EGIC
EGYPTIAN GERMAN CO.
GUARANTEE
SINCE 1991
EGIC QUALITY
EGIC GUARANTEE
SUPERIOR GERMAN QUALITY

B·R
Bänninger

BÄNNINGER
PP-R WATER SUPPLY SOLUTIONS

"SUPERIOR GERMAN QUALITY"

EGIC
EGYPTIAN GERMAN CO.
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SINCE 1991
EGIC QUALITY

ABOUT

The Egyptian German Industrial Corporate - EGIC was founded in 1991 to market all types of sanitary products and related accessories. Joining Bänninger, our German partners, we introduced PP-R systems to the water supply in the Egyptian market, then expanded our entire production to produce and market all types of reliable plumbing and sanitary products.

EGIC has established top-class manufacturing facilities; including four facilities in Egypt and one in Germany, where we produce water supply and drainage solutions from numerous plastic materials and copper (polypropylene, PVC and polyethylene) under the best-known brands; Bänninger, Kessel, and Smart Home. One of those four factories is the largest copper foundry in the Middle East that manufactures the purest bronze bars, valves, and other related accessories.

By constantly adapting our products to the needs of the market, EGIC eventually became a trendsetter and a leading developer of benchmark quality in polymer and plastic products. We manufacture an economically innovative wide product range of PP-R pipes and fittings for drinkable cold & hot water as well as PP & PVC pipes and fittings for drainage, where we provide complete home solutions for different residential and industrial projects across the world.

Our applied raw material technologies optimize the material characteristics for the protection of the environment. The use of polypropylene raw materials for manufacturing ensures a socially compatible, hygienic and healthy packaging for the most precious commodity: clean drinking water

Our promise is to not only satisfy but to also exceed our customers' expectations by offering them the highest quality products as well as a wide range of support services. Our outstanding customer relations skills ensure efficient delivery, which in return results in customer loyalty.

At EGIC we believe in teamwork, progress, honesty, open communication and a better tomorrow.

Founded by
Omar Safey El Dine

EGIC company was established in early **1991** with the intent to market all types of plumbing-related products. Overtime, **EGIC is a pioneer and market leader** in manufacturing pipes and fittings for water supply and drainage, using numerous plastic materials: Polypropylene, PVC and Polyethylene. As a result, the company was positioned as a main sanitary solution supplier in the construction value chain, and was known for its superior, high-quality, German products.

EGIC's Timeline since 1991

1991	EGIC was founded as an importer of top-class plumbing products.
1995	EGIC was the first company to introduce PPR water supply solutions to the Egyptian Market.
1997	EGIC launched its integrated customer service loyalty program. EGIC introduced a new PP push-to-fit drainage solutions.
2000	EGIC started its first corporate social responsibility initiative via establishing Nahdet Beni Suief Foundation.
2001	EGIC established its first manufacturing facility to locally produce PPR water supply solutions.
2006	EGIC expanded to its second manufacturing facility to locally produce UPVC drainage solutions.
2013	EGIC implemented the SAP system. EGIC established the Egyptian Plumbers Foundation as part of EGIC's corporate social responsibility program.
2014	EGIC launched its PVC cleaning cement & adhesives as well as new pumping systems in order to provide an integrated and complete home solution strategy. EGIC acquired its third manufacturing facility.
2016	EGIC established one of the largest bronze and brass foundries in the Middle East.
2019	EGIC expanded its manufacturing process to produce the new Kessel shower drains and Smart Home accessories.

EGIC Facilities

- Cairo Head Office.
- Bani Suef Manufacturing Facility.
- Bani Suef Bronze/Brass Foundry.
- October | Manufacturing Facility.
- October II Manufacturing Facility.
- Customer Service Branches Across Egypt.

QUALITY ASSURANCE

Our promise is to be a dependable provider of comprehensive and integrated home solutions of superior German quality, with the support of our exemplary customer care service, comprehensive warranties, and outstanding distribution network.

EGIC's entire production line has been adjusted to fit European standards, which have been previously approved and certified by different accredited independent international institutes.

Those standards are being sustained by our Quality Assurance laboratories which test all raw materials, products and effectiveness.

All products undergo tests in abnormal conditions to guarantee optimum quality, through using the highest quality raw material Borealis,Basell, Sabic and Formosa implying the required standards of the following certifications: DVGW, SKZ, EOS, GL, NOPWASD, IGH and Certificates of quality process ISO 9001, ISO 14001, ISO 45001, ISO 17025.

COMPLETE HOME SOLUTIONS

Home is where most of our time is spent, and investing in high-quality water Plumbing solutions is of the upmost importance, in order to ensure a stable water supply for a peaceful and hassle-free life.

1 PP-R Water Supply Solutions
2 PPR-R Water Supply Solutions with UV Resistance
3 PVC Drainage Solutions
4 Floor Drains
5 Gully traps
6 Inspection Chamber for Outdoor Drainage Solutions
7 Backwater Valve for Outdoor Drainage Solutions
8 Underground Push to Fit Drainage Solutions
9 Lifting Station for Basements
10 Water channels for Garage and Swimming Pools

Related Plumbing Solutions: Valves, Flexible Hoses, Lubricant, Adhesives, Waterproof cementitious coating and water pumps.

An Environmentally Responsible Product

Environmentally-friendly
Before polypropylene was invented, the gaseous waste from oil such as propylene and ethylene were simply burned, because they were useless. Today, these gases are used to produce polypropylene, thus drastically reducing atmospheric pollution. The production process also eliminates the potential pollution of rivers, streams and lakes, due to the use of water in a closed cooling cycle.

Recyclable
Polypropylene is commonly recycled, and has the number "5" as its resin identification code, allowing efficient separation of different polymer types for recycling the raw material. The recycled raw material has to meet the manufacturing requirements of the environment commission, which stipulate that there is a minimum and optimum re-use. Reduced emissions, a long working lifespan noting that there is a high demand for polypropylene for recycling purposes as it can be recycled more than 50 times without any reduction in strength.

Superior
Polypropylene (PP), is a thermoplastic polymer used in a wide variety of applications; it is unusually resistant to many chemical solvents, bases and acids. This allows polypropylene to be used as an engineering plastic. Polypropylene is most commonly used for plastic molding; it is injected into a mold while molten, forming complex shapes at relatively low cost and high volume, such as pipes and fitting.

Durable
Polypropylene products last much longer than those made from most similar materials. They are easy to wipe clean, hard wearing and withstand aging and extreme temperatures. Being more durable than alternative materials, products made from polypropylene doesn't need to be replaced as often, which means saving cost, resources, our environment and our future. Bänninger (B.R) is designed for hot and cold water application and it is the latest and most suitable system for all plumbing applications. Besides plumbing, it also can be used for a variety of applications like air distribution, radiator heating, etc. The specific chemical structure of Bänninger (B.R) provides well balanced mechanical properties and superior long term heat resistance, ensuring the water flowing; it does not have any negative biological effect.

Customer Care
We support our customers in making cost-effective and correct use of our pipes and fittings range; this involves assistance in planning, installation, training, troubleshooting, maintenance, upgrading, and product disposal. Our sales and service representatives' basic goal is not only to satisfy our customers, but to offer them an experience that exceeds their expectations. We aim to extend out automated customer services through our internet website, providing 24-hours a day service.
Whatever the situation may be, our call center staff make sure that they don't leave our customers with unanswered questions.

Customer and Partner Training
Train your customers better, your results will be better. We increase customer satisfaction and product awareness and knowledge through training services to our customers. Customers who get full utility out of the products and services they have purchased are simply more likely to repeat purchases and refer others; Providing education and information on our pipes and fittings simplifies a customer's decision, making process on what solution to best fit their needs; this improves our product adoption and effectively reflects on our increased sales.

Quality Assurance
The production of a quality controlled pipe system demands supervision, regulation and control on all work operations. We follow DIN-guidelines, DVGW working sheets and supervisory regulations of the MPA NRW, to maintain minimum requirements for internal control, through internal audits and laboratory tests.

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Products

Bänninger PP-R/ PP-RCT for Indoor Applications – warm and cold water supply

For the residential and commercial plumbing projects, EGIC manufactures complete range of water supply solutions under German brand name Bänninger.

We offer a comprehensive product portfolio comprising pipes, fittings and valves that are made with superior German quality for the distribution of healthy hot and cold water in plumbing and air conditioning systems, for the conveyance of drinking water.

Our PPR- Pipes and fittings are manufactured using random copolymer polypropylene (PP-R and PP-RCT) ensuring high mechanical resistance and duration, even at high temperatures and pressures.

Bänninger products are commonly offered on green and an informative laser stripe along the length of it, it also endures high temperatures up to 90°C. EGIC follows global standards as we implement international institutes' policies such as the DIN 8077/DIN 8078, DIN EN ISO 15874 to ensure your absolute comfort.

