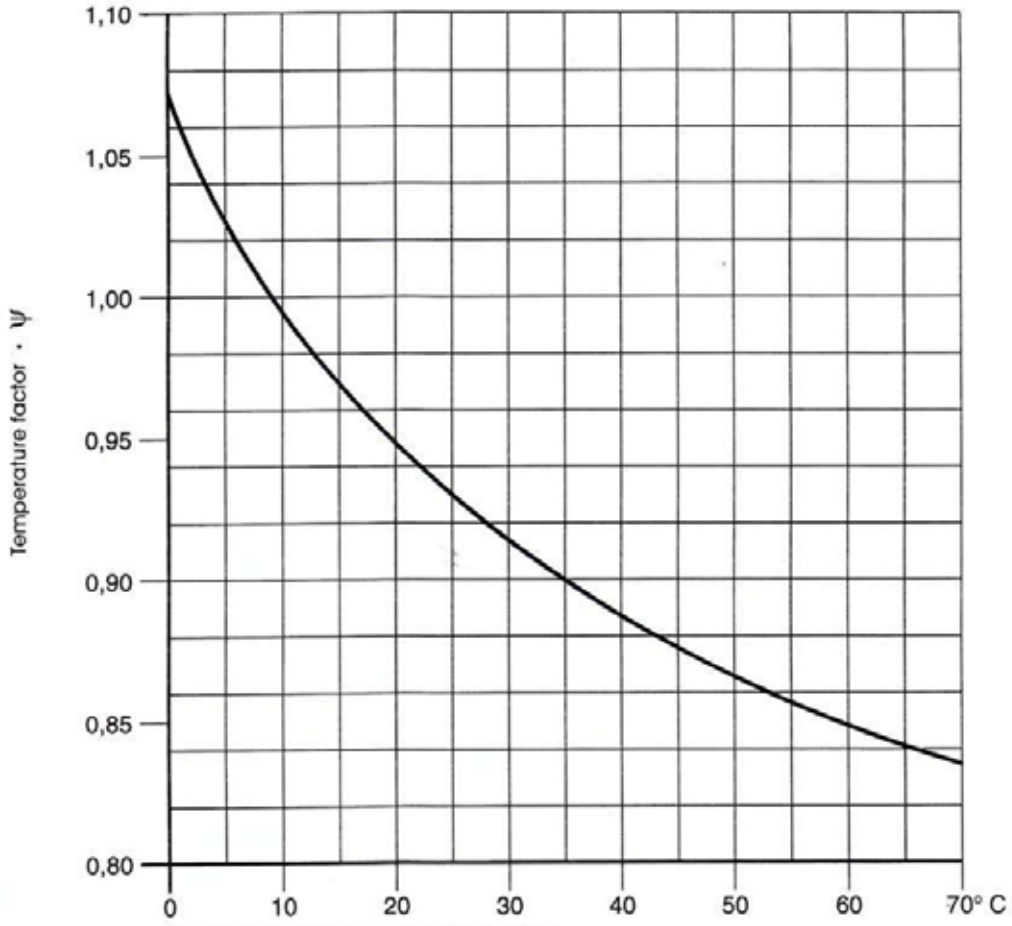


Fig. 2: Temperature of the flow medium

For the individual fitting resistance values given in the chart below (fig. 3) can be applied by approximation. The individual joint resistance values can be determined altogether. As a standard value add an extra of 3% to 5% to the overall pressure drop.

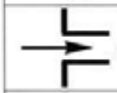
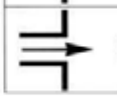
Outside pipe diameter d mm	16 20 25	32 40	50 63	≥63
Fitting Type	Drag coefficient ζ			
	1,5	1,0	0,6	0,5
	2,0	1,7	1,1	0,8
	0,3			
	1,5			
 Stream in	0,5			
 Stream out	1,0			

Fig. 3: Pressure drop in fittings

Minimum flow pressures

Reference values for the minimum flow pressures and calculated flows for generally used drinking water service points

Minimum flow pressure $P_{min\ Fl}$ bar	Type of drinking water service points		Calculated flow for outlet of: Mixed water – Volume flow cold l/s	Mixed water – Volume flow hot l/s	Either cold or hot water – Volume flow l/s
	outlet valve				
0.5	without air whirler	DN 15	–	–	0.30
0.5		DN 20	–	–	0.50
0.5		DN 25	–	–	1.00
1.0	with air whirler	DN 10	–	–	0.15
1.0		DN 15	–	–	0.15
1.0	shower heads for clinsing showers	DN 15	0.10	0.10	0.20
1.2	Pressure rinser in acc.to DIN 3265 part 1	DN 15	–	–	0.70
1.2	Pressure rinser in acc.to DIN 3265 part 1	DN 20	–	–	1.00
0.4	Pressure rinser in acc.to DIN 3265 part 1	DN 25	–	–	1.00
1.0	Pressure rinser for urinals	DN 15	–	–	0.30
0.5	corner valve for urinals	DN 15	–	–	0.30
1.0	household dishwasher	DN 15	–	–	0.15
1.0	household washing machine	DN 15	–	–	0.25
	mixer for				
1.0	showers	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	wash-stands	DN 15	0.07	0.07	–
1.0	bidet	DN 15	0.07	0.07	–
1.0	mixer	DN 20	0.30	0.30	–
0.5	flushing box acc.to DIN 19542	DN 15	–	–	0.13
	heater for drinking water for supply of service point (incl. fitting for mixed outlet)				
1.0	electric water boiler	DN 15	–	–	0.10*
	electric hot water tank and boiler				0.10
1.1**	with nominal contents 5 – 15 l	DN 15	–	–	0.20
1.2**	with nominal contents 30 – 150 l	DN 15	–	–	
	electric flow water heater with hydraulic test, without flow limitation				
1.5	nominal capacity	12 kW	–	–	0.06
1.9		18 kW	–	–	0.08
2.1		21 kW	–	–	0.09
2.4		24 kW	–	–	0.10
1.0	gas flow water heater	12 kW	–	–	0.10

* with fully opened throttle valve ** values under unfavourable conditions (shower)

Note: Service points which are not included in the table and devices of similar kind with larger flow of fittings than indicated are to be taken into account according to the recommendations of the producer as far as determination of pipe diameter is concerned

Linear deformation of PP-R pipes under heat influence

Thermoplastic plastics PP-R pipes are exposed to thermal expansion. The linear extension of such pipes is higher than with steel pipes. This fact must be all means be taken into consideration in the laying process. Already in the pipe arrangement planning stage each possibility should therefore be utilized fully to compensate all extension processes within a pipe section.

The linear thermal expansion coefficient for PP-R and PP-R CT pipes is:

$$\varepsilon t = 1.5 \cdot 10^{-4} \quad (K^{-1})$$

Polypropylene pipes mechanically stabilized by an aluminium coating on the pipe periphery (Stabi-Rohr/Stabi-Pipe) have a reduced thermal expansion coefficient. The aluminium coating prevents linear extension at about4/5.

The linear thermal expansion coefficient for PP-R Stabi-Pipes can by approximation assumed as:

$$\varepsilon t = 0.3 \cdot 10^{-4} \quad (K^{-1})$$

The linear thermal expansion coefficient for PP-R Fibre-Pipes is:

$$\varepsilon t = 0.35 \cdot 10^{-4} \quad (K^{-1})$$

Δl = Linear extension in (mm)

εt = Thermal expansion coefficient in $\left(\frac{mm}{m\ °C}\right)$

L = Pipe length (m)

Δt = Temperature difference (°K)

The linear deformation of a pipe is thus calculated according to the following formula:

$$\Delta l = \varepsilon t \cdot L \cdot \Delta t \quad (mm)$$

The calculation of the linear deformation is based on the laying temperature. The following example gives you an idea of how to calculate.

Example for a pipe length of 8m:

1. Lowest pipe wall temperature	+ 9° C	(cold-water pipe)
Difference	7° K	
2. Laying temperature	+ 16° C	
Difference	54° K	
3. Highest pipe wall temperature	+ 70° C	(hot-water pipe)

To 1. Shortening of the pipe: 8 m • 7° • 0,03 = 1,68 mm

To 3. Extension of the pipe: 8 m • 54° • 0,03 = 12,96 mm

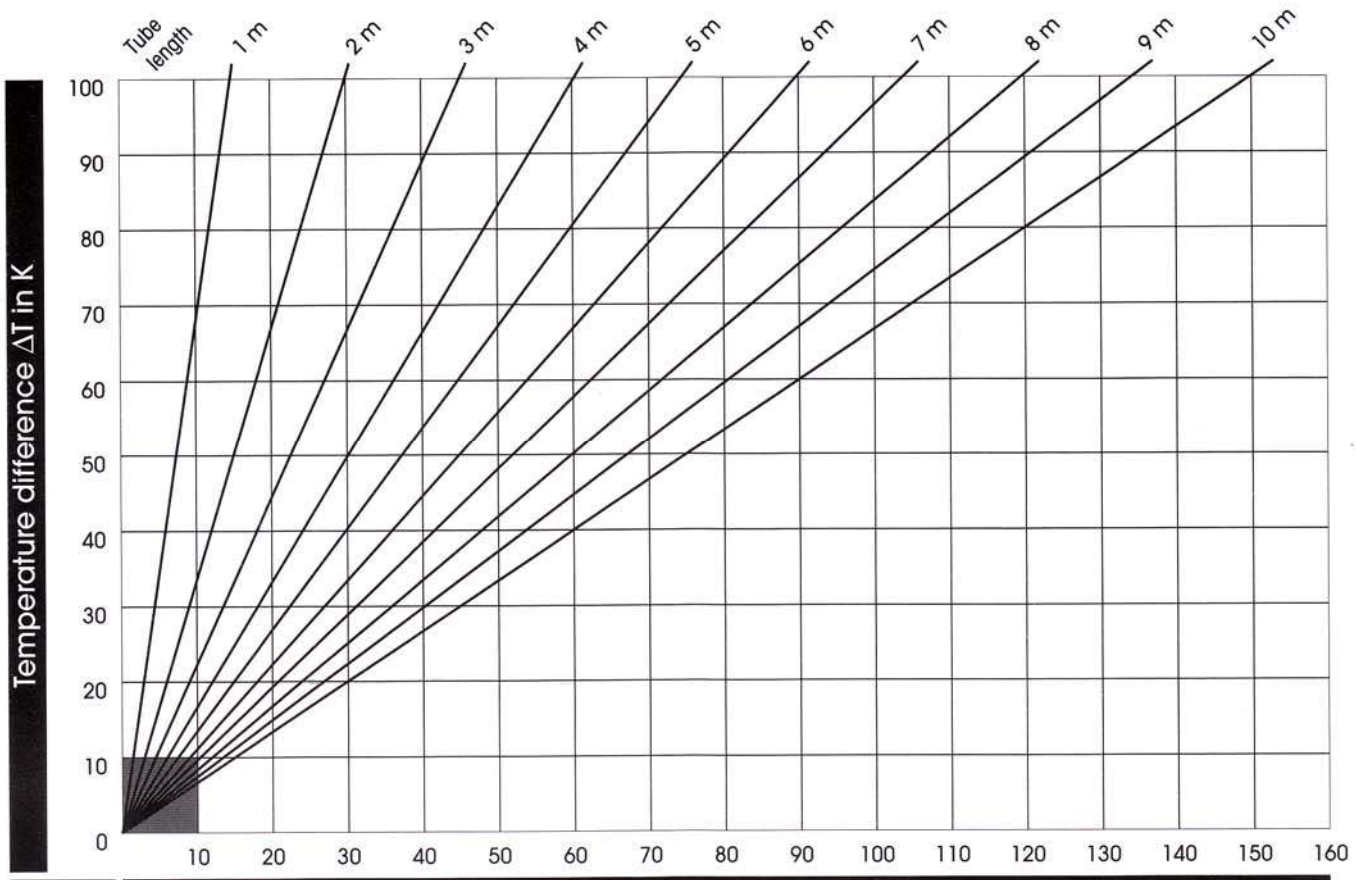


Fig. 4

	Temperature difference ΔT in K									
Tube length	10	20	30	40	50	60	70	80	90	100
0,1 m	0,15	0,30	0,45	0,60	0,75	0,90	1,05	1,20	1,35	1,50
0,2 m	0,30	0,60	0,90	1,20	1,50	1,80	2,10	2,40	2,70	3,00
0,3 m	0,45	0,90	1,35	1,80	2,25	2,70	3,15	3,60	4,05	4,50
0,4 m	0,60	1,20	1,80	2,40	3,00	3,60	4,20	4,80	5,40	6,00
0,5 m	0,75	1,50	2,25	3,00	3,75	4,50	5,25	6,00	6,75	7,50
0,6 m	0,90	1,80	2,70	3,60	4,50	5,40	6,30	7,20	8,10	9,00
0,7 m	1,05	2,10	3,15	4,20	5,25	6,30	7,35	8,40	9,45	10,50
0,8 m	1,20	2,40	3,60	4,80	6,00	7,20	8,40	9,60	10,80	12,00
0,9 m	1,35	2,70	4,05	5,40	6,75	8,10	9,45	10,80	12,15	13,50
1,0 m	1,50	3,00	4,50	6,00	7,50	9,00	10,50	12,00	13,50	15,00
2,0 m	3,00	6,00	9,00	12,00	15,00	18,00	21,00	24,00	27,00	30,00
3,0 m	4,50	9,00	13,50	18,00	22,50	27,00	31,50	36,00	40,50	45,00
4,0 m	6,00	12,00	18,00	24,00	30,00	36,00	42,00	48,00	54,00	60,00
5,0 m	7,50	15,00	22,50	30,00	37,50	45,00	52,50	60,00	67,50	75,00
6,0 m	9,00	18,00	27,00	36,00	45,00	54,00	63,00	72,00	81,00	90,00
7,0 m	10,50	21,00	31,50	42,00	52,50	63,00	73,50	84,00	94,50	105,00
8,0 m	12,00	24,00	36,00	48,00	60,00	72,00	84,00	96,00	108,00	120,00
9,0 m	13,50	27,00	40,50	54,00	67,50	81,00	94,50	108,00	121,50	135,00
10,0 m	15,00	30,00	45,00	60,00	75,00	90,00	105,00	120,00	135,00	150,00

Fig. 4a — Linear expansion ΔL in mm

Linear Expansion Chart
'Stabi' Pipe (aluminum-coated PP-R)

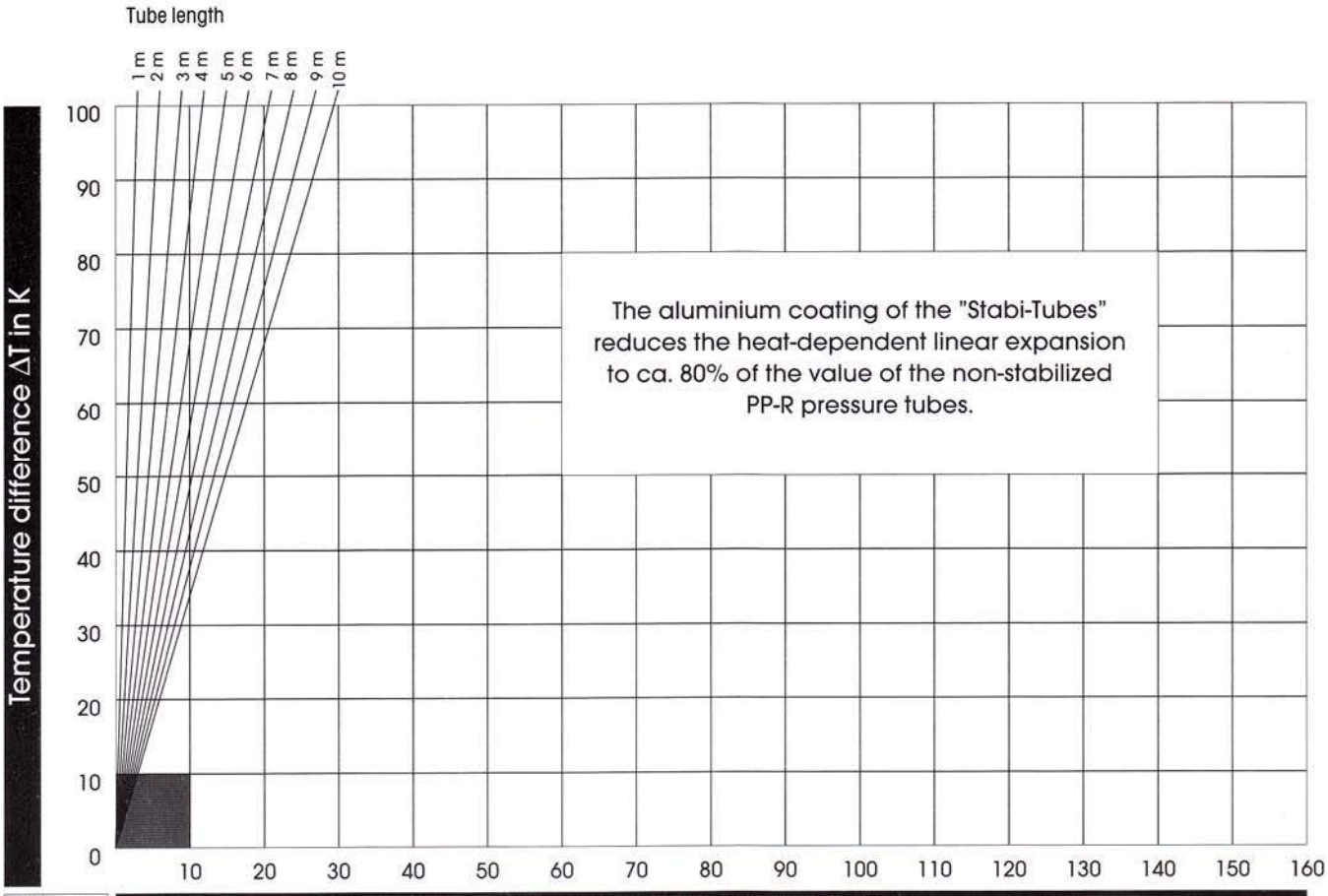


Fig. 5

Tube length	Temperature difference ΔT in K									
	10	20	30	40	50	60	70	80	90	100
0,1 m	0,03	0,06	0,09	0,12	0,15	0,18	0,21	0,24	0,27	0,30
0,2 m	0,06	0,12	0,18	0,24	0,30	0,36	0,42	0,48	0,54	0,60
0,3 m	0,09	0,18	0,27	0,36	0,45	0,54	0,63	0,72	0,81	0,90
0,4 m	0,12	0,24	0,36	0,48	0,60	0,72	0,84	0,96	1,08	1,20
0,5 m	0,15	0,30	0,45	0,60	0,75	0,90	1,05	1,20	1,35	1,50
0,6 m	0,18	0,36	0,54	0,72	0,90	1,08	1,28	1,44	1,62	1,80
0,7 m	0,21	0,42	0,63	0,84	1,05	1,26	1,47	1,68	1,89	2,10
0,8 m	0,24	0,48	0,72	0,96	1,20	1,44	1,68	1,92	2,16	2,40
0,9 m	0,27	0,54	0,81	1,08	1,35	1,62	1,89	2,16	2,43	2,70
1,0 m	0,30	0,60	0,90	1,20	1,50	1,80	2,10	2,40	2,70	3,00
2,0 m	0,60	1,20	1,80	2,40	3,00	3,60	4,20	4,80	5,40	6,00
3,0 m	0,90	1,80	2,70	3,60	4,50	5,40	6,30	7,20	8,10	9,00
4,0 m	1,20	2,40	3,60	4,80	6,00	7,20	8,40	9,60	10,80	12,00
5,0 m	1,50	3,00	4,50	6,00	7,50	9,00	10,50	12,00	13,50	15,00
6,0 m	1,80	3,60	5,40	7,20	9,00	10,80	12,80	14,40	16,20	18,00
7,0 m	2,10	4,20	6,43	8,40	10,50	12,60	14,70	16,80	18,90	21,00
8,0 m	2,40	4,80	7,20	9,60	12,00	14,40	16,80	19,20	21,60	24,00
9,0 m	2,70	5,40	8,10	10,80	13,50	16,20	18,90	21,60	24,30	27,00
10,0 m	3,00	6,00	9,00	12,00	15,00	18,00	21,00	24,00	27,00	30,00

Fig. 5a — Linear expansion ΔL in mm

Linear Expansion Chart - 'Faser' Pipe (PP-RCT with fibre glass layer))

dynatherm® PP-RCT PIPE SYSTEMS

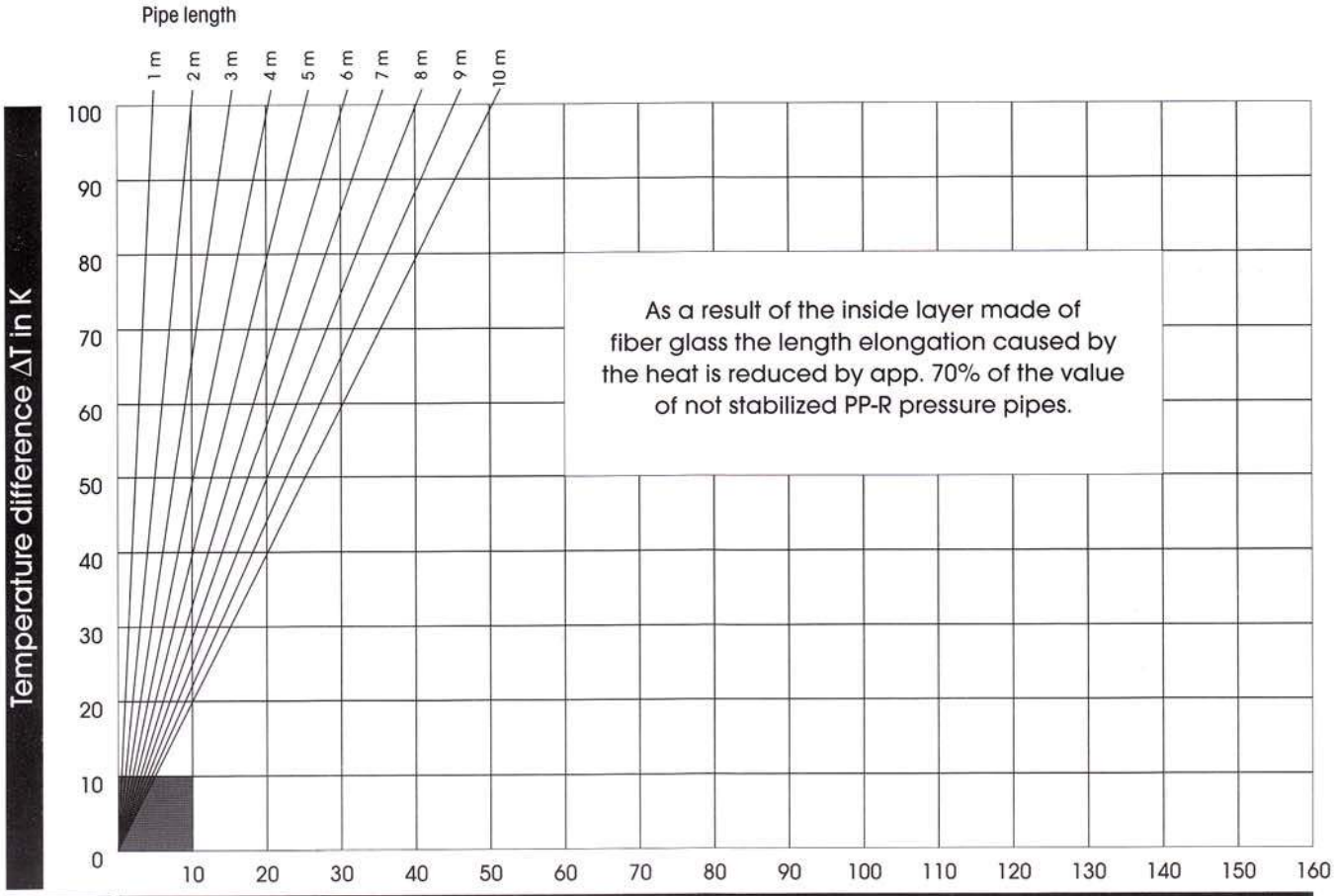


Fig. 5b

Tub length	Temperature difference ΔT in K									
	10	20	30	40	50	60	70	80	90	100
0,1 m	0,05	0,10	0,15	0,20	0,25	0,30	0,35	0,40	0,45	0,50
0,2 m	0,10	0,20	0,30	0,40	0,50	0,60	0,70	0,80	0,90	1,00
0,3 m	0,15	0,30	0,45	0,60	0,75	0,90	1,05	1,20	1,35	1,50
0,4 m	0,20	0,40	0,60	0,80	1,00	1,20	1,40	1,60	1,80	2,00
0,5 m	0,25	0,50	0,75	1,00	1,25	1,50	1,75	2,00	2,25	2,50
0,6 m	0,30	0,60	0,90	1,20	1,50	1,80	2,10	2,40	2,70	3,00
0,7 m	0,35	0,70	1,05	1,40	1,75	2,10	2,45	2,80	3,15	3,50
0,8 m	0,40	0,80	1,20	1,60	2,00	2,40	2,80	3,20	3,60	4,00
0,9 m	0,45	0,90	1,35	1,80	2,25	2,70	3,15	3,60	4,05	4,50
1,0 m	0,50	1,00	1,50	2,00	2,50	3,00	3,50	4,00	4,50	5,00
2,0 m	1,00	2,00	3,00	4,00	5,00	6,00	7,00	8,00	9,00	10,00
3,0 m	1,50	3,00	4,50	6,00	7,50	9,00	10,50	12,00	13,50	15,00
4,0 m	2,00	4,00	6,00	8,00	10,00	12,00	14,00	16,00	18,00	20,00
5,0 m	2,50	5,00	7,50	10,00	12,50	15,00	17,50	20,00	22,50	25,00
6,0 m	3,00	6,00	9,00	12,00	15,00	18,00	21,00	24,00	27,00	30,00
7,0 m	3,50	7,00	10,50	14,00	17,50	21,00	24,50	28,00	31,50	35,00
8,0 m	4,00	8,00	12,00	16,00	20,00	24,00	28,00	32,00	36,00	40,00
9,0 m	4,50	9,00	13,50	18,00	22,50	27,00	31,50	36,00	40,50	45,00
10,0 m	5,00	10,00	15,00	20,00	25,00	30,00	35,00	40,00	45,00	50,00

Fig. 5c — Linear expansion ΔL in mm

The linear extension of a PP-R pipe can in most of the cases be compensated by a change in direction.With this, see to free mobility of the piping in axial direction. Should linear extension compensation by directional change not be possible, the fitting in of an expansion bend is required. Axial bellow expansion joints are mostly unfit and uneconomical. For optimum resiliency of the pipe the size of the bending limb is important. It is calculated by the opposite formula.