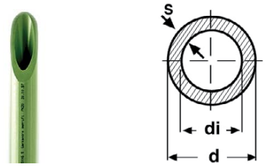
Areas of application:

- Cold and hot potable water
- Swimming pool installation
- Rainwater application
- Heating systems
- Pipelines for industrial use
- Compressed air system

Features of Bänninger – Water Supply System:

- Available with a wide range of sizes (20mm – 160mm)
- High flow rate, light weight and smooth inner surface
- Great stability and reliability at higher temperature
- Non-toxic, chemical resistant and absolutely has no rust release
- Ease of fitting and ability to maintain water pressure.
- Low installation cost

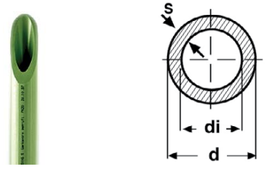
PP-R pipes



PP-R pipe PN10 SDR 11

Material: PP-R
Pipe series: SDR 11/S 5
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: Green with laser labeling system.
Form Supplied: 4 meter straight length, also in coils for some diameters

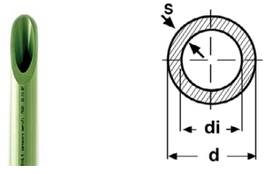
Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
331010001	50 mm.	40.8	4.6	1.307	0.638	20
331010002	63 mm.	51.4	5.8	2.075	1.010	16
331010003	75 mm.	61.4	6.8	2.941	1.410	12
331010004	90 mm.	73.6	8.2	4.254	2.030	8
331010005	110 mm.	90	10.0	6.362	3.010	8
331010006	125 mm.	102.2	11.4	8.199	3.910	8
331010007	160 mm.	130.8	14.6	13.4	6.380	4



PP-R pipe PN16 SDR 7.4

Material: PP-R
Pipe series: SDR 7.4/S 3.2
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: Green with laser labeling system.
Form Supplied: 4 meter straight length, also in coils for some diameters

Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
331021101	20 mm.	14.4	2.8	0.163	0.148	160
331021102	25 mm.	18	3.5	0.254	0.230	100
331021103	32 mm.	23.2	4.4	0.415	0.370	60
331021104	40 mm.	29	5.5	0.660	0.575	40
331021105	50 mm.	36.2	6.9	1.029	0.896	20
331021106	63 mm.	45.8	8.6	1.647	1.41	16
331021107	75 mm.	54.4	10.3	2.323	2.01	12
331021108	90 mm.	65.4	12.3	3.358	2.87	8
331021109	110 mm.	79.8	15.1	4.999	4.30	8
331021110	125 mm.	90.8	17.1	6.472	5.53	8
331021111	160 mm.	116.2	21.9	10.599	9.04	4

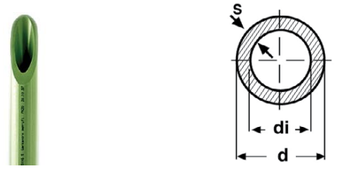


PP-R pipe PN20 SDR 6

Material: PP-R
Pipe series: SDR 6/S 2.5
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: Green with laser labeling system.
Form Supplied: 4 meter straight length, also in coils for some diameters

Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
331020001	20 mm.	13.2	3.4	0.137	0.172	160
331020002	25 mm.	16.6	4.2	0.216	0.266	100
331020003	32 mm.	21.2	5.4	0.353	0.438	60
331020004	40 mm.	26.6	6.7	0.555	0.680	40
331020005	50 mm.	33.4	8.3	0.876	1.055	20
331020006	63 mm.	42	10.5	1.385	1.681	16
331020007	75 mm.	50	12.5	1.963	2.382	12
331020008	90 mm.	60	15	2.826	3.430	8
331020009	110 mm.	73.4	18.3	4.229	5.116	8
331020010	125 mm.	83.4	20.8	5.460	6.607	8
331020011	160 mm.	106.8	26.6	8.954	10.818	4

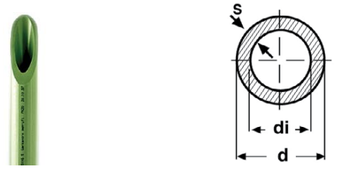
PP-RCT Pipes



PP-RCT Pipe PN20 – SDR 7.4

Material: PP-RCT
Pipe series: SDR 7.4/S 3.2
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: Green with laser labeling system.
Form Supplied: 4 meter straight length, also in coils for some diameters

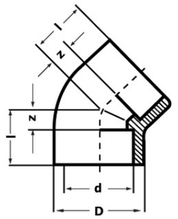
Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
331040001	20 mm.	14.4	2.8	0.163	0.148	160
331040002	25 mm.	18	3.5	0.254	0.230	100
331040003	32 mm.	23.2	4.4	0.415	0.370	60
331040004	40 mm.	29	5.5	0.660	0.575	40
331040005	50 mm.	36.2	6.9	1.029	0.896	20
331040006	63 mm.	45.8	8.6	1.647	1.41	16
331040007	75 mm.	54.4	10.3	2.323	2.01	12
331040008	90 mm.	65.4	12.3	3.358	2.87	8
331040009	110 mm.	79.8	15.1	4.999	4.30	8
331040010	125 mm.	90.8	17.1	6.472	5.53	8
331040011	160 mm.	116.2	21.9	10.599	9.04	4



PP-RCT Pipe PN16 – SDR 11

Material: PP-RCT
Pipe series: SDR 11/S 5
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: Green with laser labeling system.
Form Supplied: 4 meter straight length, also in coils for some diameters

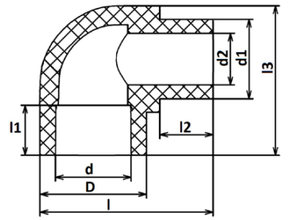
Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
331040211	160mm	130.8	14.6	13.4	6.380	4



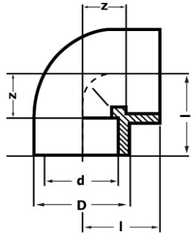
ELBOW 45°

Code	Dn	d	D	l	Z	Pieces/Box
351010001	20	19.5	29	21	6	120
351010002	25	24.5	34	24	8	100
351010003	32	31.5	43	28	10	50
351010004	40	39.4	52	32	11	30
351010005	50	49.4	65	37	13	18
351010006	63	62.5	82	44	16	24
351010007	75	74.7	99	50	20	15
351010008	90	89.7	120	58	25	8
351010009	110	109.7	148	69	32	4

Code	Dn	D	D1	d	d1	d2	l	l1	l2	l3	Pieces/ Box
351020061	20	28	28	19.5	20.3	12.5	47.4	14.5	15.5	43	120
351020062	25	34	34	24.5	25.3	16.5	55.25	16	17	47.75	80

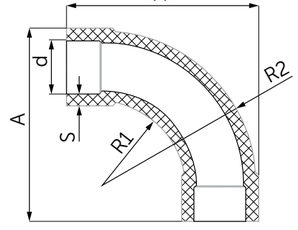


MALE ELBOW 90°



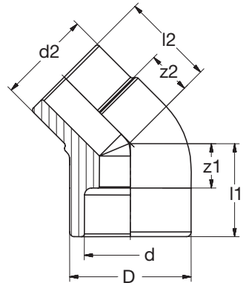
ELBOW 90°

Code	Dn	d	D	l	Z	Pieces/Box
351020001	20	19.5	29	28	13	120
351020002	25	24.5	34	32	16	80
351020003	32	31.5	43	38	20	80
351020004	40	39.4	52	44	23	50
351020005	50	49.4	66.5	52	26.5	30
351020006	63	62.5	84	62	34	20
351020007	75	74.7	101	71	41	12
351020008	90	89.7	120	83	50	6
351020009	110	109.7	148	99	62	3



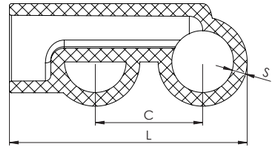
Code	Dn	A	D	S	R1	R2	Pieces/Box
351120002	25	86	24.3	5.1	37	70	40
351120003	32	100	31.3	6.5	40	80	20

LONG ELBOW 90°



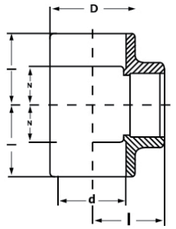
MALE ELBOW 45°

Code	Dn	d	d2	D	l1	l2	z	Pieces/Box
351010061	20	19.5	20.3	28	19.5	23.9	7	150
351010062	25	24.5	25.3	34	21	28.5	9	100



Code	Dn	L	C	S	Pieces/Box
351050022	25	89	40	5.1	20

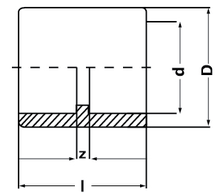
DOUBLE BRANCH-TEE



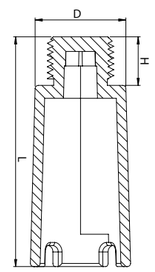
Tee 90°

Code	Dn	d	D	l	Z	Pieces/Box
351050001	20	19.5	29	28	13	80
351050002	25	24.5	33.5	31.5	16	50
351050003	32	31.5	43	38	20	30
351050004	40	39.4	52	44	23	40
351050005	50	49.4	65.7	51.7	28.2	20
351050006	63	62.5	84	61.5	32	6
351050007	75	74.7	100	71	41	10
351050008	90	89.7	120	83	50	6
351050009	110	109.7	148	99	62	2

Code	Dn	d	D	l	Z	Pieces/Box
351070001	20	19.5	29	34	5	150
351070002	25	24.5	34	37	5	120
351070003	32	31.5	43	41	5	60
351070004	40	39.4	52	46	5	80
351070005	50	49.4	65	52	5	70
351070006	63	62.5	84	60	5	36
351070007	75	74.7	99	65	5	32
351070008	90	89.7	120	76	10	14
351070009	110	109.7	148	80	6	7