The figures 6. and 7. show the effects of the linear deformation and its compensation. With regard to the required bending limbs L_s make sure to chose the correct locating points.

$$L_s = C \cdot \sqrt{d \cdot \Delta L} \quad (mm)$$

L_s = Length of bending limb (mm)

d = Outside pipe diameter (mm)

DL = Linear deformation (mm)

C = Material-depending constant for PP-R = 20

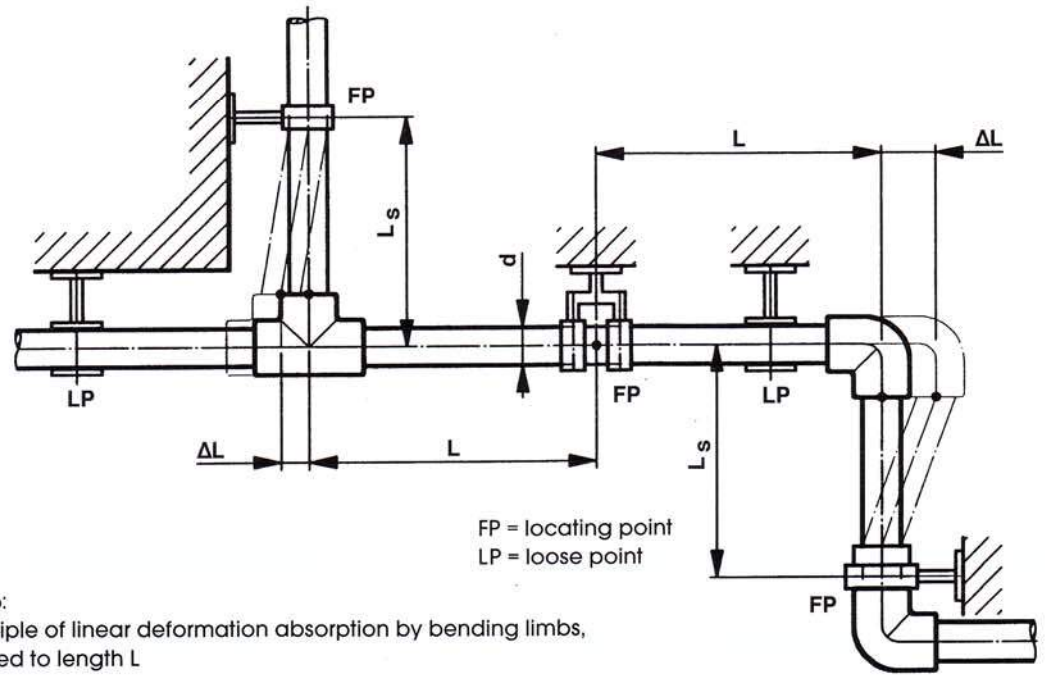


Fig. 6:
Principle of linear deformation absorption by bending limbs, related to length L

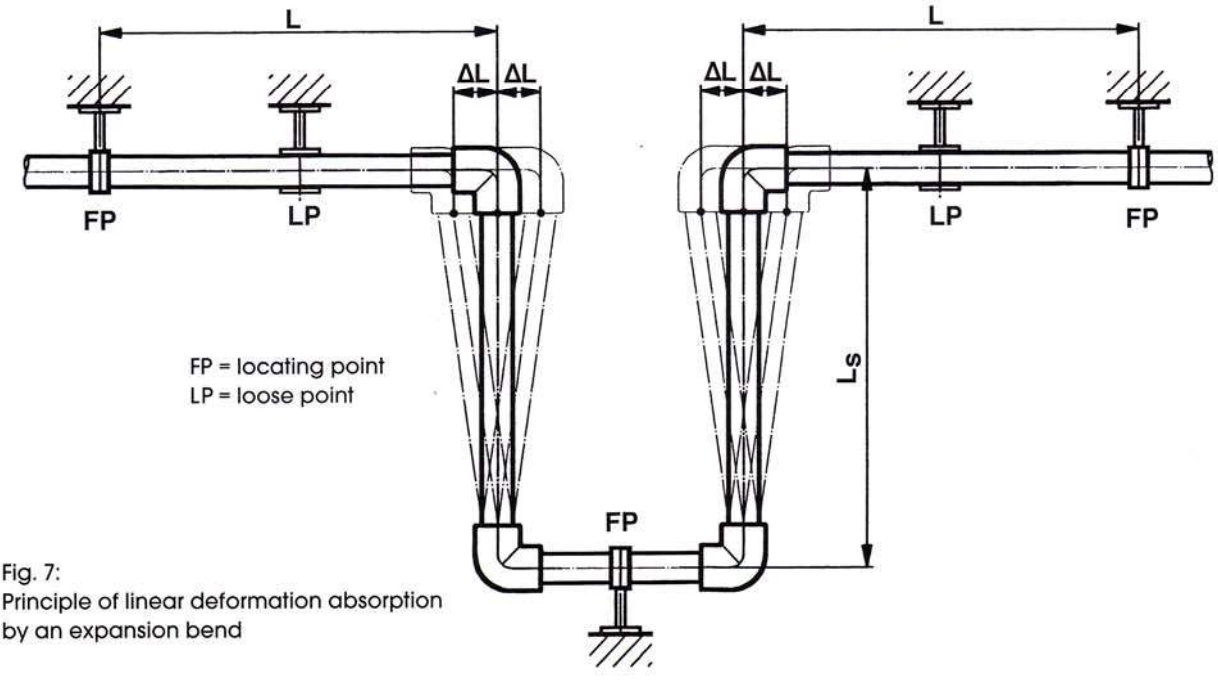


Fig. 7:
Principle of linear deformation absorption by an expansion bend

Construction of expansion bends

Expansion bends can easily be made right at the site.
Beside the required pipe length 4 elbows (8090) or 4 pipe bends (8002a) are needed.
To construct an expansion bend, the bending limb L_s is calculated in dependence on the linear deformation ΔL. As standard value, the L_s value given in the Fig. 8 diagram can be used.
Spacing B should be at least 10 • d.

Fig. 7:
Expansion bend, made of PP-R pipe and 90° elbow

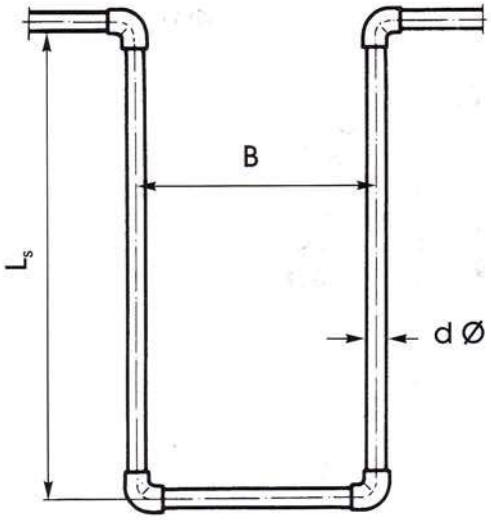
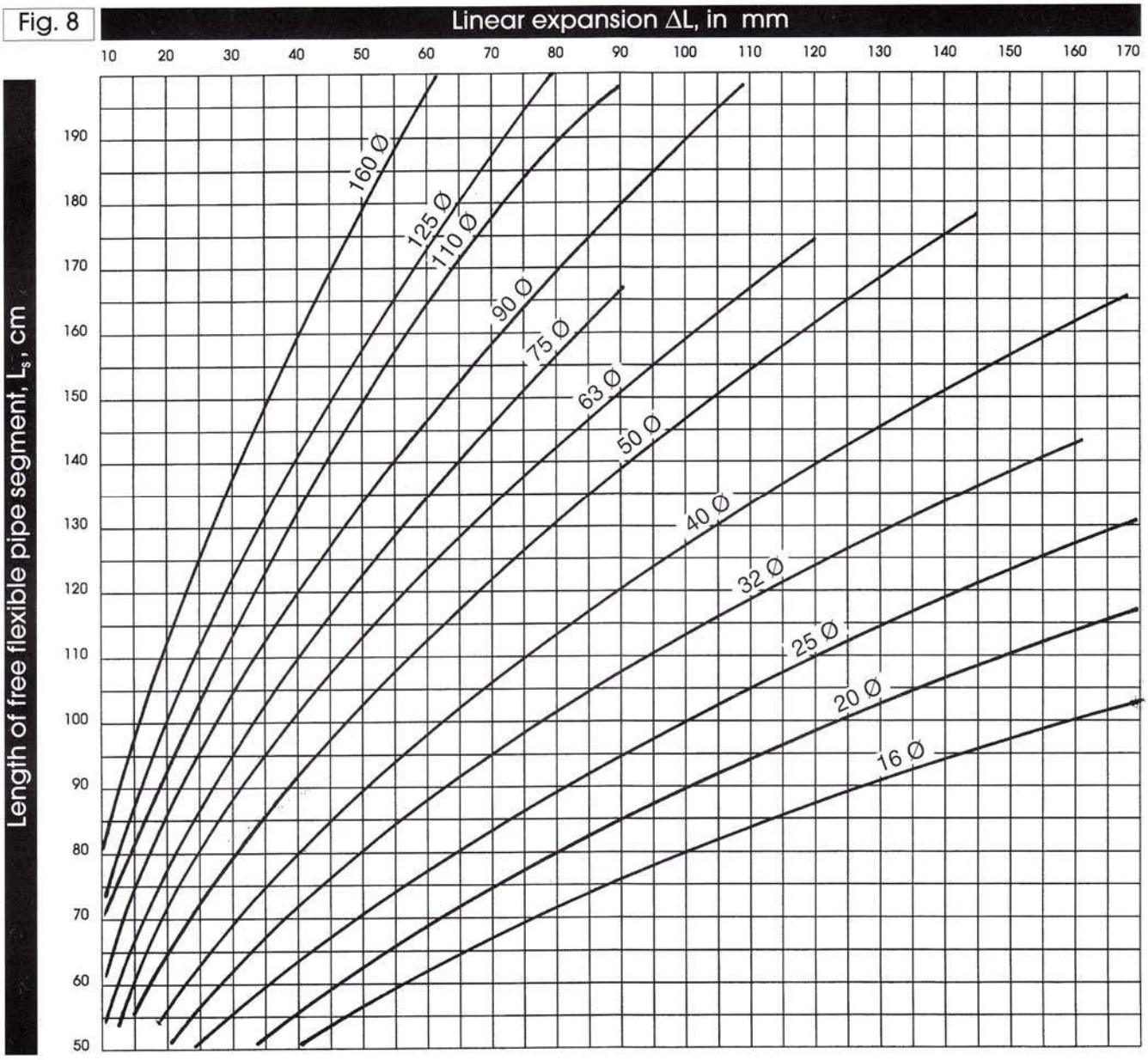


Fig. 8



Example for concealed piping

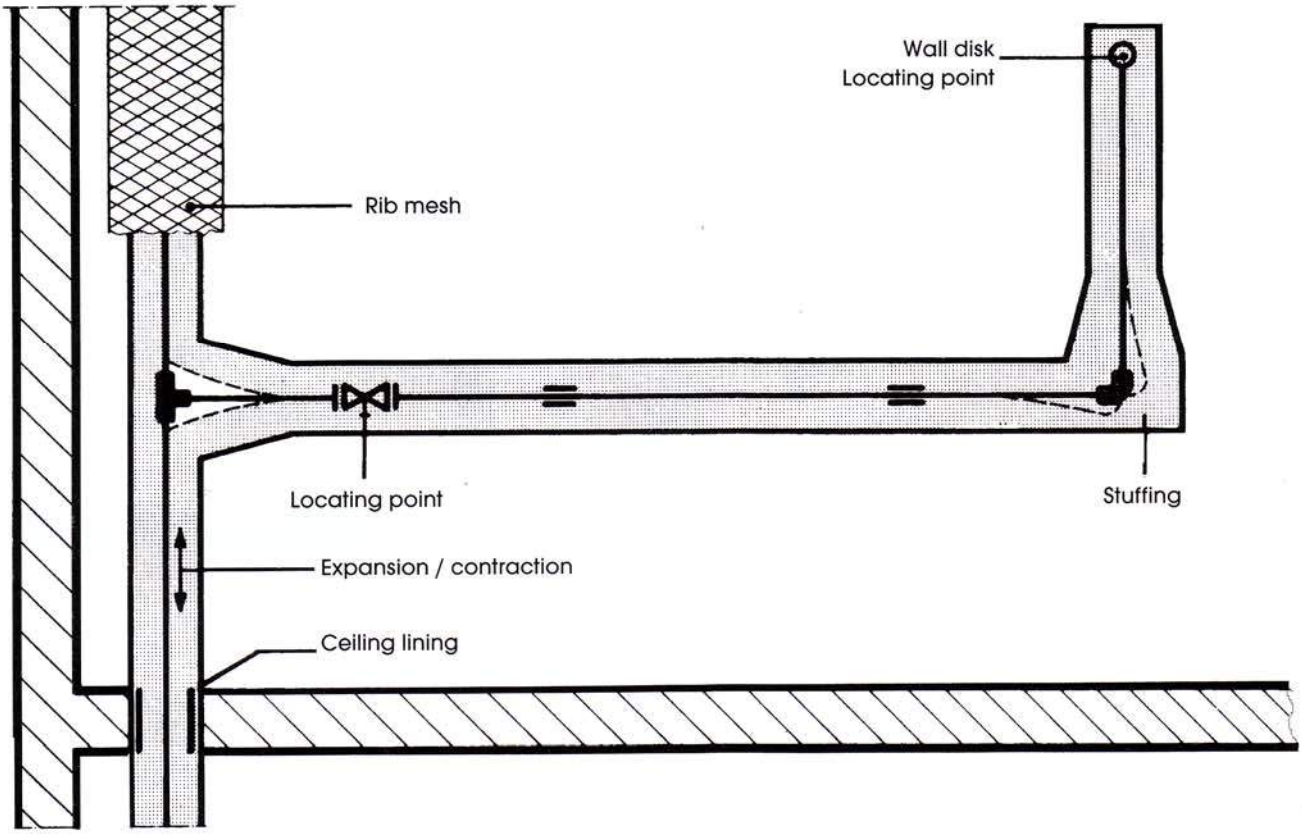


Fig. 9

Applications in Sanitary Installation Shaft:
When making the apartment pipe connections from main pipe, the following alternative techniques can be applied in order to compensate for the pipe thermal expansions:

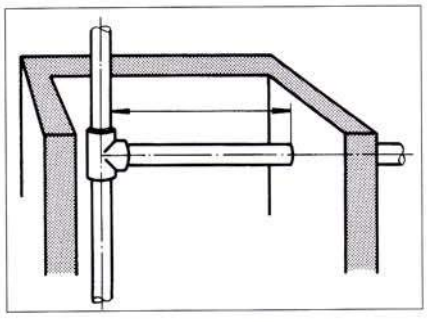


Fig. 1
Pipe connection can be made at some distance "a" away from the wall.

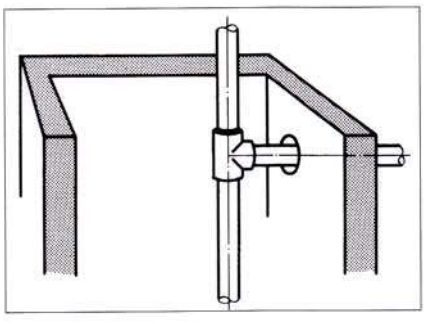


Fig. 2
The connecting pipe can be passed through a hole much larger than the pipe diameter.

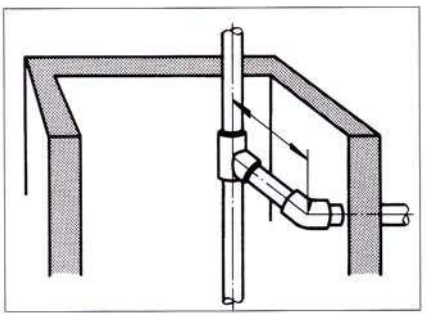


Fig. 3
The appartment connection can be made through a branch pipe to provide flexibility

dynatherm®
PP-RCT PIPE SYSTEMS

PN20 PP-RCT/Solid Wall
Longditudinal Expansion in mm (rounded)

0.15 mm/m/degC

Pipe length in metres	Temperature Difference in °C								
	10	20	30	40	50	60	70	80	90
1	2	3	5	6	8	9	11	12	14
2	3	6	9	12	15	18	21	24	27
3	5	9	14	18	23	27	32	36	41
4	6	12	18	24	30	36	42	48	54
5	8	15	23	30	38	45	53	60	68
6	9	18	27	36	45	54	63	72	81
7	11	21	32	42	53	63	74	84	95
8	12	24	36	48	60	72	84	96	108
9	14	27	41	54	68	81	95	108	122
10	15	30	45	60	75	90	105	120	135
11	17	33	50	66	83	99	116	132	149
12	18	36	54	72	90	108	126	144	162
13	20	39	59	78	98	117	137	156	176
14	21	42	63	84	105	126	147	168	189
15	23	45	68	90	113	135	158	180	203
16	24	48	72	96	120	144	168	192	216
17	26	51	77	102	128	153	179	204	230
18	27	54	81	108	135	162	189	216	243
19	29	57	86	114	143	171	200	228	257
20	30	60	90	120	150	180	210	240	270
21	32	63	95	126	158	189	221	252	284
22	33	66	99	132	165	198	231	264	297
23	35	69	104	138	173	207	242	276	311
24	36	72	108	144	180	216	252	288	324
25	38	75	113	150	188	225	263	300	338
26	39	78	117	156	195	234	273	312	351
27	41	81	122	162	203	243	284	324	365
28	42	84	126	168	210	252	294	336	378
29	44	87	131	174	218	261	305	348	392
30	45	90	135	180	225	270	315	360	405
31	47	93	140	186	233	279	326	372	419
32	48	96	144	192	240	288	336	384	432
33	50	99	149	198	248	297	347	396	446
34	51	102	153	204	255	306	357	408	459
35	53	105	158	210	263	315	368	420	473
36	54	108	162	216	270	324	378	432	486
37	56	111	167	222	278	333	389	444	500
38	57	114	171	228	285	342	399	456	513
39	59	117	176	234	293	351	410	468	527
40	60	120	180	240	300	360	420	480	540

Notes:

1. Temperature difference is the difference between the ambient temperature at installation, and the system operating temperature.
2. To calculate the expansion for a run, simply add or multiply the data shown above, eg. to calculate the expansion on 50m of pipe at 40°C, 40m (240) + 10m (60) = 300mm.

dynatherm®
PP-RCT PIPE SYSTEMS

PN20 PP-RCT/Stabi Pipe
Longditudinal Expansion in mm (rounded)

0.03 mm/m/degC

Pipe length in metres	Temperature Difference in °C								
	10	20	30	40	50	60	70	80	90
1	0	1	1	1	2	2	2	2	3
2	1	1	2	2	3	4	4	5	5
3	1	2	3	4	5	5	6	7	8
4	1	2	4	5	6	7	8	10	11
5	2	3	5	6	8	9	11	12	14
6	2	4	5	7	9	11	13	14	16
7	2	4	6	8	11	13	15	17	19
8	2	5	7	10	12	14	17	19	22
9	3	5	8	11	14	16	19	22	24
10	3	6	9	12	15	18	21	24	27
11	3	7	10	13	17	20	23	26	30
12	4	7	11	14	18	22	25	29	32
13	4	8	12	16	20	23	27	31	35
14	4	8	13	17	21	25	29	34	38
15	5	9	14	18	23	27	32	36	41
16	5	10	14	19	24	29	34	38	43
17	5	10	15	20	26	31	36	41	46
18	5	11	16	22	27	32	38	43	49
19	6	11	17	23	29	34	40	46	51
20	6	12	18	24	30	36	42	48	54
21	6	13	19	25	32	38	44	50	57
22	7	13	20	26	33	40	46	53	59
23	7	14	21	28	35	41	48	55	62
24	7	14	22	29	36	43	50	58	65
25	8	15	23	30	38	45	53	60	68
26	8	16	23	31	39	47	55	62	70
27	8	16	24	32	41	49	57	65	73
28	8	17	25	34	42	50	59	67	76
29	9	17	26	35	44	52	61	70	78
30	9	18	27	36	45	54	63	72	81
31	9	19	28	37	47	56	65	74	84
32	10	19	29	38	48	58	67	77	86
33	10	20	30	40	50	59	69	79	89
34	10	20	31	41	51	61	71	82	92
35	11	21	32	42	53	63	74	84	95
36	11	22	32	43	54	65	76	86	97
37	11	22	33	44	56	67	78	89	100
38	11	23	34	46	57	68	80	91	103
39	12	23	35	47	59	70	82	94	105
40	12	24	36	48	60	72	84	96	108

Notes:

1. Temperature difference is the difference between the ambient temperature at installation, and the system operating temperature.
2. To calculate the expansion for a run, simply add or multiply the data shown above, eg. to calculate the expansion on 70m of pipe at 40°C, 40m (48) + 30m (36) = 84mm.

dynatherm®
PP-RCT PIPE SYSTEMS

PN20 PP-RCT/Fibre Pipe
Longitudinal Expansion in mm (rounded)

0.035 mm/m/degC

Pipe length in metres	Temperature Difference in °C								
	10	20	30	40	50	60	70	80	90
1	0	1	1	1	2	2	2	3	3
2	1	1	2	3	4	4	5	6	6
3	1	2	3	4	5	6	7	8	9
4	1	3	4	6	7	8	10	11	13
5	2	4	5	7	9	11	12	14	16
6	2	4	6	8	11	13	15	17	19
7	2	5	7	10	12	15	17	20	22
8	3	6	8	11	14	17	20	22	25
9	3	6	9	13	16	19	22	25	28
10	4	7	11	14	18	21	25	28	32
11	4	8	12	15	19	23	27	31	35
12	4	8	13	17	21	25	29	34	38
13	5	9	14	18	23	27	32	36	41
14	5	10	15	20	25	29	34	39	44
15	5	11	16	21	26	32	37	42	47
16	6	11	17	22	28	34	39	45	50
17	6	12	18	24	30	36	42	48	54
18	6	13	19	25	32	38	44	50	57
19	7	13	20	27	33	40	47	53	60
20	7	14	21	28	35	42	49	56	63
21	7	15	22	29	37	44	51	59	66
22	8	15	23	31	39	46	54	62	69
23	8	16	24	32	40	48	56	64	72
24	8	17	25	34	42	50	59	67	76
25	9	18	26	35	44	53	61	70	79
26	9	18	27	36	46	55	64	73	82
27	9	19	28	38	47	57	66	76	85
28	10	20	29	39	49	59	69	78	88
29	10	20	30	41	51	61	71	81	91
30	11	21	32	42	53	63	74	84	95
31	11	22	33	43	54	65	76	87	98
32	11	22	34	45	56	67	78	90	101
33	12	23	35	46	58	69	81	92	104
34	12	24	36	48	60	71	83	95	107
35	12	25	37	49	61	74	86	98	110
36	13	25	38	50	63	76	88	101	113
37	13	26	39	52	65	78	91	104	117
38	13	27	40	53	67	80	93	106	120
39	14	27	41	55	68	82	96	109	123
40	14	28	42	56	70	84	98	112	126

Notes:

1. Temperature difference is the difference between the ambient temperature at installation, and the system operating temperature.
2. To calculate the expansion for a run, simply add or multiply the data shown above, eg. the expansion on 70m of pipe at 40°C difference, 40m (56) + 30m (42) = 98mm.

Dynatherm PP-RCT
Minimum clipping distance for Expansion Elbow

Expansion	Minimum clipping distance (mm) by pipe diameter													
(mm)	20	25	32	40	50	63	75	90	110	125	160	200	225	250
5	150	168	190	212	237	266	290	318	352	375	424	474	503	530
10	212	237	268	300	335	376	411	450	497	530	600	671	712	750
15	260	290	329	367	411	461	503	551	609	650	735	822	871	919
20	300	335	379	424	474	532	581	636	704	750	849	949	1006	1061
25	335	375	424	474	530	595	650	712	787	839	949	1061	1125	1186
30	367	411	465	520	581	652	712	779	862	919	1039	1162	1232	1299
35	397	444	502	561	627	704	769	842	931	992	1122	1255	1331	1403
40	424	474	537	600	671	753	822	900	995	1061	1200	1342	1423	1500
45	450	503	569	636	712	799	871	955	1055	1125	1273	1423	1509	1591
50	474	530	600	671	750	842	919	1006	1112	1186	1342	1500	1591	1677
55	497	556	629	704	787	883	963	1055	1167	1244	1407	1573	1669	1759
60	520	581	657	735	822	922	1006	1102	1219	1299	1470	1643	1743	1837
65	541	605	684	765	855	960	1047	1147	1268	1352	1530	1710	1814	1912
70	561	627	710	794	887	996	1087	1191	1316	1403	1587	1775	1882	1984
75	581	650	735	822	919	1031	1125	1232	1362	1452	1643	1837	1949	2054
80	600	671	759	849	949	1065	1162	1273	1407	1500	1697	1897	2012	2121
85	618	691	782	875	978	1098	1198	1312	1450	1546	1749	1956	2074	2187
90	636	712	805	900	1006	1129	1232	1350	1492	1591	1800	2012	2135	2250
95	654	731	827	925	1034	1160	1266	1387	1533	1635	1849	2068	2193	2312
100	671	750	849	949	1061	1191	1299	1423	1573	1677	1897	2121	2250	2372
105	687	769	869	972	1087	1220	1331	1458	1612	1718	1944	2174	2306	2430
110	704	787	890	995	1112	1249	1362	1492	1650	1759	1990	2225	2360	2487
115	719	804	910	1017	1137	1277	1393	1526	1687	1798	2035	2275	2413	2543
120	735	822	930	1039	1162	1304	1423	1559	1723	1837	2078	2324	2465	2598
125	750	839	949	1061	1186	1331	1452	1591	1759	1875	2121	2372	2516	2652
130	765	855	967	1082	1209	1357	1481	1622	1794	1912	2163	2419	2565	2704
135	779	871	986	1102	1232	1383	1509	1653	1828	1949	2205	2465	2614	2756
140	794	887	1004	1122	1255	1409	1537	1684	1861	1984	2245	2510	2662	2806
145	808	903	1022	1142	1277	1434	1564	1714	1894	2019	2285	2554	2709	2856
150	822	919	1039	1162	1299	1458	1591	1743	1927	2054	2324	2598	2756	2905
155	835	934	1056	1181	1321	1482	1617	1772	1959	2088	2362	2641	2801	2953
160	849	949	1073	1200	1342	1506	1643	1800	1990	2121	2400	2683	2846	3000
165	862	963	1090	1219	1362	1529	1669	1828	2021	2154	2437	2725	2890	3047
170	875	978	1106	1237	1383	1552	1694	1855	2051	2187	2474	2766	2934	3092
175	887	992	1122	1255	1403	1575	1718	1882	2081	2219	2510	2806	2976	3137
180	900	1006	1138	1273	1423	1597	1743	1909	2111	2250	2546	2846	3019	3182
185	912	1020	1154	1290	1443	1619	1767	1936	2140	2281	2581	2885	3060	3226
190	925	1034	1170	1308	1462	1641	1791	1962	2169	2312	2615	2924	3101	3269
195	937	1047	1185	1325	1481	1663	1814	1987	2197	2342	2650	2962	3142	3312
200	949	1061	1200	1342	1500	1684	1837	2012	2225	2372	2683	3000	3182	3354
205	960	1074	1215	1358	1519	1705	1860	2037	2252	2401	2717	3037	3222	3396
210	972	1087	1230	1375	1537	1725	1882	2062	2280	2430	2750	3074	3261	3437
215	984	1100	1244	1391	1555	1746	1905	2087	2307	2459	2782	3110	3299	3478
220	995	1112	1259	1407	1573	1766	1927	2111	2333	2487	2814	3146	3337	3518
225	1006	1125	1273	1423	1591	1786	1949	2135	2360	2516	2846	3182	3375	3558
230	1017	1137	1287	1439	1609	1806	1970	2158	2386	2543	2877	3217	3412	3597
235	1028	1150	1301	1454	1626	1825	1991	2181	2412	2571	2909	3252	3449	3636
240	1039	1162	1315	1470	1643	1844	2012	2205	2437	2598	2939	3286	3486	3674
245	1050	1174	1328	1485	1660	1864	2033	2227	2462	2625	2970	3320	3522	3712
250	1061	1186	1342	1500	1677	1882	2054	2250	2487	2652	3000	3354	3558	3750
255	1071	1198	1355	1515	1694	1901	2074	2272	2512	2678	3030	3387	3593	3787
260	1082	1209	1368	1530	1710	1920	2095	2295	2537	2704	3059	3421	3628	3824
265	1092	1221	1381	1544	1727	1938	2115	2317	2561	2730	3089	3453	3663	3861
270	1102	1232	1394	1559	1743	1956	2135	2338	2585	2756	3118	3486	3697	3897
275	1112	1244	1407	1573	1759	1974	2154	2360	2609	2781	3146	3518	3731	3933
280	1122	1255	1420	1587	1775	1992	2174	2381	2632	2806	3175	3550	3765	3969
285	1132	1266	1432	1602	1791	2010	2193	2402	2656	2831	3203	3581	3798	4004
290	1142	1277	1445	1616	1806	2027	2212	2423	2679	2856	3231	3612	3832	4039
295	1152	1288	1457	1629	1822	2045	2231	2444	2702	2880	3259	3643	3865	4074
300	1162	1299	1470	1643	1837	2062	2250	2465	2725	2905	3286	3674	3897	4108