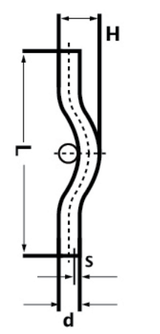


Socket

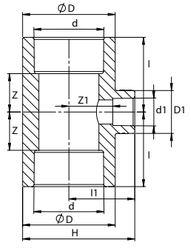


Wall inlet Plug

Code	Dn	O-Ring	H	D	L	Pieces/Box
351080012	20	20.5x3	15	28	71	120



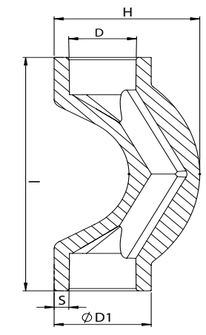
Crossover



Reducing Tee 90°

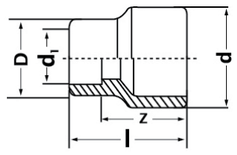
Code	Dn – Dn1 – Dn2	d - d1- d	D	D1	l	l1	Z	Z1	Pieces/ Box
351060001	25- 20- 25	24.5- 19.5- 24.5	34	29	32	32	16	17	140
351060002	32- 20- 32	31.5- 19.5- 31.5	43	34	38	36	20	21	80
351060003	32- 25- 32	31.5- 24.5- 31.5	43	34	38	36	20	20	80
351060004	40- 20- 40	39.4- 19.5- 39.4	52	43	44	39	24	24	60
351060005	40- 25- 40	39.4- 24.5- 39.4	52	43	44	40	23	24	50
351060006	40- 32- 40	39.4- 31.5- 39.4	52	43	44	40	23	22	50
351060007	50- 20- 50	49.4- 19.5- 49.4	65	43	52	46	28	31	30
351060008	50- 25- 50	49.4- 24.5- 49.4	65	43	52	46	28	30	30
351060009	50- 32- 50	49.4- 31.5- 49.4	65	43	52	46	28	28	30
351060010	50- 40- 50	49.4- 39.4- 49.4	85	85	62	62	39	35	30
351060011	63- 20- 63	62.5- 19.5- 62.5	85	43	62	62	35	48	16
351060012	63- 25- 63	62.5- 24.5- 62.5	85	43	62	62	35	46	16
351060013	63- 32- 63	62.5- 31.5- 62.5	85	43	62	62	35	44	16
351060014	63- 40- 63	62.5- 39.4- 62.5	85	85	62	62	35	42	16
351060015	63- 50- 63	62.5- 49.4- 62.5	85	85	62	62	35	39	16
351060016	75- 20- 75	74.7- 19.5- 74.7	100	43	71	71	41	57	12
351060017	75- 25- 75	74.7- 24.5- 74.7	100	43	71	71	41	55	12
351060018	75- 32- 75	74.7- 31.5- 74.7	100	43	71	71	41	53	12
351060019	75- 40- 75	74.7- 39.4- 74.7	100	65	71	71	41	51	12
351060020	75- 50- 75	74.7- 49.4- 74.7	100	65	71	71	41	48	12
351060021	75- 63- 75	74.7- 62.5- 74.7	100	101	71	71	41	44	12
351060022	90- 63- 90	89.7- 62.5- 89.7	120	120	83	83	50	55	6
351060023	90- 75- 90	89.7- 74.7- 89.7	120	120	83	83	50	53	6
351060024	110- 63- 110	109.7- 62.5- 109.7	148	85	99	99	62	71	4
351060025	110- 75- 110	109.7- 74.7- 109.7	148	100	99	99	62	69	4
351060026	110- 90- 110	109.7- 89.7- 109.7	148	120	99	99	62	66	4

Code	d	S	H	L	Pieces/Box
351030001	20	3.4	53	365	100
351030002	25	4.2	56	370	70
351030003	32	5.4	68	370	50



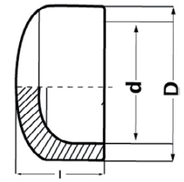
Short Crossover

Reducer



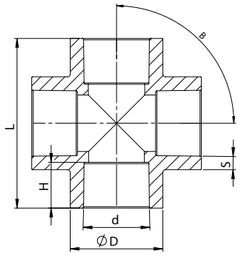
Code	Dn – Dn1	d	d1	D	l	Z	Pieces/Box
351040001	25- 20	25.3	19.5	29	36	22	180
351040002	32- 20	32.3	19.5	29	37	23	120
351040003	32- 25	32.3	24.5	34	39.4	23	120
351040004	40- 20	40.3	19.5	34	43	28	90
351040005	40- 25	40.3	24.5	34	43	27	80
351040006	40- 32	40.3	31.5	43	45	27	60
351040007	50- 20	50.4	19.5	43	51	36	50
351040008	50- 25	50.4	24.5	43	51	35	50
351040009	50- 32	50.4	31.5	43	51	33	40
351040010	50- 40	50.4	39.4	52	53	33	30
351040011	63- 20	63.4	19.5	34	56	42	25
351040012	63- 25	63.4	24.5	34	56	40	25
351040013	63- 32	63.4	31.5	43	58	40	25
351040014	63- 40	63.4	39.4	52	60	40	20
351040015	63- 50	63.4	49.4	65	63	40	20
351040016	75- 50	75.5	49.4	65	67	44	16
351040017	75- 63	75.5	62.5	80	71	44	12
351040018	90- 63	90.6	62.5	80	78	51	12
351040019	90- 75	90.6	74.7	99	81	51	12
351040022	110- 90	109.7	89.7	110	93	61	4

Code	Dn	d	D	l	Pieces/Box
351080001	20	19.5	28.6	25	250
351080002	25	24.5	34	28	150
351080003	32	31.5	43	31.3	100
351080004	40	39.4	52	36	60
351080005	50	49.4	65	40	80
351080006	63	62.5	79	48	60
351080007	75	74.7	99	54	16
351080008	90	89.7	120	66	8
351080009	110	109.7	148	79	8



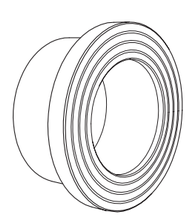
Cap

Cross Tee



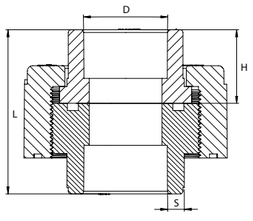
Code	Dn	D	d	H	L	S	B	Pieces/Box
351050062	25	34.5	24.5	16	60	4.4	90°	100
351050063	32	43	31.5	18	75	5.8	90°	50

Code	Dn	d	D	D1	l	Z	h	Pieces/Box
351090001	63	62.5	89.5	75.6	40.9	12.9	15.5	24
351090002	75	74.7	105	89	37	7.5	15	18
351090003	90	89.7	125.5	110	43.5	9.5	19.5	10
351090004	110	109.7	158	132	51	13.35	18	7



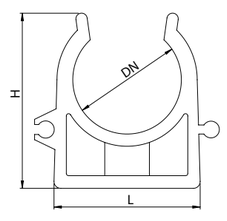
Flange

Union

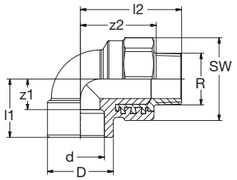


Code	D	H	L	S	Pieces/Box
371080001	20	20	45	4.3	140
371080002	25	23	51	4.8	100
371080003	32	27	61	5.5	60

Code	Dn	d	D	l	Pieces/Box
351099945	20	33	26	14	250
351099946	25	38	32	14	200
351099947	32	46	38	15	150

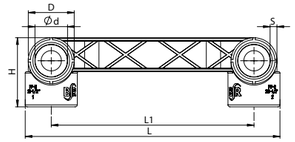


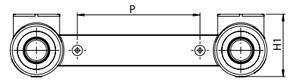
Pipe Clamps



Code	Dn – Dn1	d	D	l	l1	Z	Z1	SW	Pieces/Box
361010001	20- ½	19.5	29	28	34	14	49	36	70
361010003	25- ½	24.5	34	32.27	38	16	53	36	60
361010004	25- ¾	24.5	34	32	40	16	56	44	40
361010006	32- 1	31.5	43	38	48	20	66	51	30

Elbow 90° Male Thread



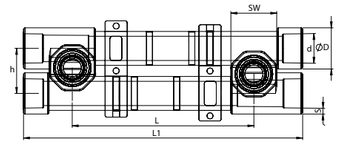


Code	Dn-Rp	D	d	H	H1	L	L1	S	P	Pieces/ Box
361020007	20-½"	29	19.5	41	46	186	150	4.4	90	48
361020006	25-½"	34	24.5	53	47	186	150	4.8	90	32

Double Elbow with Female Thread

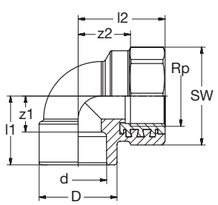
Code	Dn – Rp	d	D	D1	L	L1	h	T	Z	Z1	Pieces /Box
361020001	20- ½	19.5	35	29	35	27	15	40	21	11	40
361020002	25- ½	24.5	35	29	37	30	17	40	23	14	40
361020003	25- ¾	24.5	43	34	43	35	22	50	28	19	20
361020004	32- ¾	31.5	43	43	43	35	22	50	28	17	20

Bracket Elbow Female thread



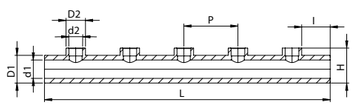
Code	Dn-Rp	L adjustable	D	d	SW	L1	S	h	Pieces/ Box
358091008	20- ½	100 - 135 - 150	29	19.5	38	230	4.4	30.5	28
358091009	25- ½	100 - 135 - 150	34	24.5	38	230	4.8	37.75	20