The recommended maximum clipping distances must be take in to account when using the above information

Dynatherm PP-RCT
Minimum length of bending leg for Expansion Loop

Expansion (mm)	Minimum width of	Minimum length of bending leg (mm) by pipe diameter													
		20	25	32	40	50	63	75	90	110	125	160	200	225	250
5	160	106	119	134	150	168	188	205	225	249	265	300	335	356	375
10	170	150	168	190	212	237	266	290	318	352	375	424	474	503	530
15	180	184	205	232	260	290	326	356	390	431	459	520	581	616	650
20	190	212	237	268	300	335	376	411	450	497	530	600	671	712	750
25	200	237	265	300	335	375	421	459	503	556	593	671	750	795	839
30	210	260	290	329	367	411	461	503	551	609	650	735	822	871	919
35	220	281	314	355	397	444	498	543	595	658	702	794	887	941	992
40	230	300	335	379	424	474	532	581	636	704	750	849	949	1006	1061
45	240	318	356	402	450	503	565	616	675	746	795	900	1006	1067	1125
50	250	335	375	424	474	530	595	650	712	787	839	949	1061	1125	1186
55	260	352	393	445	497	556	624	681	746	825	879	995	1112	1180	1244
60	270	367	411	465	520	581	652	712	779	862	919	1039	1162	1232	1299
65	280	382	428	484	541	605	679	741	811	897	956	1082	1209	1283	1352
70	290	397	444	502	561	627	704	769	842	931	992	1122	1255	1331	1403
75	300	411	459	520	581	650	729	795	871	963	1027	1162	1299	1378	1452
80	310	424	474	537	600	671	753	822	900	995	1061	1200	1342	1423	1500
85	320	437	489	553	618	691	776	847	928	1026	1093	1237	1383	1467	1546
90	330	450	503	569	636	712	799	871	955	1055	1125	1273	1423	1509	1591
95	340	462	517	585	654	731	821	895	981	1084	1156	1308	1462	1551	1635
100	350	474	530	600	671	750	842	919	1006	1112	1186	1342	1500	1591	1677
105	360	486	543	615	687	769	863	941	1031	1140	1215	1375	1537	1630	1718
110	370	497	556	629	704	787	883	963	1055	1167	1244	1407	1573	1669	1759
115	380	509	569	643	719	804	903	985	1079	1193	1272	1439	1609	1706	1798
120	390	520	581	657	735	822	922	1006	1102	1219	1299	1470	1643	1743	1837
125	400	530	593	671	750	839	941	1027	1125	1244	1326	1500	1677	1779	1875
130	410	541	605	684	765	855	960	1047	1147	1268	1352	1530	1710	1814	1912
135	420	551	616	697	779	871	978	1067	1169	1293	1378	1559	1743	1849	1949
140	430	561	627	710	794	887	996	1087	1191	1316	1403	1587	1775	1882	1984
145	440	571	639	722	808	903	1014	1106	1212	1340	1428	1616	1806	1916	2019
150	450	581	650	735	822	919	1031	1125	1232	1362	1452	1643	1837	1949	2054
155	460	591	660	747	835	934	1048	1144	1253	1385	1476	1670	1867	1981	2088
160	470	600	671	759	849	949	1065	1162	1273	1407	1500	1697	1897	2012	2121
165	480	609	681	771	862	963	1081	1180	1293	1429	1523	1723	1927	2044	2154
170	490	618	691	782	875	978	1098	1198	1312	1450	1546	1749	1956	2074	2187
175	500	627	702	794	887	992	1114	1215	1331	1472	1569	1775	1984	2105	2219
180	510	636	712	805	900	1006	1129	1232	1350	1492	1591	1800	2012	2135	2250
185	520	645	721	816	912	1020	1145	1249	1369	1513	1613	1825	2040	2164	2281
190	530	654	731	827	925	1034	1160	1266	1387	1533	1635	1849	2068	2193	2312
195	540	662	741	838	937	1047	1176	1283	1405	1553	1656	1873	2095	2222	2342
200	550	671	750	849	949	1061	1191	1299	1423	1573	1677	1897	2121	2250	2372
205	560	679	759	859	960	1074	1205	1315	1441	1593	1698	1921	2148	2278	2401
210	570	687	769	869	972	1087	1220	1331	1458	1612	1718	1944	2174	2306	2430
215	580	696	778	880	984	1100	1234	1347	1475	1631	1739	1967	2199	2333	2459
220	590	704	787	890	995	1112	1249	1362	1492	1650	1759	1990	2225	2360	2487
225	600	712	795	900	1006	1125	1263	1378	1509	1669	1779	2012	2250	2386	2516
230	610	719	804	910	1017	1137	1277	1393	1526	1687	1798	2035	2275	2413	2543
235	620	727	813	920	1028	1150	1291	1408	1543	1705	1818	2057	2299	2439	2571
240	630	735	822	930	1039	1162	1304	1423	1559	1723	1837	2078	2324	2465	2598
245	640	742	830	939	1050	1174	1318	1438	1575	1741	1856	2100	2348	2490	2625
250	650	750	839	949	1061	1186	1331	1452	1591	1759	1875	2121	2372	2516	2652
255	660	757	847	958	1071	1198	1344	1467	1607	1776	1894	2142	2395	2541	2678
260	670	765	855	967	1082	1209	1357	1481	1622	1794	1912	2163	2419	2565	2704
265	680	772	863	977	1092	1221	1370	1495	1638	1811	1930	2184	2442	2590	2730
270	690	779	871	986	1102	1232	1383	1509	1653	1828	1949	2205	2465	2614	2756
275	700	787	879	995	1112	1244	1396	1523	1669	1845	1967	2225	2487	2638	2781
280	710	794	887	1004	1122	1255	1409	1537	1684	1861	1984	2245	2510	2662	2806
285	720	801	895	1013	1132	1266	1421	1551	1699	1878	2002	2265	2532	2686	2831
290	730	808	903	1022	1142	1277	1434	1564	1714	1894	2019	2285	2554	2709	2856
295	740	815	911	1031	1152	1288	1446	1578	1728	1911	2037	2304	2576	2733	2880
300	750	822	919	1039	1162	1299	1458	1591	1743	1927	2054	2324	2598	2756	2905

The recommended maximum clipping distances must be take in to account when using the above information.

The kind and number of pipe fixings depends among other things on the pipe size and linear expansion. Locating points shall divide the pipes into individual pipe sections that allow expansion or contraction. The arrangement of such sections is dome by loose clips. The clip distances or spans depend on the operation conditions, pipe material, and the weight of the filled pipe. In practical use, the spans given in the figures 10, 10a, 11 and 11a proved to be appropriate distances.

Spans L in cm bei **20°C**	
d	L = cm
16	50
20	60
25	75
32	90
40	100
50	120
63	140
75	150
90	160
110	180
125	190
160	200

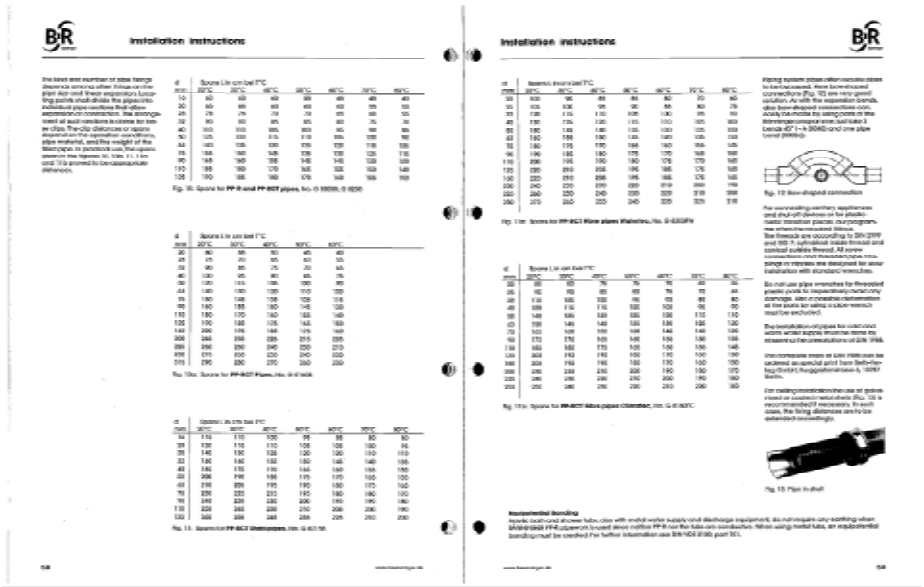
Fig. 10a:
Spans for PP-R 80 pipes, **PN 16**

d	Spans L in cm bei T°C						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
16	60	60	60	55	45	45	40
20	65	65	60	60	60	55	50
25	75	75	70	70	65	60	55
32	90	90	85	85	80	75	70
40	110	110	105	100	95	90	85
50	125	120	115	110	105	100	90
63	140	135	130	125	120	115	105
75	155	150	145	135	130	125	115
90	165	160	155	145	140	130	120
110	185	180	170	165	155	150	140
125	190	185	180	170	160	155	150

Fig. 10: Spans for PP-R pipes and PP-R CT, No. D125._ _

d	Spans L in cm bei T°C						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
16	115	110	100	95	85	80	80
20	120	115	110	105	105	100	95
25	140	130	125	120	120	110	110
32	160	160	155	150	145	140	135
40	185	175	170	165	160	155	150
50	200	180	185	175	170	165	155
63	210	205	195	190	180	175	165
75	230	225	215	195	180	180	170
90	240	230	220	200	195	190	180
110	250	240	230	210	205	200	190
125	265	255	245	235	225	210	200

Fig. 11: Spans for PP-R **Stabi**-pipes, **PN 20** No. D140



d	Spans L in cm bei T°C						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	100	90	85	85	80	70	65
25	105	100	95	90	85	80	75
32	120	115	110	105	100	95	90
40	130	125	120	115	110	105	100
50	150	145	140	135	130	125	120
63	160	155	150	145	140	135	130
75	180	175	170	165	160	155	145
90	190	185	180	175	170	165	150
110	200	195	190	180	175	170	160
125	220	210	205	195	185	175	165
160	220	210	205	195	185	175	165
180	235	225	220	210	200	190	180
200	245	235	230	220	210	200	190
225	260	250	240	230	220	210	200
250	275	265	255	245	235	225	210

Fig. 11a: Spans for **PP-RCT Fibre pipes Watertec,** No. D101._ _ _

d	Spans L in cm bei T°C						
mm	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	80	80	75	75	70	60	55
25	95	90	85	80	75	70	65
32	110	105	100	95	90	85	80
40	120	115	110	105	100	95	90
50	140	135	130	125	120	115	110
63	150	145	140	135	130	125	120
75	165	160	155	150	145	140	130
90	175	170	165	160	155	150	135
110	185	180	175	165	160	155	145
125	205	195	190	180	170	160	150
160	205	195	190	180	170	160	150
180	220	210	205	190	180	170	160
200	230	220	210	200	190	180	170
225	240	230	220	210	200	190	180
250	250	240	230	220	210	200	185

Fig. 11b: Spans for **PP-RCT Fibre pipes Climatec,** No. D111._ _

Piping system pipes often require pipes to be bypassed. Here bow-shaped connections (Fig. 12) are very good solution. As with the expension bends, also bow-shaped connections can easily be made by using parts of the Bänninger programme; just take 2 bends 45° I - A (8040) and one pipe bend (8002a).

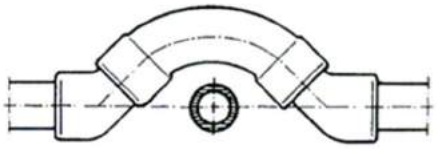


Fig.. 12: Bow-shaped connection

For connecting sanitary appliances and shut-off devices or for plastic-metal transition pieces, our programme offers the required fittings.
The threads are according to DIN 2999 and ISO 7: cylindrical inside thread and conical outside thread. All screw connections and threaded pipe couplings or nipples are designed for easy installation with standard wrenches.

Do not use pipe wrenches for threaded plastic parts to imperatively avoid any damage. Also a possible deformation of the parts by using a pipe wrench must be excluded.

The installation of pipes for cold and warm water supply must be done by observing the prescriptions of DIN 1988.

The complete copy of DIN 1988 can be ordered as special print from Beth-Verlag GmbH, Burggrafenstrasse 6, 10787 Berlin.

For ceiling installation the use of galvanized or coated metal shells (Fig. 13) is recommended if necessary. In such case, the fixing distances are to be extended accordingly.

Fig. 13: Pipe in shell

Equipotential Bonding
Acrylic bath and shower tubs, also with metal water supply and discharge equipment, do not require any earthing when BÄNNINGER PP-R pipework is used since neither PP-R nor the tubs are conductive. When using metal tubs, an equipotential bonding must be created. For further information see DIN VDE 0100, part 701.

Welding procedure

The **Bänninger** PP-R pipework is coupled by socket fusion welding. The pipes and fittingsare connected longitudinally overlapping. The heating of pipe ends and fitting faucets is done by a heating element with fitted bushes. After the necessary welding temperature is reached, the joining process is done. The pipe and fitting faucet diameters as well as the respective heated bush diameters are matched to build up the necessary pressure during the joining process.

The heating element is electrically heated. It complies with DVS Directive 2208 part 1 in construction and accuracy.

Note on the welding process:
The heating elements (mandrel and bush) must correspond to DVS 2208 part 1, par. 5, table 2, type A (excluding mechanical working of pipe).

Figures a, b and c schematically show the 3 welding process stages:

a = Welding preparation

b = Warming up

c = Welded joint

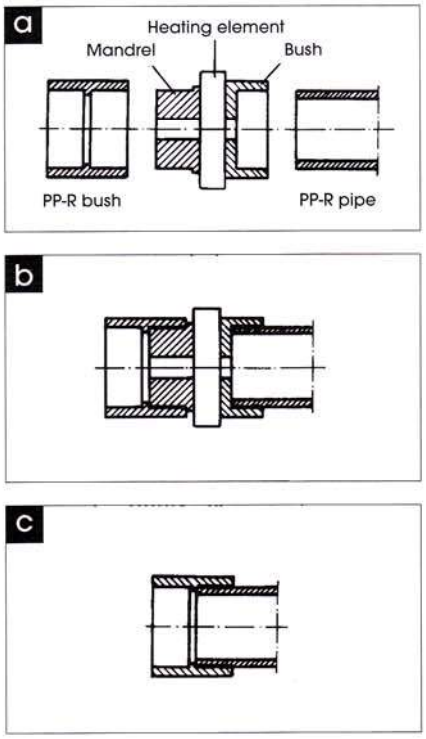
Preparations

Cut pipes square into sections.
Thoroughly clean both joint faces, the pipe end and fittingfaucet, with spirit and absorbent paper. Mark bush depth on the pipe.
Bring the heating element to 260° C.
Check the set temperature before the welding process.
Temperature tolerance ± 10° C.
The heating element should have an integrated thermometer, otherwise the temperature of the heating element must be controlled by an appropriate measuring device.

Do not start heating the joint parts before the heating temperature is a 260° C. The mandrel and bush must be clean and have to be purified before each following welding process.

Welding

Push the pipe and fitting quickly and axially up to the stop of the mandrel and the marked insertion depth respectively and keep them fast without torsion. The heating of the joint faces is done according to the table in fig. 14. After the end of the heating period pull the pipe and fitting abruptly from the heating element and joint them immediately axially aligned and without torsion. In doing so, mind the correct insertion depth (fig. 15). The pipe must be pushed in up to marked insertion depth of the bush bottom. We recommend to fix the two joint parts again for a certain time (approximately the heating period).
Do not expose the welded joint to mechanical stress but after epiration of the cooling period.



1	2	3	4
Pipe outside diameter mm	Heating phase s	Switch s	Cooling min
16 20 25	5 5 7	4	2
32 40 50	8 12 18	6	4
63 75	24 30	8	6
90 110 125	40 50 60	10	8

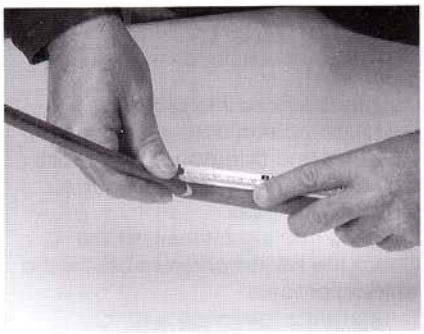
Fig. 14
Standard values for socket fusion welding at a room temperature of 20° C. With a room temperature below +5° C the heating phases should be increased by up to 100%.

Pipe Ø d (mm)	Bush depth=Insertion depth (mm)
16	13,0
20	14,5
25	16,0
32	18,0
40	20,5
50	23,5
63	27,5
75	30,0
90	33,0
110	37,0
125	40,0

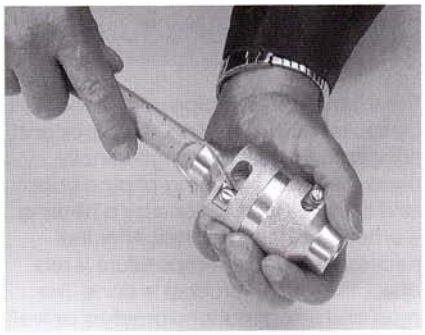
Fig. 15: Bush depths for PP-R fittings

Socket fusion welding procedure

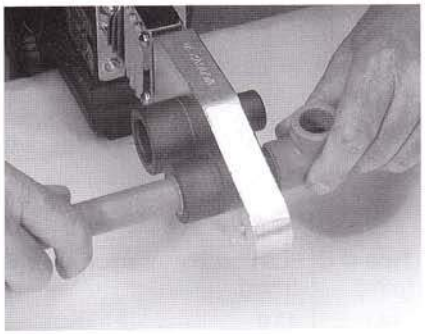
1. Pipes are measured and cut to the required length. Cutting should be perpendicular to the pipe axis (90°).



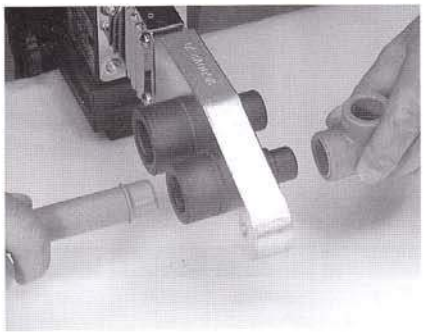
2. The socket depth or the welding on the welding distance should marked to the end of pipe.



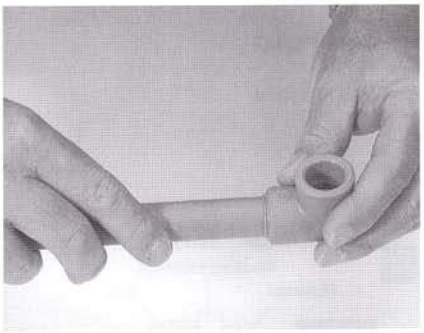
3. With **Bänninger Stabi-Tubes,** the aluminium coating has to be peeled off before connecting them.



4. The pipe end and the socket of fitting are pushed to heaters in axial direction. Pipe and fitting should be heated simultaneously.



5. At the end of heating period fitting and pipe end are separated from the heating elements.



6. Fitting and pipe are quickly joined together in the axial direction. During joining, the pipe end should not be turned around its axis in the socket.

Directly after the cooling time the fused joints can fully work under pressure.

Socket fusion welding procedure
Bench machine for 50mm-125mm pipe

dynatherm®
PP-RCT PIPE SYSTEMS

The welding machine No. 8988 is suitable for socket welding of pipes and / or fittings made of PP-R from d = 50 mm to d = 125 mm

The socket welding machine No. 8988 consists of:

- Basic unit with movable slides
- Heating element
- Prism clamping jaws
- Socket and spigots from d = 50 mm to d = 125 mm according to DVS 2208
- Tripod for pipe support
- Metal transport case

Setting of welding machine:
Set the heat reflector in the holder. Mount the appropriate welding tools (socket and spigot) install the clamping jaws.
Switch-on the device, and the energy control lamp turns on. The temperature control lamp goes off after reaching the operating temperature (260°).

Fig. 1
Set the heat reflector in the holder

Fig. 2
Place the socket and the spigot on the heat reflector

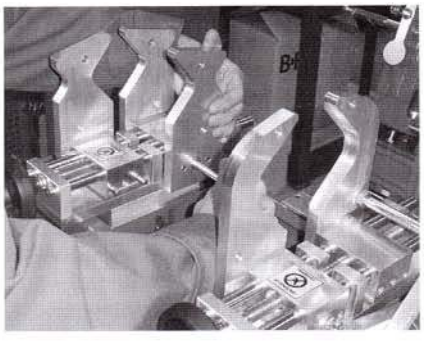


Fig. 3
Mount the prism clamping jaws

This is how the push-in depth will be precisely determined:
Select the relevant fitting/pipe diameter on the measuring drum, which is situated in the middle of the machine base.
Adjust the position of the slides; arrows in the middle of the machine base must stand one over the other, also on the handle lock.
Position the fitting in the clamping jaw and seize it with the handle lock. Lock and seize the stop. Place the pipe axial to the fitting in the chunk jaw and position it so that it is situated frontal to the fitting. Seize the pipe with the handle lock.

Fig. 4
Select the pipe / fitting diameter

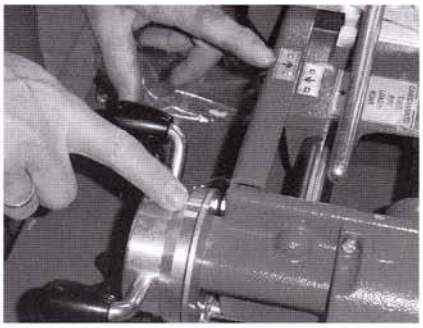


Fig. 5
Adjust the position of the slides

Fig. 6
Place and adjust the fitting in the clamping jaw

Fig. 7
Adjust the stop to hold the fittings

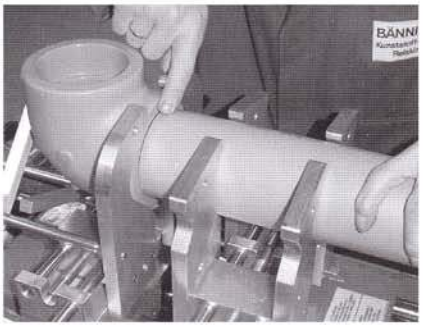


Fig. 8
Lay the pipe axial to the fitting and position it so that is situated frontal to the fitting

Welding
(According to the DVS regulations 2207, part 11)

Check before the welding process begins if the welding temperature is reached. The first welding should take place only 5 minutes after the welding temperature is reached. Split apart the machine slides and close down the heat reflector. Slowly move the machine slides by turning the hand wheel. Align the heat reflector so that the pipe and the fitting properly fit into the welding tools. Move the slides with constant forward motion up to the point until the stop is reached. The heating timer of the joint surfaces starts only after the stop is reached. After completion of the heating time the slides will be split and the heating unit be brought as fast as possible in a rest position.
Move the machine slides with the hand wheel at constant forward motion up to stroke end so that the precise jointing depth between the pipe and the fitting is reached. The welding jointing may only be removed from the clamping jaws after the cooling time has past. In addition unscrew the clamping jaw with the handle lock and take off the welded unit.

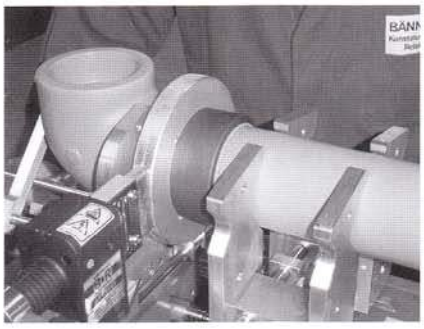


Fig. 9
Move the machine slides with the handle lock, warmup the pipe and the fitting in the welding tools

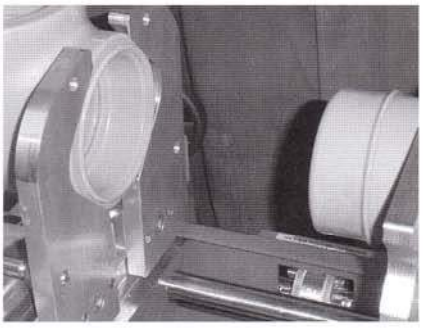


Fig. 10
After the warming time bond the pipe and the fitting

Fig. 11
Move the machine slides up to stroke end

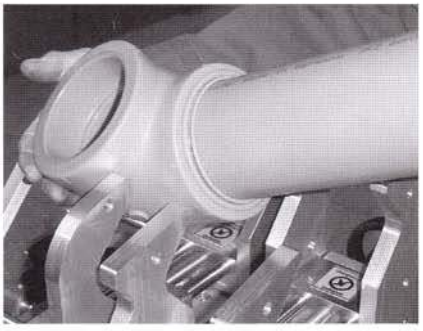
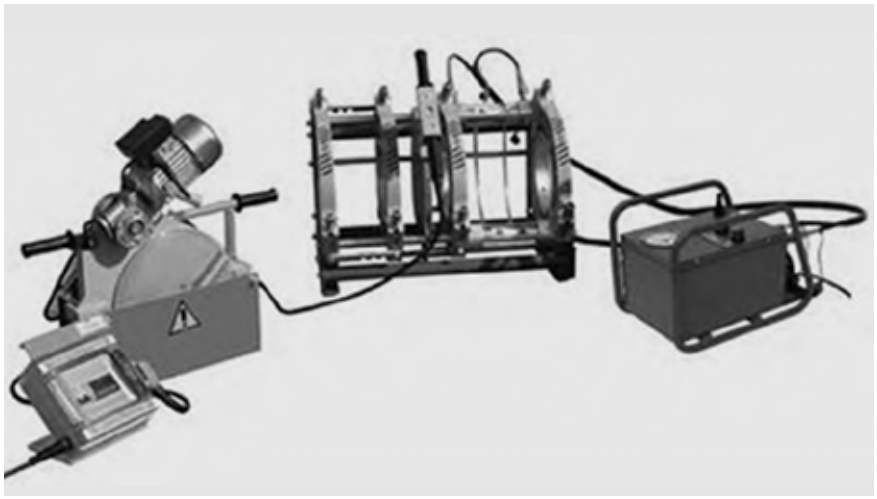


Fig. 12
Remove the welding jointing after the cooling time from the clamping jaws has past

The welding machine part no. 8989 is suitable for butt welding of pipes and/or fittings made of PP-R / PP-RCT from dia = 90 mm up to dia = 315 mm



The butt welding machine with heating element part no. 8989 includes:

- Basic machine with movable slide
- Heating element
- Hydraulic aggregate
- Electrical planing tool
- Flexible hydraulic hoses
- Metal box for electrical heating elements and planing tool.