Adjustable Water Battery



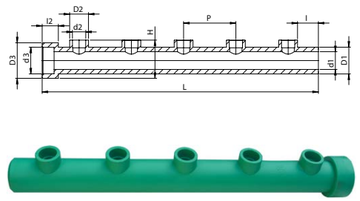
Code	Dn - Rp	d	SW	D	l2	l1	z1	z2	Pieces/ Box
361020005	32-1	31.5	52	43	49	38	28	20	20

Elbow 90 female thread



Code	Dn-Dn1	D1	d1	D2	d2	L	P	I	H	Pieces / Box
358091003	50 - 32	50.2	33.2	43	31.1	650	123	50	70	19
358091001	63 – 32	63.2	42	43	31.1	650	123	50	83	15

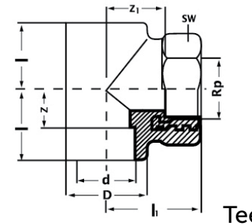
Manifold welding without end socket



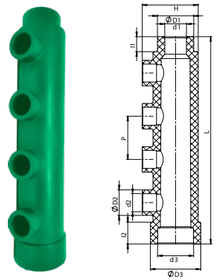
Manifold welding - End socket

Code	Dn-Dn1	D1	d1	D2	d2	D3	d3	L	P	I	I2	H	Pieces / Box
358091004	50 - 32	50.2	33.2	43	31.1	66	49	650	123	50	31.5	78	19
358091002	63 - 32	63.2	42	43	31.1	83	61.9	650	123	50	37.5	93	12

Code	Dn- Rp	d	D	I	I1	Z	Z1	SW	Pieces/Box
361030001	20- ½	19.5	29	28	34	14	20	36	60
361030003	25- ½	24.5	34	32	38	16	24	36	50
361030004	25- ¾	24.5	34	32	40	16	25	44	40
361030005	32- ¾	31.5	43	38	45	20	30	44	20
361030006	32- 1	31.5	43	38	48	20	30	51	20



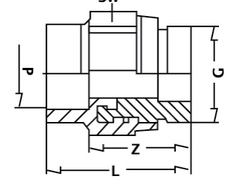
Tee 90° Female Thread



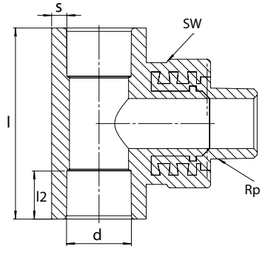
Manifold Welding 4 outlets

Code	DN	L	D1	d1	D2	d2	D3	d3	P	H	I1	I2	Pieces / Box
358091107	50/25	322	50.2	33.2	34.6	24.5	69.5	49.3	70	79	22	31.5	20
358091102	50/32	322	50.2	33.2	44.5	31.5	69.5	49.3	70	79	22	31.5	20
358091105	63/25	337	63.3	42	34.6	24.5	87.7	62.2	70	93.1	26	37.5	20
358091104	63/32	337	63.3	42	44.5	31.5	87.7	62.2	70	93.1	36	37.5	20

Code	Dn-R	d	L	Z	Pieces/Box
361050001	20- ½	19.5	50	34	60
361050002	20- ¾	19.5	53	38	60
361050003	25- ½	24.5	51	35	80
361050004	25- ¾	24.5	54	38	40
361050005	32 – ¾	31.5	56	37	50
361050006	32- 1	31.5	62	46	40
361050007	40- 1 ¼	39.4	72	51	27
361050009	50- 1 ½	49.4	77	53	24
361050010	63- 2	62.5	88	60	12
361050011	75- 2½	74.7	102	71	2
361050012	90- 3	89.7	143	111	4
361050013	110- 4	109.7	161	124	3



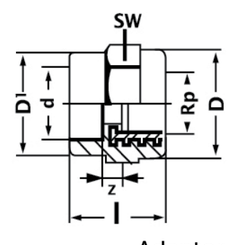
Adaptor Socket Male Thread



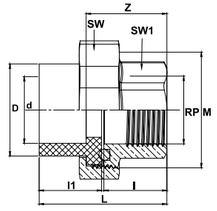
Tee Male Thread

Code	Dn-Rp	SW	I2	I	S	d	Pieces/Box
361030011	20- ½	38	14.5	56	4.4	19.5	60
361030012	20- ¾	45	14.5	56	4.4	19.5	40
361030013	25- ½	38	16	61	4.9	24.5	40
361030014	25- ¾	45.2	16	69	4.9	24.5	40

Code	Dn-Rp	D	D	D1	I	Z	SW	Pieces/Box
361060001	20- ½	19.5	35	29	40	11	36	60
361060003	25- ½	19.5	35	34	41	11	36	60
361060004	25- ¾	24.5	43	34	42	11	44	50
361060005	32- ¾	24.5	43	43	44	11	44	60
361060006	32- 1	31.5	50	43	48	12	51	40
361060008	40- 1 1/4	39.4	62	52	54	13	63	36
361060010	50-1½	49.4	69	64	57	14	70	27
361060011	63- 2	62.5	84	79	68	19	85	12
361060012	75- 2½	74.7	113	99	82	22	114	4
361060013	90- 3	89.7	129	124	92	27	-	8
361060014	110- 4	109.7	160	151	165	27	-	4

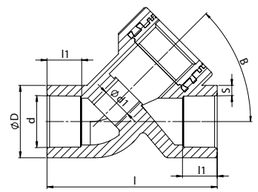


Adaptor Socket Female Thread



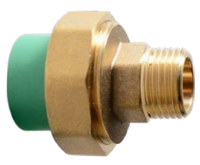
Union Female Thread

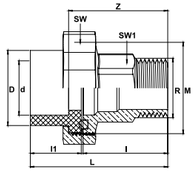
Code	Dn - Rp	D	d	L	l	l1	Z	SW	SW1	Rp	M	Pieces / Box
371073001	20-1/2"	33.85	19.5	43.5	21.9	20.55	28	40	25	1/2"	36 x 1.5	80
371073002	25-3/4"	38.8	24.5	47.4	22.8	22.7	29	45.7	31	3/4"	42 x 1.5	72
371073003	32-1"	49.4	31.5	52.15	23.1	27	31.15	56	38	1"	52 x 1.5	36
371073004	40-11/4	54	39	51.5	20.5	29	30.5	68	46	11/4"	64 x 1.5	24
371073005	50-11/2	67.5	48.5	58	23	32	35	85	54	11/2"	80 x 2	16



Y Filter Female Thread

Code	Dn - Rp	D	d	d1	s	l	l1	B	Pieces / Box
361040011	20 - 1/2"	28	19.5	12	4.25	70	14.5	45°	100
361040012	25 - 3/4"	34	24.5	14	4.75	80	16	45°	80
361040013	32 - 3/4"	42.7	31.5	14	5.6	80	18	45°	60



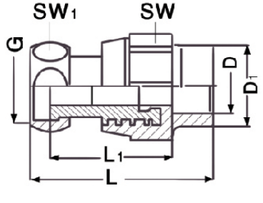


Union Male Thread

Code	Dn - R	D	d	L	l	l1	Z	SW	SW1	R	M	Pieces / Box
371073011	20 - 1/2"	33.85	19.5	58	36.25	20.55	42.4	40	21	2/1"	36 x 1.5	64
371073012	25 - 3/4"	38.8	24.5	62.2	37.6	22.7	43.5	45.7	27	4/3"	42 x 1.5	48
371073013	32 - 1"	49.4	31.5	69.5	40.4	27	48.5	56	33.5	1"	52 x 1.5	36
371070015	50 - 11/2"	68	48	78	35	41	54	85	49	11/2"	80 x 2	12

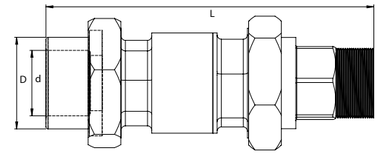
Check Valve-PPR Ends

Code	Dn-	d	D	l	Z	Pieces/ Box
371060041	20- ½	20	14.5	50	115	24
371060031	25- 3/4	25	16	62	133	16
371060034	32- 3/4	32	18	91	160	6



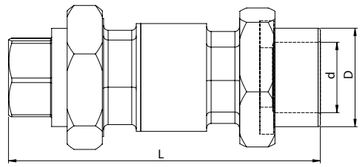
Socket with loose nut

Code	Dn- Rp	D1	D	H	SW1	SW2	L	Pieces/ Box
351070021	20- ½	20	19.5	14	36	23	35	60
351070062	20- 3/4	20	19.5	14	36	31	35	60
351070063	25- 3/4	25	24.5	14	36	31	35	60



Check Valve-PPR & Male thread

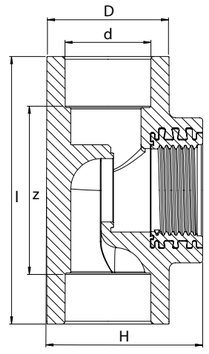
Code	Dn	d	D	L	Pieces/ Box
371060038	25- ¾	19.2	32	132	22
371060033	32 – 1	24.1	36	150	12
371060036	50 – 1 ½	31.1	43	178	6



Check Valve-PPR & female thread

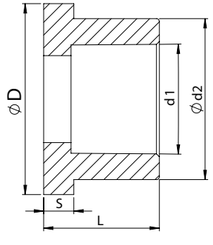
Code	Dn	d	D	L	Pieces/ Box
371060037	25- ¾	19.2	32	120	22
371060032	32 – 1	24.1	36	138	16
371060035	50 – 1 ½	31.1	43	166	6

Tee female valve



Code	Dn	D	d	I	Z	H	Pieces/ Box
361040001	20- ¾	32	19.5	82.5	53.5	50.5	80
361040002	25- ¾	36	24.5	82.5	51.5	52.5	80
361040003	32- ¾	42.5	31.5	82.5	45.5	56.8	60

Flang of Ball Valves



Code	Dn	D	d1	d2	L	S	Pieces/ Box
351091001	20	33.85	19.5	28.5	20.55	5.4	150
351091002	25	38.8	24.5	33.2	22.7	5.5	100
351091003	32	49.4	31.5	43	27	6.1	50
351091004	50	77	49	67.7	32.2	9	30

PP-RCT Fittings for Water Supply Solutions

Material Properties of PP-RCT

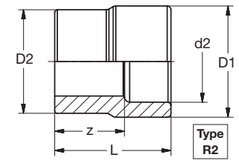
- PP-RCT (Polypropylene-Random Crystallinity Temperature) is the new generation of PP-R material.