Parameters for PP-butt welding with heating element at 20° C outside temperature according to DVS data sheet 2207, part 11

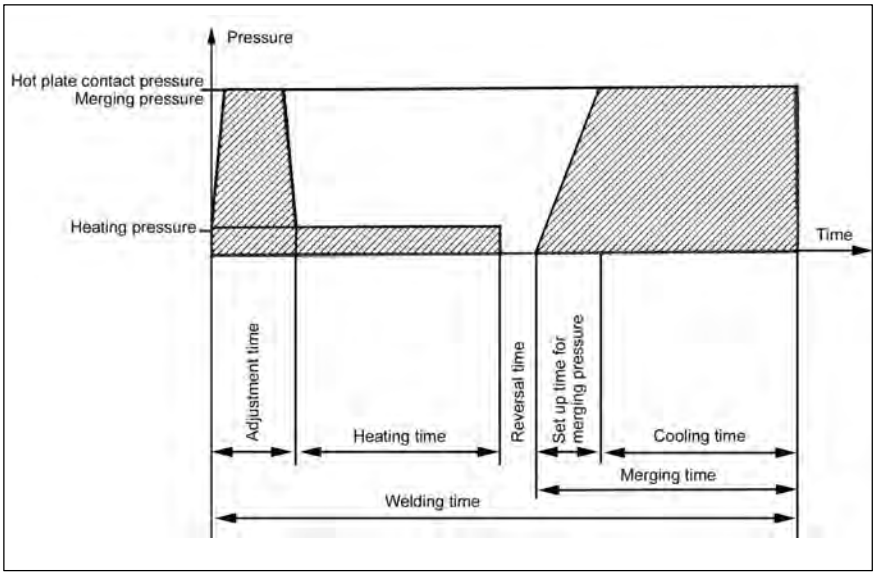


Fig. 1

dia	SDR	Merging pressure bar	Bead height mm	Heating time sec.	Welding pressure bar	Cooling time min.
160	17	8	1	147	8	16
	11	13	1	225	13	24
200	17	13	1	180	13	20
	11	20	1	290	20	30
250	17	21	1	217	21	24
	11	32	1,5	313	32	35
280	17	27	1	259	27	27
	11	40	1,5	329	40	40
315	17	34	1	290	34	30
	11	51	1,5	335	51	41

Permissable misalignment of wall 0,1 x wall thickness (s)

During butt welding with heating elements the areas to be joined are heated up to the welding temperature by means of the heating element and compressed after the heating element has been removed. Heating temperature 210° C ± 10° C
The step-by-step welding procedure is shown in Fig. 1.

Welding Procedure:

During butt welding with heating elements the areas to be joined are adjusted with pressure at the heating element (adjusting with merging pressure) until the specified bead height is reached. Following heating up to welding temperature with reduced pressure (0,10 ± 0,01 N/mm²) and joining with merging pressure after removal of the heating element (Adaption).

Fig. 2 shows the principle of the welding procedure.

After merging a double bead (K) has to exist over the complete perimeter.
The bead formation is an orientation for the uniformity of the weldings among each other.

Fig. 3 shows the bead formation during butt welding with heating elements.

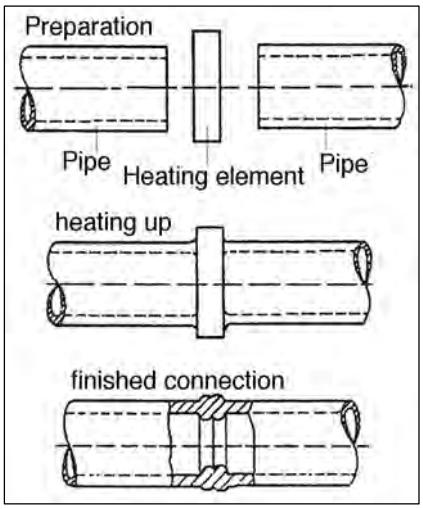


Fig. 2

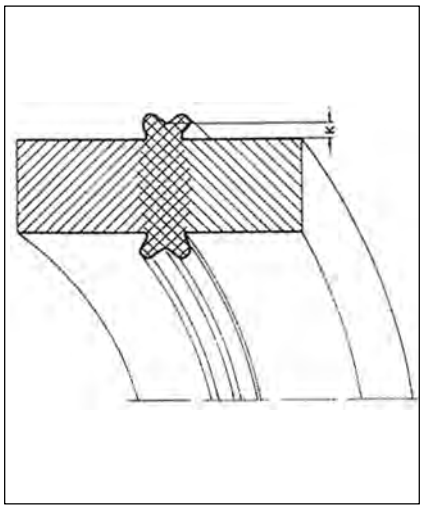


Fig. 3

Socket fusion welding procedure
PP-R weld-in saddle

dynatherm®
PP-RCT PIPE SYSTEMS

Application area:
Additional extension of existing pipe systems.
Direct connection of consumer pipe to a utility line.
Alternative to T-pieces.

Welding preparation:
Heat up the heating unit to 260° C.
Control the set temperature prior to the welding process. Temperature difference ± 10° C.
The welding elements must be clean and should be cleansed prior to every welding process.

Fig. 1
Bore the pipe wall with the boring machine (Art.-No. 8986b)

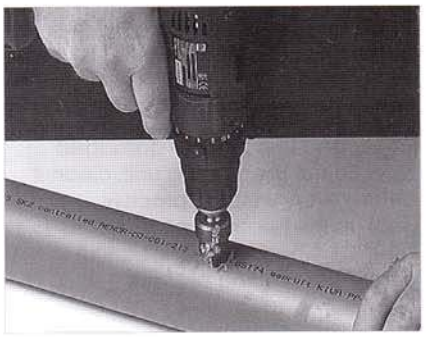


Fig. 2
For stabi composite pipes (Art.-No. 8215B) remove the residual aluminium with the chamfering tool (Art.-No. 8986a)

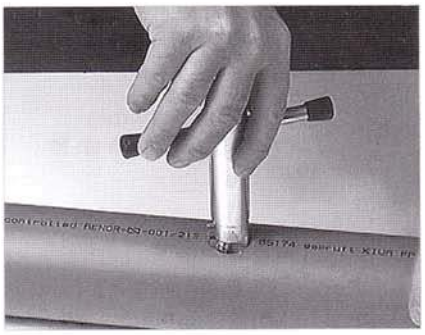


Fig. 3
Push in the heat nozzle of the welding saddle tool (Art.-No. 8984e) in the bore as well as the connecting piece of the welding saddle in the heating socket. The heating time for all dimensions amounts to 30 seconds.

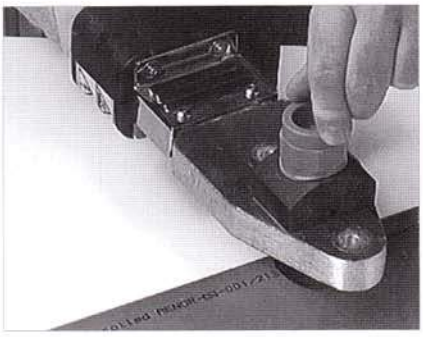
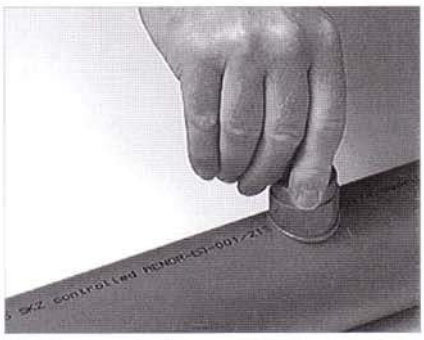


Fig. 4
Push the connecting piece of the welding saddle fast in the heated bore hole. Fix the fitting for about 15 seconds on the pipe.



After a cooling time of 10 minutes the fused joint can fully work under pressure.

The appropriate branch connections will be assembled through socket fusion welding or by using female or male adaptors with the welding saddle.

Application area:
Repair of drill damaged pipes.

Preparations:
Empty and uncover the damaged pipe. Select the heating unit, clean it before every welding process.
Heat up the heating unit to 260° C (±10° C). Check the temperature before the welding process.

Selection of welding elements:

Repair -Set: d = 7 mm
For welding of holes up to 6 mm

Repair-Set: d = 11 mm
For welding of holes up to 10 mm

Fig. 1
Mark the degree of the push-in depth (wall thickness) on the repair plug. Distance tool to be fixed according to the wall thickness of the pipe and tighten the screw.

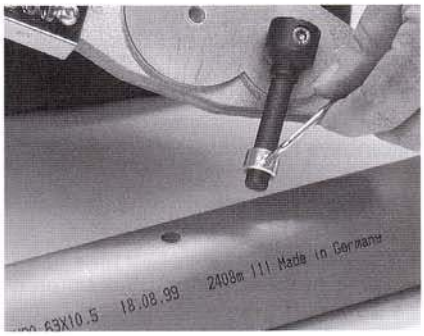


Fig. 2
Heat up the borehole and the welding plugs with the repair-set for 15 seconds.

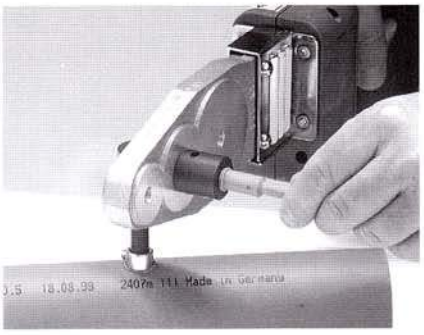
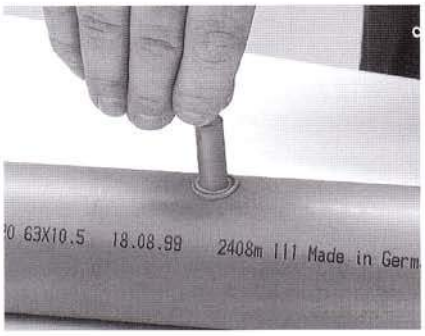


Fig. 3
Remove the welding device and set in the repair plug precisely without twisting it.
After cooling time of 5 minutes remove the protruding end of the repair plug, and the repaired part can again work under pressure.



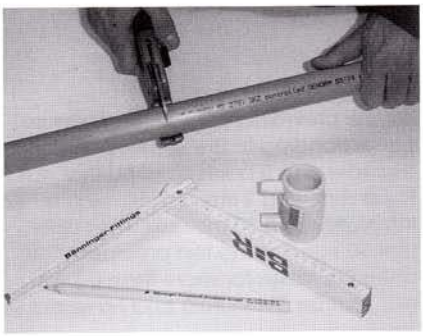


Fig. 1
Cut the pipe in a rectangular manner with plastic scissors or with a pipe cutter.

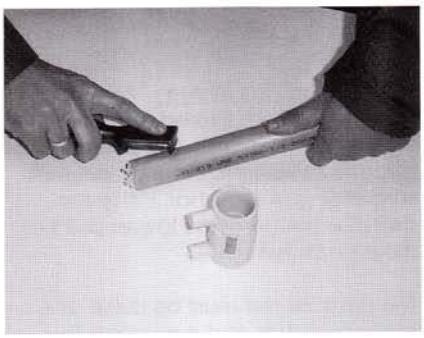


Fig. 2
Remove the outside oxide layer using a scraper.

Fig. 3
On **Bänninger Stabi-Pipes,** the aluminium coating must be peeled off before jointing.

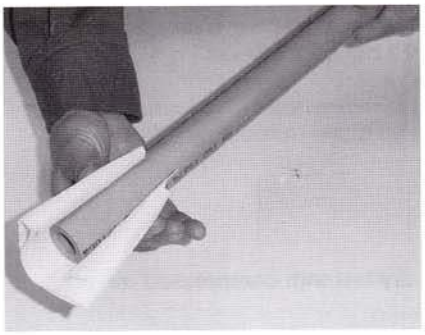


Fig. 4
Clean the joint surfaces with a purifying agent (e. g. spirit).

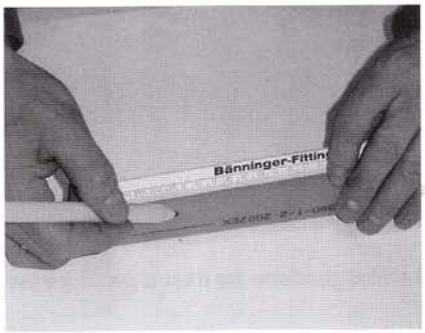


Fig. 5
Mark out the socket depth.

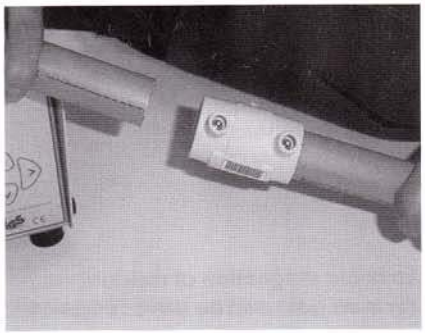


Fig. 6
Push in the socket up to the marked position on the pipe.

Fig. 7
Plug in the cable plugs in the contact bushings.
Enter the voltage and the welding time in the welding device. The welding data can be seen on the barcode label of the socket. Start the welding device from the switch.

Preparing the welding surfaces.
Cut the PP-R tube ends rectangularly to the tube axis with a pair of plastic-tube scissors. Remove in chips the outer surface oxide layer with a scraper and purify with non-fuzzing, absorbend paper and purifying agent (e. g. spirit).

With **Bänninger Stabi-Tubes**, the aluminium coating has to be peeled off before connecting them. For this the **Bänninger** peeling tools (no. 8979) for electrofusion welding sockets must be used. They achieve a greater peeling length than that required for normal socket welding. The tube ends are pushed into the peeling tool to wring off the aluminium coating up to the stop of the peeling tool.

Mounting of the electrofusion welding sockets.
Mark the socket depth on the tube. After having finished all preparatory work, take the electrofusion welding socket out of its packing and **be careful not to touch the inner surfaces of the socket.** Now shove the socket slowly on the tube to position it where marked.

Repair work with the electrofusion welding socket.
Remove from the defective tube (at its leakage place) by cuts rectangular to its axis a section of at least 3 - 4 times the socket length. Fit the new tube piece into the gap and prepare the ends of the old tube and the new tube piece as described before.

Unpack two sockets and shove them completely over the two ends of the new tube piece. Now fit in the new tube piece and move the sockets to the marks on the old tube.