This new material is designated by ISO 1043-1 and has been added to DIN 8078 and EN ISO 15874.

- PP-RCT made a big breakthrough in plastic pipes due to the very small crystallites of microscopic hexagonal structure which result in high pressure-temperature rating.
- Thanks to its features and performance, it has been able to win the trust of designers and customers.

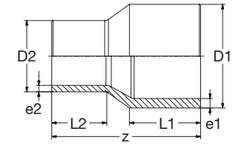
The Advantage of PP-RCT

- Higher Pressure temperature rating.
- Up to 25% weight reduction for same pressure class.
- Higher flow rate (water capacity) for the same outer diameter.
- Easier in handling, transportation, and installation.
- Higher safety factor.



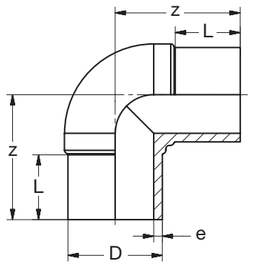
Code	D1-D2	D2	L	Z	KG
351040020	110-63	85	87	60	0.32
351040021	110-75	100	90	60	0.37

PP-RCT Reducer



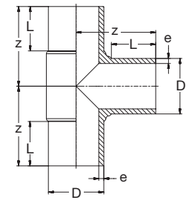
Code	D1-D2	e1	e2	L1	L2	z	KG
351040026	160-110	14.6	10.0	110	93	255	1.15

PP-RCT Reducer



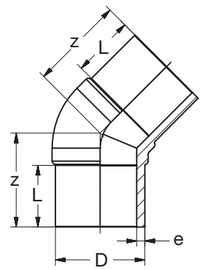
PP-RCT Elbow 160mm/90°

Code	D	e	L	Z	KG
351020011	160	14.6	117	210	3.0



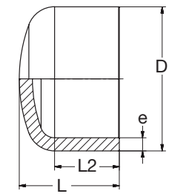
PP-RCT Tee 90° long butt SDR11

Code	D	e	L	Z	KG
351050011	160	14.6	124	225	4.01



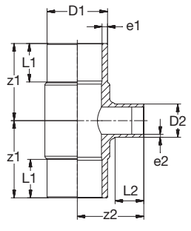
PP-RCT Elbow 160mm/45°

Code	D	e	L	z	KG
351010011	160	14.6	113	169	2.4



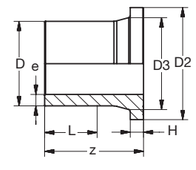
PP-RCT Cap long butt green

Code	D	e	L	l2	KG
351080011	160	14.6	140	100	0.91



PP-RCT Tee 90° long butt SDR11

Code	D1-D2	e1	e2	L1	L2	z1	z2	KG
351060027	160-90	14.6	8.2	111	84	212	190	3.53
351060028	160-110	14.6	10.0	111	93	212	197	3.56



PP-RCT Flange adaptor spigot grooved long but

Code on	D	e	D2	D3	H	L	Z	KG
351090006	160	14.6	212	175	25	110	175	1.57

Bänninger PP-R/ PP-RCT for Outdoor Applications – UV-Resistant system for warm and cold water supply

While the green PP-R pipes and fittings are designed to be used indoor, we developed an ultraviolet resistant water supply system to avoid the corrosion of the plumbing system under high temperatures and all weather conditions that might affect it.

Bänninger – UV pipes consist of well-established four layers;

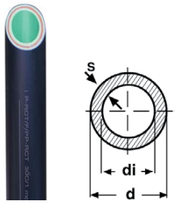
1. The first-outer layer is coated with a black UV-resistant material to ensure pipe long-term durability and prevent PP-R material from expansions and deformities.
2. The second layer of PP-R Polypropylene Copolymer, which is ideally integrated within the pipe structure to retain high water flow.
3. The unique third layer of absolute fiber/aluminum provides high rigidity and stability that prevents outside air from infiltration into the pipe.
4. The forth-inner layer is made of PP-R where the smooth surface is in direct contact with hot and cold water to guarantee you a safer and better way of water transportation.

Advantages of Black UV Pipes:

- Linear expansion coefficient is only 20-30% of ordinary PP-R pipe, completely resolves the stretching problem of common plastic pipe.
- Enhances pipe rigid, prevents droop down phenomenon, and also reduces the density and number of supporting points, thus cuts down the total cost of installation.
- Higher pressure-resistant level and longer working life under usual vibration.
- Better high-temperature resistance, and obvious energy-saving effect; used in water heating system, the normal temperature is up to 95-100 degrees, it not only increases the medium temperature.
- Solves the oxygen permeability of the pipeline, the inner surface is non-toxic, fine sealing, and sphagnum will not appear. The middle layer of the pipe completely prevents outside air from infiltration into pipe inside, thereby inhibits algae growth, and maintains fresh pure water.

Note: All Bänninger UV fittings are injected with UV-resistant material to ensure long-term durability

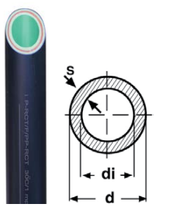
PP-R Pipes with UV resistance / outdoor water supply solutions



Material: PP-R with integrated fiber reinforced layer and external UV layer
Pipes Series: SDR6/S2.5
Standard: DIN 8077/DIN8078, DIN EN ISO 15874
Color: internal layer is green and outer layer is black.
Pipe: black pipes with laser labelling system
Form Supplied: 4 meters straight length

Code	D	di	S	Water Capacity Lit/m	Kg/m	m/bag
Lit/m	Kg/m	m/bag				
331050001	20 mm	13.2	3.4	0.187	0.137	160
331050002	25 mm	16.6	4.2	0.278	0.216	100
331050003	32 mm	21.2	5.4	0.451	0.353	60
331050004	40 mm	26.6	6.7	0.711	0.637	40
331050005	50 mm	33.4	8.3	1.068	0.988	20
331050006	63 mm	42.0	10.5	1.695	1.336	16
331050007	75 mm	50.0	12.5	2.404	1.963	12
331050008	90 mm	60.0	15.0	3.452	2.827	8
331050009	110 mm	73.2	18.3	5.148	4.094	8

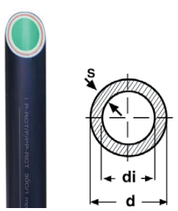
Multilayer pipes with fiber Reinforced UV in Black PN 20 SDR 6



Material: PP-R with integrated fiber reinforced layer and external polypropylene layer
Pipe series: SDR 7.4/S 3.2
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: internal layer is green and outer layer is black.
Form Supplied: 4 meter straight length.

Code	D	di	S	Water Capacity Lit/m	Kg/m	m/bag
331050024	20 mm.	14.4	2.8	0.163	0.160	160
331050025	25 mm.	18	3.5	0.254	0.242	100
331050026	32 mm.	23.2	4.4	0.415	0.392	60
331050027	40 mm.	29	5.5	0.660	0.597	40
331050028	50 mm.	36.2	6.9	1.029	0.949	20
331050029	63 mm.	45.8	8.6	1.647	1.434	16
331050030	75 mm.	54.4	10.3	2.323	2.127	12
331050031	90 mm.	65.4	12.3	3.358	2.956	8
331050032	110 mm.	79.8	15.1	4.999	4.320	8

Multilayer pipes with fiber Reinforced UV in Black PN 16 SDR 7.4



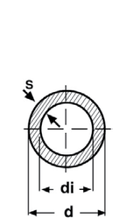
Material: PP-RCT with integrated fiber reinforced layer and external polypropylene layer
Pipe series: SDR 7.4/S 3.2
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: internal layer is green and outer layer is black.
Pipe: black pipes with laser labeling system
Form Supplied: 4 meter straight length, also in coils for some diameters

Code	D	di	S	Water Capacity Lit/m	Kg/m	m/bag
331050011	20 mm.	14.4	2.8	0.163	0.160	160
331050012	25 mm.	18	3.5	0.254	0.242	100
331050013	32 mm.	23.2	4.4	0.415	0.392	60
331050014	40 mm.	29	5.5	0.660	0.597	40
331050015	50 mm.	36.2	6.9	1.029	0.949	20
331050016	63 mm.	45.8	8.6	1.647	1.434	16
331050017	75 mm.	54.4	10.3	2.323	2.127	12
331050018	90 mm.	65.4	12.3	3.358	2.956	8
331050019	110 mm.	79.8	15.1	4.999	4.320	8

Multilayer pipes with fiber Reinforced UV in Black PN 20 SDR 7.4

Code	D	di	S	Water Capacity Lit/m	Kg/m.	m/bag
331080101	20 mm.	13.2	3.4	0.187	0.137	160
331080102	25 mm.	16.6	4.2	0.216	0.216	100
331080103	32 mm.	21.2	5.4	0.353	0.353	60
331080104	40 mm.	26.6	6.7	0.637	0.637	40
331080105	50 mm.	33.4	8.3	0.988	0.988	20
331080106	63 mm.	42.0	10.5	1.336	1.336	16

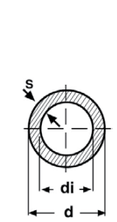
Material: PP-R with integrated Aluminum reinforced layer and external polypropylene layer
Pipe series: SDR 6/S 2.5
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: internal layer is green and outer layer is black.
Form Supplied: 4 meter straight length.



Multilayer pipes with Aluminum Reinforced UV in Black PN 20 SDR 6/S 2.5

Code	D	di	S	Water Capacity Lit/m	Kg/m.	m/bag
331080001	20	14.4	2.8	0.163	0.16	160
331080002	25	18	3.5	0.254	0.242	100
331080003	32	23.2	4.4	0.415	0.392	60
331080004	40	29	5.5	0.66	0.597	40
331080005	50	36.2	6.9	1.029	0.949	20
331080006	63	45.8	8.6	1.647	1.434	16

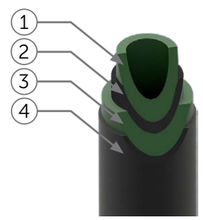
Material: PP-R with integrated Aluminum reinforced layer and external polypropylene layer
Pipe series: SDR 6/S 2.5
Standard: DIN 8077/DIN 8078, DIN EN ISO 15874
Color: internal layer is green and outer layer is black.
Form Supplied: 4 meter straight length.



Multilayer pipes with Aluminum Reinforced UV in Black PN 16 SDR 7.4

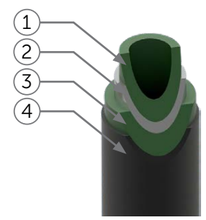
Multilayer pipes with fiber Reinforced UV Layers

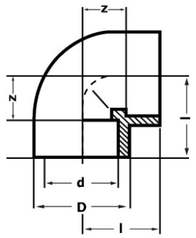
1- Green PP-R Layer
2- Fiber Layer
3- Green PP-R Layer
4- Black UV Resistance Layer



Multilayer pipes with Aluminum Reinforced UV

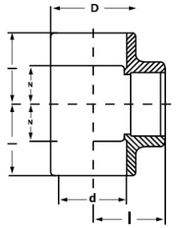
1- Green PP-R Layer
2- Aluminum Layer
3- Green PP-R Layer
4- Black UV Resistance Layer





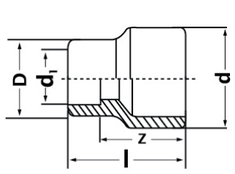
ELBOW 90°

Code	Dn	d	D	l	Z	Pieces/Box
355020002	25	24.5	34	32	16	80
355020003	32	31.5	43	38	20	80
355020004	40	39.4	52	44	23	50
355020005	50	49.4	66.5	52	26.6	30
355020006	63	62.5	84	62	34	20



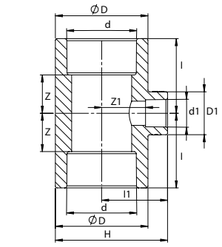
Tee 90°

Code	Dn	d	D	l	Z	Pieces/Box
355050002	25	24.5	33.5	31.5	16	50
355050003	32	31.5	43	38	20	30
355050004	40	39.4	52	44	23	40
355050005	50	49.4	65.7	51.7	28.2	20
355050006	63	62.5	84	61.5	32	6



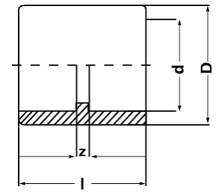
Reducer

Code	Dn - Dn1	d	d1	D	l	Z	Pieces/Box
355040002	32- 20	32.3	19.5	29	37	23	120
355040003	32- 25	32.3	24.5	34	39.4	23	120
355040009	50- 32	50.4	31.5	43	51	33	40
355040010	50- 40	50.4	39.4	52	53	33	30
355040015	63- 50	63.4	49.4	65	63	40	20



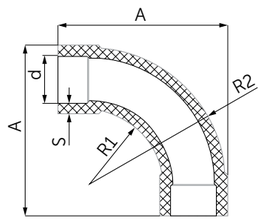
Reducing Tee 90°

Code	Dn – Dn1 – Dn2	d - d1- d	D	D1	l	l1	Z	Z1	Pieces/ box
355060002	32- 20- 32	31.5- 19.5- 31.5	43	34	38	36	20	21	80
355060015	32- 25- 32	31.5- 24.5- 31.5	43	34	38	36	20	20	80
355060009	50- 32- 50	49.4- 31.5- 49.4	65	43	52	46	28	28	30
355060003	63- 50- 63	62.5- 49.4- 62.5	85	85	62	62	35	39	16



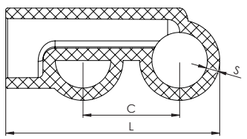
Socket

Code	Dn	d	D	l	Z	Pieces/Box
355070002	25	24.5	34	37	5	120
355070003	32	31.5	43	41	5	60
355070004	40	39.4	52	46	5	80
355070005	50	49.4	65	52	5	70
355070006	63	62.5	84	60	5	36



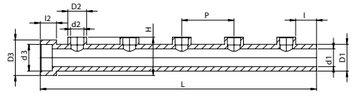
LONG BEND 90°

Code	Dn	A	D	S	R1	R2	Pieces/Box
355120002	25	86	24.3	5.1	37	70	40
355120003	32	100	31.3	6.5	40	80	20



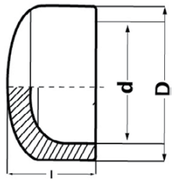
DOUBLE BRANCH-TEE

Code	Dn	L	C	S	Pieces/Box
355050022	25	89	40	5.1	20



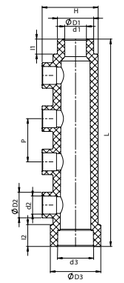
Manifold welding - End socket

Code	Dn-Dn1	D1	d1	D2	d2	D3	d3	L	P	I	I2	H	Pieces/ Box
358091014	50 - 32	50.2	33.2	43	31.1	66	49	650	123	50	31.5	78	19
358091012	63 - 32	63.2	42	43	31.1	83	61.9	650	123	50	37.5	93	12



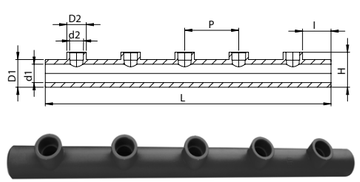
Cap

Code	Dn	d	D	l	Pieces/Box
355080002	25	24.5	34	28	150
355080003	32	31.5	43	31.3	100
355080004	40	39.4	52	36	60
355080005	50	49.4	65	40	80
355080006	63	62.5	79	48	60



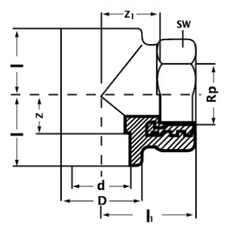
Manifold Welding 4 outlets

Code	DN	L	D1	d1	D2	d2	D3	d3	P	H	I1	I2	Pieces / Box
358091115	50/25	322	50.2	33.2	34.6	24.5	69.5	49.3	70	79	22	31.5	20
358091114	50/32	322	50.2	33.2	44.5	31.5	69.5	49.3	70	79	22	31.5	20
358091117	63/25	337	63.3	42	34.6	24.5	87.7	62.2	70	93.1	26	37.5	20
358091112	63/32	337	63.3	42	44.5	31.5	87.7	62.2	70	93.1	36	37.5	20



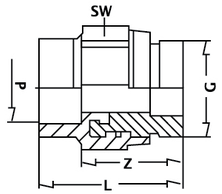
Manifold welding without end socket

Code	Dn-Dn1	D1	d1	D2	d2	L	P	I	H	Pieces/ Box
358091013	50 - 32	50.2	33.2	43	31.1	650	123	50	70	19
358091011	63 – 32	63.2	42	43	31.1	650	123	50	83	15



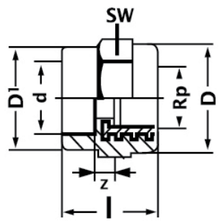
Tee 90° Female Thread

Code	Dn- Rp	D	D	I	I1	Z	Z1	SW	Pieces/Box
365030006	32- 1	31.5	43	38	48	20	30	51	20



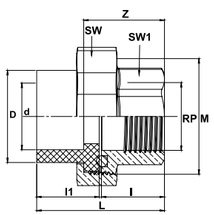
Adaptor Socket Male Thread

Code	Dn-G	d	L	Z	Pieces/Box
361050006	32- 1	31.5	62	43	40
361050007	40- 1 ¼	39.4	72	51	27
361050009	50- 1 ½	49.4	77	53	24
361050010	63- 2	62.5	88	60	12