Connecting the socket cord.
Position the electrofusion welding sockets in a way offering easiest connection of the cord plugs to the contact bushes. Having checked the required generator voltage to be available, switch on the device and put the cord plugs on to the contact bushes. Set the diameter of the tubes to be connected and start the welding process with the switch. The electrofusion machine automatically calculates and controls the required welding time and shows the welding indicators after troublefree welding. The welding indicator does not access the welding quality. Its value may differ depending on the slot width between the electrofusion welding socket and the tube.

Cooling Time
Never disregard the required cooling times. The full loading capacity of the welded section for example for test pressure or working pressure requires a minimum cooling time of 2 hours.

PP-RCT PIPING SYSTEM PRESSURE TEST

UPG Pipe Systems recommends pressure testing to DIN 1988/2 for plastic pipes as stated below.

As a result of the material properties of plastic pipes the pipe will expand during the pressure testing. The pressure testing is split into a preliminary test and a main test. The preliminary test is sufficient for small sections of the piping such as connecting pipes and distributing pipes in the wet rooms.

a) Preparation

1. After the pipes have been installed and before they are concealed the piping is filled with water and any air removed.
2. If possible the pump should be placed at the lowest point in the system
3. The manometer should be capable of reading changes in pressure of 0.1 bar and should be placed at the lowest point of the section of piping being tested.

b) Preliminary testing

The test pressure is equal to the maximum operating pressure of the system plus 5 bar (minimum: 15 bar). The test pressure must be built up over a period of 30 minutes. Within the 30 minutes the pressure should be re-adjusted 2 times (each time 10 minutes apart). After a further period of 30 minutes under pressure, there should be no leaks and the drop in pressure should not exceed 0.6 bar.

c) Main testing

The main testing should be carried out immediately after the preliminary testing. The duration of the test is 2 hours. The drop in pressure between the end of the preliminary testing and the end of the 2 hour main test must not exceed 0.2 bar.

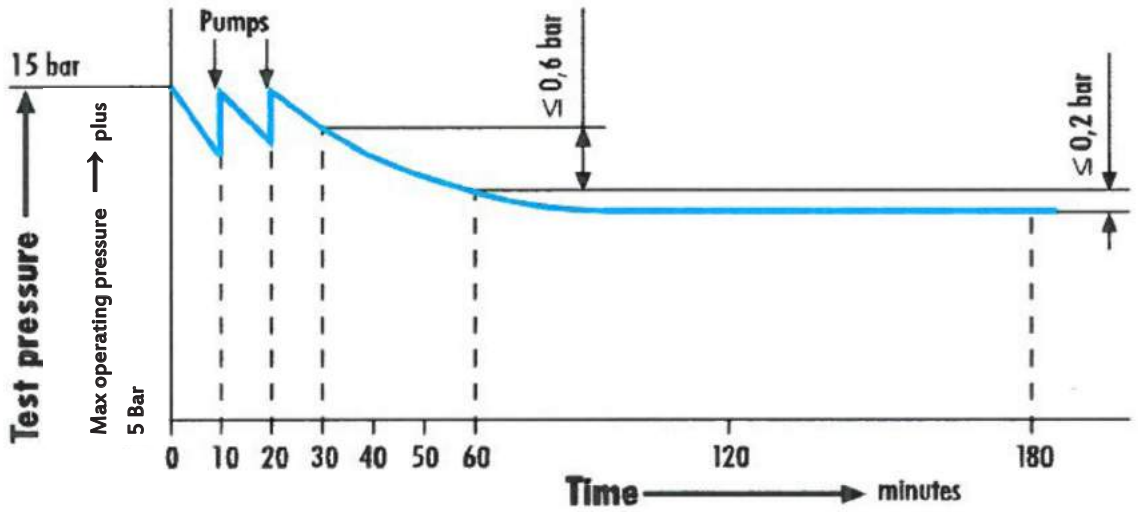
If leaking occurs, please replace the section and restart the test at the preliminary testing stage.

Please note:

- **Fluctuations in the temperature may alter the test pressure**

Testing is complete when the above has been undertaken and no leaks are present in the pipe system.
All parts of the test sheet are to be completed. Once completed please **fax form to 0800 767 190**, or scan and **email to** info@upg.net.nz

UPG Pipe Systems must receive this test information within 3 months from date of completion for the warranty to be valid.



dynatherm®
PP-RCT PIPE SYSTEMS

upg
PIPE SYSTEMS

TEST SHEET

According to standards given in DIN 1988

PROJECT:_____

Address:_____

Contractor:_____Contact No._____

Client:_____

Raw material: **PP-R** ☐

Pipe length:

Ø 16 m	Ø 20 m	Ø 25 m	Ø 32 m
Ø 40 m	Ø 50 m	Ø 63 m	Ø 75 m
Ø 90 m	Ø 110 m	Ø 125 m	Ø 140 m
Ø 160 m	Ø 225 m	Ø 250 m	Ø 280 m
Ø 315 m			

Joining: Welding pcs. Gluir – –

Number of tapping points: pcs. Highest tapping point above pressure gauge: pcs. pipe length: m

Preliminary test:

Test pressure bar

1st regulation after 10 minutes bar

2nd regulation after 10 minutes bar

Pressure after 30 minutes bar

Pressure decrease bar

Result of preliminary:

Principal test:

Test pressure bar

Pressure decrease after 2 hours bar
(0,2 bar max.)

Result of the principal test:

Pressure test acknowledged:

Beginning of the test o'clock End of test o'clock Test period h

Place Date Time

Signatures:
Customer Contractor

Pressure test with compressed air or inert gas

General
Because of compressibility of gases during implementation of pressure tests with air the provisions for prevention of accidents "Working on gas facilities" as well as the regulation "Technical rules for gas installations DVGW-TRGI (German Technical and Scientific Association for Gas and Water – Technical rules for gas installations)" should be taken into account because of physical and technical security reasons. In coordination with the responsible professional organization and following this regulation the testing pressure was set at max. 3 bar, like the case with load and leak tests for gas lines.

General provisions
New pipeline facilities may only be put into operation when the compulsory pressure test is successfully passed. No leakages are allowed. The pressure test should be carried out before the lines are buried. The tests on the new line facility can be implemented either on the whole facility or in line sections.
The division into smaller test sections (small pressure / liter product) provides higher level of reliability and is more precise while testing. On the pressure gauge leaks can be identified faster compared to bigger and widely ramified voluminous sections. Hence leak locations can be determined faster.
Apparatuses, drinking water warmers, armatures or pressure tanks must be disconnected from the pipelines prior to the air pressure test in case they have larger capacity and can affect reliability and test accuracy.
All pipeline openings must be directly closed with metallic plugs, metallic blanking plates or blank flanges that withstand the testing pressure.
Closed shut-off valves do not count as leak-proof closures.
Exhaust valves for deflation of the testing pressure should be installed in sufficient number and on appropriate locations where the air can be deflated in a safe manner.

If leaks are observed during the visual or noise inspections or if a pressure drop is identified above the allowed values all connections should be checked with regard to leak thghtness with test equipment that creates bubbles.
After removal of possible leaks the pressure test should be repeated. During the testing period no single leak may be detected on any location of the inspected facility.

In exceptional cases a minor pressure drop may be identified on the pressure gauge although during the visual inspection or during the inspection with testing equipment that creates bubbles no leaks cold be observed.

Nevertheless the facility can be water proof.

In case of doubt a water proof test can bring a certainty regarding the leak tightness.

The safety of people and goods during the test should be taken into account as a basic principle.

Because of technical security reasons e. g. slipping away of a defective pipe connection, higher pressures than 3 bar are not permitted.

A gradual pressure increase and a regular visual inspection of the pipe connections are appropriate as additional safety measures.

Leak tightness test
The leak tightness test is implemented with a pressure test of **110 mbar** prior to the load test.
The applied pressure gauge must have an appropriate precisness of 1 mbar (10 mmWS) display range for the pressure that will be measured.
For this purpose the U-pipe pressure gauges known from the TRGI test or the standpipes can be used.
The components on the pipeline facility must be dismounted appropriately for the test pressures or prior to the test.

Afterapplication of the test pressure the testing period for **up to 100 liter line volume must be at least 30 minutes.**
For every additional 100 liters the testing period must be increased by 10 minutes.
The leak tightness test begins once the test pressure is achieved and taking into consideration the respective warming period for adjusting the medium to the temperature of the environment.

Load test
The load test is implemented with a maximum test pressure of **3 bar** and a pressure gauge with a display range of 0,1 bar. The load test is combined with a visual inspection of all pipe connections. In doing so it is checked whether welding, solder pressure and clamp connections as well as adhesive and screwed joints are performed in a proper manner in order to be leak-proof.

The load test with diameter increased pressure should be:
– at nominal up to DN 50 maximum 3 bar and

– at nominal diameter over DN 50 – DN 100 maximum 1 bar.

After application of the test pressure the testing period is 10 minutes.

Selection of the test medium
For leak tightness and load test the following media can be used:

- oil-free compressed air,
- inert gas
  e. g. Nitrate and carbon dioxide
- inert gas
  with 5% hydrogen in the nitrogen (applied at the procedure for locating the leakage)

Through technical security equipment like pressure reducing regulatoron compressors it should be ensured that the envisaged test pressure for the pipe facility is not exceeded.

dynatherm®
PP-RCT PIPE SYSTEMS

B-R Bänninger
MADE IN GERMANY

Pressure test protocol for drinking water installation with compressed air or inert gas as a control medium (model)

Construction project: _____

_____

_____

Client represented by: _____

Contractor / responsible expert represented by: _____

Material of the pipeline system: _____

Connection category: _____

Pressure on the facility: _____ bar Temperature of the environment: _____ °C Of the control medium: _____ °C

Control medium ☐ Oil-Free compressed air ☐ Nitroge ☐ Carbon dioxide ☐ _____

The water supply facility was controlled as ☐ a complete facility ☐ sectionwise

All lines are closed with metallic plugs, caps, blanking plates or blank flange.
Aparatuses, pressure tanks or drinking water warmers are disconnected from the lines.
A visual inspection of all pipe connections was done with regard to the professional construction.

☐ **Leak tightness test** Test pressure 110 mbar
Testing period up to 100 l line volume for at least 30 minutes.
For each additional 100 liters the testing period should be increased by 10 minutes.

Line volume _____ Liter Testing period _____ Minutes

First a temperature balance and a steady-state condition is awaited, after this the testing period starts.

☐ During the testing period no pressure decrease was observed.

☐ **Loading test with higher pressure**

Testing pressure ≤ 50 DN max. 3 bar > 50 DN max 1 bar

Testing time 10 Minutes

First a temperature balance and a steady-state condition is awaited, after this the testing period starts.

☐ During the testing period no pressure decrease was observed.

☐ The pipelines are leak-proof.

_____ Location _____ Date

_____ Client / Representative _____ Contractor / Representative

Insulation instructions for Cold and Hot water pipes

dynatherm® PP-RCT PIPE SYSTEMS

Authoritative for the insulation of pipework are DIN 1988 part 2 and the German Heating Installation Regulation of the Energy Saving Act/Heizungsanlagen-Verordnung zum Energieeinsparungsgesetz (HeizAnLV)

Heat insulation according to DIN 1988
Drinking water systems for cold water must be protected against heating and, if necessary, condensation water. For the minimum insulation layer standard values see table (fig. 16).

Installation mode	Insulation layer thickness λ= 0,040 W/(m · K)
Pipes freely installed, in non-heated room (e. g. cellar)	4 mm
Pipes freely installed, in heated room	9 mm
Pipes in channel, no hot-water pipes	4 mm
Pipes in channel, beside hot-water pipes	13 mm
Pipes in wall conduit, risers	4 mm
Pipes in wall recesses, beside hot water pipes	13 mm
Pipes on concrete surface	4 mm
For other heat conductivity values, convert insulation layer thickness accordingly by using a diameter of d = 20 mm.	

Fig. 16

Heat insulation according to the Heating Installation Regulation.

Heat distribution installations must be insulated against heat loss.
See figures 17 + 18

Line	Nominal width (NW) of the pipes/Fittings in mm	Minimum insulation layer Thickness, related to a thermal conductivity of 0,035 W $m^{-1}K^{-1}$
1	up to NW 20	20 mm
2	from NW 22 to NW 35	30 mm
3	from NW 40 to NW 100	as NW
4	over NW 100	100 mm
5	Pipes and fittings under lines 1 to 4 inceiling and wall cut-throughs, pipe-crossing sections, with central distributing pipes, radiator connection pipes of maximally 8 m length	1/2 of the requirements given in lines 1 to 4

Fig. 17

	d x s	DN	Insulation layer thickness λ= 0,035 W/(m · K)
Pipes PN 20	16 x 2,7	10,6	20 mm
	20 x 3,4	13,2	
	25 x 4,2	16,6	
	32 x 5,4	21,2	30 mm
	40 x 6,7	26,6	
	50 x 8,4	33,2	
	63 x 10,5	42,0	42 mm
	75 x 12,5	50,0	50 mm
	90 x 15,0	60,0	60 mm

Fig. 18

Polypropylene pipes according to DIN 8077 are highly selfinsulating as to their heat transfer. Thus, PN 20 PP-R pipes in continuous operation at a passing medium temperature of 80° C show an about 27° C lower temperature at their outside diameter. This proves their heat insulation to be much more effective than it is with metal pipes.

Fire Protection

PP-R is classified under building material class 2 - normal flammability.
The respective national building laws (building regulations on all administrative levels and their implementing regulations) must be observed.
The application of approved fire protection measures prevent the passing of smoke and fire with pipes through walls and ceilings.

Notes

dynatherm®
PP-RCT PIPE SYSTEMS

Notes

dynatherm®
PP-RCT PIPE SYSTEMS

dynatherm®
PP-RCT PIPE SYSTEMS

DISTRIBUTED BY:

upg
PIPE SYSTEMS

Auckland Branch
Unit 3, 68 McLaughlins Road, Wiri, 2104
P 09 971 0020
E aucklandsales@upg.net.nz

Wellington Branch
15 Raiha Street, Porirua. 5022
P 0800 473 100
E sales@upg.net.nz

Follow @upgpipesystems
W www.upg.nz