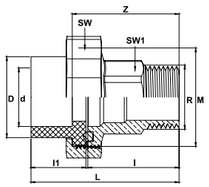
Adaptor Socket Female Thread

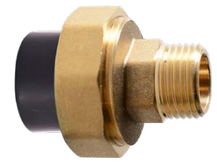
Code	Dn-Rp	D	D	D1	l	Z	SW	Pieces/Box
365060006	32- 1	31.5	50	43	48	12	51	40
365060008	40- 1 1/4	39.4	62	52	54	13	63	36
365060010	50-1½	49.4	69	64	57	14	70	27
365060011	63- 2	62.5	84	79	68	19	85	12



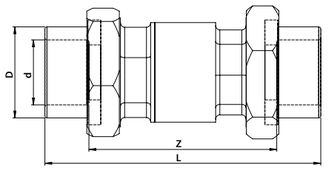
Union Female Thread

Code	Dn - Rp	D	d	L	l	l1	Z	SW	SW1	Rp	M	Pieces/ Box
371073023	32 - 1"	49.4	31.5	52.15	23.1	27	31.15	56	38	1"	52 x 1.5	36
371070025	50-1/1/2	67.5	48.5	58	23	32	35	85	54	11/2"	80 x 2	16



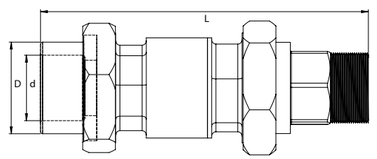


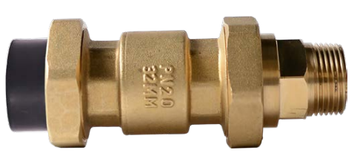
Union Male Thread



Check Valve-PPR Ends

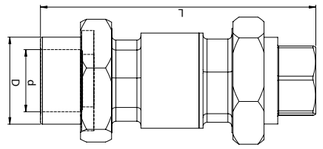
Code	Dn	d	D	l	Z
371060141	25	19.2	32	50	115
371060131	32	24.1	36	62	133
371060134	50	31.1	43	91	160





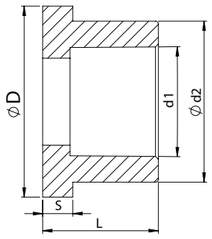
Check Valve-PPR & Male thread

Code	Dn	d	D	L
371060138	25- ¾	19.2	32	132



Check Valve-PPR & female thread

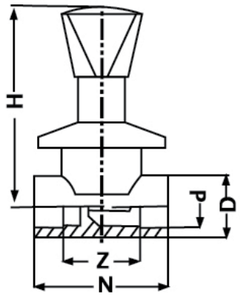
Code	Dn	d	D	L
371060137	25 – ¾	19.2	32	120



Flang of Ball Valves

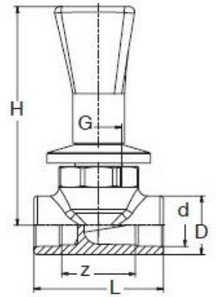
Code	Dn	D	d1	d2	L	S	Pieces/ Box
351095001	20	33.85	19.5	28.5	20.55	5.4	150
351095002	25	38.8	24.5	33.2	22.7	5.5	100
351095003	32	49.4	31.5	43	27	6.1	50
351095004	50	77	49	67.7	32.2	9	30

BR Valves



Dn-Rp	d	D	Z	N	H
20- 3/4	19.5	32	53.5	82.5	112
25- 3/4	24.5	36	51.5	82.5	112
32- 3/4	31.5	42.5	45.5	82.5	112

Concealed Valve

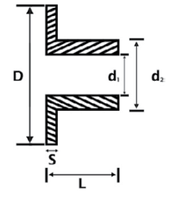


Dn-Rp	d	D	Z	L	H
25- 3/4	24.5	36	51.5	82.5	118

Elite concealed valve

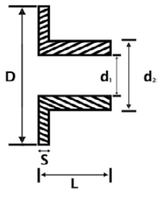
Dn-Rp	d	D1	Z	L	H	Pieces/Box
20- ½	19.5	32	53.5	82.5	69	150
25- ½	24.5	36	51.5	82.5	69	150
32- 3/4	31.5	42.5	45.5	82.5	69	150

Straight seated valve



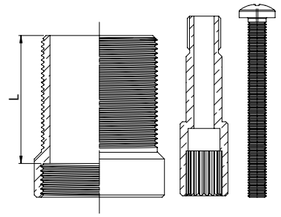
d	d1	d2	D	L	S
32	31.5	43	49.4	27	6.1
40	39	54.5	61.2	29.5	7.7
50	49	67.7	77	32.2	9
63	61.9	87	96	36	11

Ball Valve with UV resistance

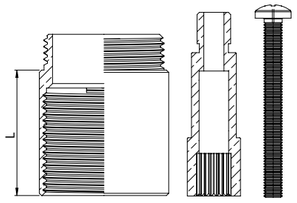


d	d1	d2	D	L	S
20	19.5	28.5	33.85	20.55	4.6
25	24.5	33.2	38.8	22.7	5.5
32	31.5	43	49.4	27	6.1
40	39	54.5	61.2	29.5	7.7
50	49	67.7	77	32.2	9
63	61.9	87	96	36	11
75	73.4	103	115	43.7	13.15
90	88.2	117	131	45.7	15
110	108	145	162.25	48	16

Ball Valve



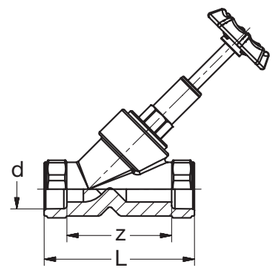
Code	L
371010002	28



Code	L
371010001	29

Elongation Kit

Dn - Rp	Dn - Rp	d	L	Z	Pieces / Box
371060051	20 - 1/2"	19.5	70	41	60
371060052	25 - 3/4"	24.5	80	48	40
371060053	32 - 3/4"	31.5	80	44	40



Y Seated Valve

An Environmentally Responsible Product

INDEX

Product features

Product features

Raw materials

Pipes and fittings of Bänninger (B.R) system are made of polypropylene random copolymer, type 3 (PP-R).

This material is known for its strength, stability and resistance to high temperatures. Physical and chemical properties of the material meet the special requirements of drinking water supply and heating systems.

Polypropylene (PP) is a thermoplastic polymer and is non-hazardous to human health. It is manufactured in the chemical industry by polymerization which is a process of combining many small molecules known as monomers into a covalently bonded chain or network of repeated polypropylene monomer as seen in the below diagram:

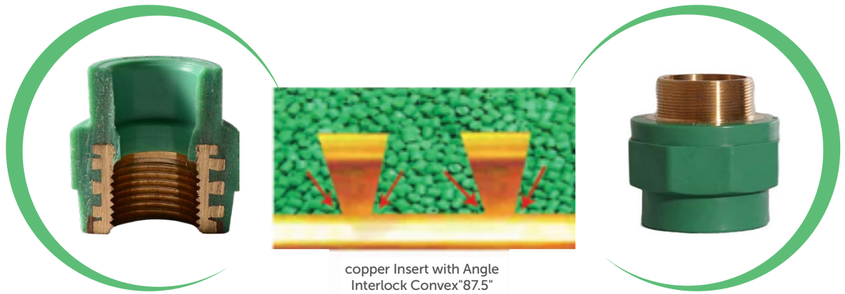
2.1 scope

Bänninger products offer a superior German-quality piping system that could be equally installed in the residential and the industrial field:

- Sanitary applications.
- Heating & air-conditioning systems.
- Compressed air installations.
- Watering systems for greenhouses and gardens.
- Transporting liquid material.
- Vacuum installations.
- In the chemical industry for the flow of various fluids.

Bänninger (B.R) is an excellent choice for piping of clean hot & cold water. (Fig. A)
Bänninger (B.R) is certified by the European Water Authority (DVGW) under standard DIN 50930 -6
Bänninger (B.R) uses the best unique thread design and makes the strongest correlation feature between PP-R & copper.

Unlike other products, this correlation gets more and more stronger once the temperature increases, these features reflect on lifetime durable products.



Cross section shows the strength of correlation between copper and polypropylene

copper Insert with Angle Interlock Convex"87.5"

Copper insert

2.2 chemical resistance

Bänninger (B.R) is a polyolefin polymer that features a high molecular weight. Therefore, it is more resistant to chemicals such as acid, lime or cement, See (fig. E). The resistance of products which are not submitted to the following factors: mechanical stress, various fluids, 20°c 60°c and 100°c temperatures according to ISO TR7471.

2.3 resistance to current strays

Like most thermoplastic products, Bänninger (B.R) is a poor electrical conductor. Therefore, there is no risk of stray currents occurring.

2.4 Soundproofing

The elasticity of Bänninger (B.R) pipes makes it viable to absorb and eliminate almost all vibrations that would normally occur in the traditional cast iron pipes. Therefore, Bänninger (B.R) is highly soundproof at no extra cost.

2.5 low thermal conductivity

Bänninger (B.R) has a low thermal conductivity (0.24 W/ m.K) that reduces the heat dispersion of the fluid that it conveys. Also, it reduces the condensation, which is normally formed on the outside of the generic metal pipes, under specific hygrometric conditions.

2.6 Low pressure loss

The inside surface of Bänninger (B.R) is sleek, smooth with very few irregularities (0.0070 µ), which convey a significant reduction in pressure loss. As a result, limestone cannot be built up inside the pipe.

2.7 No toxicity

The raw material used for the production of Bänninger (B.R) is absolutely non-toxic and complies with the most up-to-date national and international regulations.

2.8 Easy workability

One of the major attractions of the Bänninger (B.R) system is that it is extremely light and easy to weld and install. Our pipes, with diameters ranging from 20 mm to 110 mm, are extremely simple to assemble, providing the suitable polyfusion device. (See chapters 3 & 4)

2.9 UV Resistance

Bänninger (B.R) black coated pipes are UV-resistant but must not be installed in an exposed area. Bänninger (B.R) pipes and fittings are equipped with a stabilizer which allows for safe transport and installation. However, they should not be stored for more than six months in the open air.

2.10 Cracking Resistance under Stress

The values determining the time resistance capacity of the system are the following:
Mechanical stress = Pressure
Thermal strain = Temperature
Stress duration = Time
The relationship between the above parameters can be controlled through regression curves. Bänninger (B.R) minimum

resistance values have been determined through internal pressure tests, at various temperature intervals: 20, 40, 60, 80, 95, 120 °C. A logarithmic graphic representation shows the comparative tensions, the lifetime (in years), and the regression curves at various temperatures according to the DIN 8078 standard. See (fig. A)

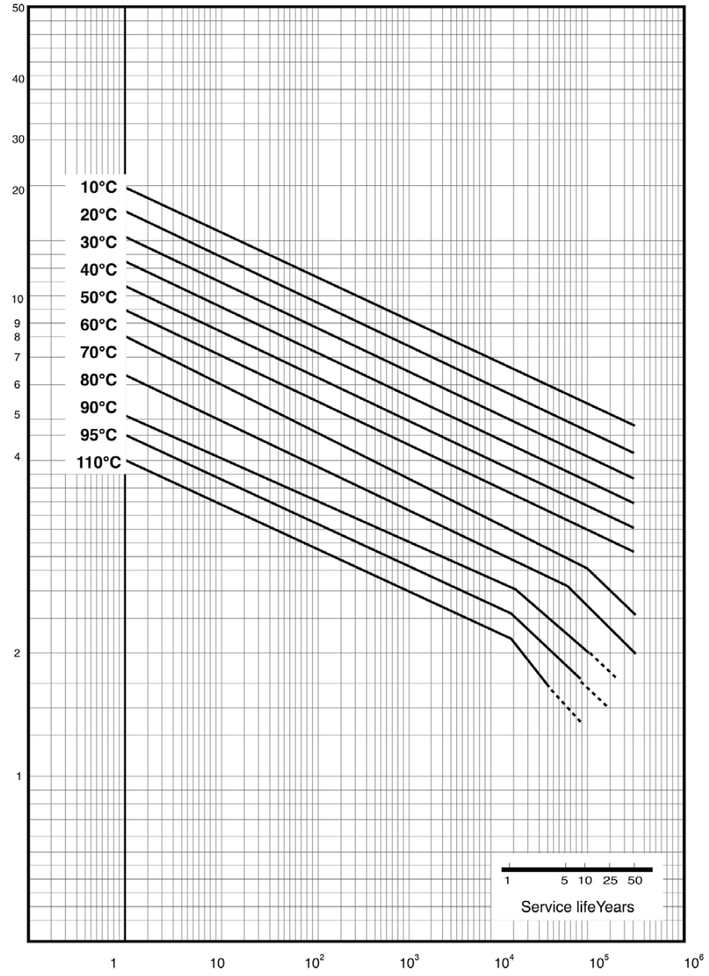
2.11 Advantages of Bänninger (B.R) Piping System

Bänninger (B.R) provides all the necessary parts, for a complete and easy installation, from the beginning to the end, saying goodbye to the conventional problems of the past. It is guaranteed to feel and see the difference with the Bänninger (B.R) piping system. Bänninger (B.R) is manufactured with Superior German quality. Bänninger (B.R) is made of corrosion resistant material, putting an end to old corrosion complications. Enjoy some serenity and peacefulness with Bänninger (B.R) because it is not as noisy as metal pipes. Unlike the alternatives, Bänninger (B.R) is made of opaque polypropylene, which is a nonpolluting material, preventing algae from growing.

Bänninger (B.R) is completely recyclable, with no risk of air pollution, making it an environmentally-friendly system.

- Long lifetime thanks to their resistance to environmental influences; non-corrosive even after 50 years.
- They reduce the risk of condensation to a minimum, which is the characteristic of the metal installation.
- Great welding ability as all parts can be connected with a welder or electrical socket.
- Low weight (9 times lighter than steel) which makes it easier for transportation and handling.
- High resistance to inner pressure.
- No harmful gas emission from burning.
- High cracking resistance under stress.

Diagram of pressure tests of Bänninger (B.R)



Utilization section for pipes and fittings of Smart Home according to DIN 8078

Cold water supply:

Permanent operating temperature up to 20°C
Permanent operating pressure up to 20 bar

Hot water supply:

Permanent operating temperature up to 70°C
Permanent operating pressure up to 10 bar

Heating supply:

Permanent operating temperature up to 70°C
Permanent operating pressure up to 3 bar

The utilization of at least 50 years

Physical Characteristics

CHARACTERISTICS	METHODS	UNITS	VALUES
Specific weight	ISO/R 1183	g/cm3	0,897
Melt index at 190°c with 5 KG.	ISO 1133	g/10 min	0,5
Melt index at 230°with 2, 16 KG.	ISO 1133	g/10 min	0,3
Melting point	Polarizing-microscope	°c	140-150

Physical Characteristics

CHARACTERISTICS	METHODS	UNITS	VALUES
Thermal conductivity at 20°	DIN52612	W/m°K	0,24
Specific heat at 20°C	Adiabatic calorimeter	KJ/Kg°K	2,0
Linear expansion coefficient	VDE 0304	K1	1,5x 10
Heart deflection temperature B (0.45 MPa)	ISO 758-1.-2	°c	70
Vicat softening temperature(A/50)	ISO 306	°c	132
OIT (200 °C)	EN 1451	Min	58

Mechanical Characteristics

CHARACTERISTICS	METHODS	UNITS	VALUES
Yield strength	ISO/R 527	N/mm2	21
Ultimate tensile strength	DIN 53455	N/mm2	40
Ultimate elongation	DIN 53455	%	600
Modulus of elasticity	ISO 178	N/mm,	800
Hardness test	ISO 2039	N/mm	40
Impact strength 0°C	DIN 8078		Does not break
Charpy Impact Strength. notched(23°C)	180179/1 eU	KJ/m	20
Charpy Impact Strength. Notched (-0°C)	180179/1 eU	KJ/m	3.5
Charpy Impact Strength. notched(-20°C)	180179/1 eU	KJ/m	2
Charpy Impact Strength. unnotched (23°C)	180179/1 eU		Does not break
Charpy Impact Strength. unnotched (0°C)	180179/1 eU		Does not break
Charpy Impact Strength. unnotched (-2D°C)	180179/1 eU	KJ/m	40
Shore hardness D	ISO 868	R Scale	65

Material Properties of PP-R

Properties	Measuring technique	Unit	PP-R Value
Melting index	ISO/Rll33		
MFR 190/5		g/10 min.	0.5
MFR 230/2.16		g/10 min.	0.24 - 0.36
Density	ISO IR 1183	g/cm'	0.895
Melting range	Polarizing microscope	°c	140 - 150
Yield stress	ISO/R527	N/mm'	21
Tensile strength	Feed speed	N/mm'	40
Tensile expansion	Test bar	%	600
Bending stress at 3.5%	ISO 178	N/mrn'	20
Marginal fiber Expansion	Test specimen 5.1		
Modulus of elasticity	ISO 178	N/mrn'	800
Mechanical properties			
Following impact			
Bending test at O°C	DIN 8078		No fraction
Expansion coefficient	VDE 0304		1. 5 x 10·4
	Part 1 §4	K-'	
Thermal conductivity at 20°c	DIN 52612	W/mK	0.24
Specific heat at 20'(	Adiabatic calorimeter	KJ/Kg K	2
Pipe friction factor			0.007

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Quality Assurance

Quality Assurance

3.1 System Standards

Pipes and Fittings of PP-R/PP-RCT for hot and cold water as well as for heating installations	
DIN EN ISO 15874	**Plastic piping systems for hot and cold water installations Polypropylene (PP)**
DIN 8077	**Polypropylene (PP) pipes Dimensions**
DIN 8078	**Polypropylene (PP) pipes** General quality requirements
DVGW W 534, W 542 W 544	**Pipe joints Compound pipes for drinking water installations Plastic pipes for drinking water installations**
DVS 2207 Part 11	**Welding of thermoplastic Heated tool welding of pipes, piping parts and panels made of PP**
DVS 2208 Part 1	**Welding of thermoplastics Machines and devices for heated tool welding of pipes, piping parts and panels**
KTW Recommendation	**Physiological harmlessness** According to the recommendations of the German health authority
VOB Partl C DIN 18381	**German construction contract procedures (VOB) – part C: General technical specifications in construction contracts (ATV)- Installation of gas, water and drainage pipework inside buildings**
DIN EN 10226 Part 1	**Wittworth pipe threads for pipes and fittings Parallel female thread and tapered male thread**
DIN 16928	**Pipe joints and piping parts installation General regulations**

3.2 Technical Information

Material:

PP-R (Polypropylene Random-Co-polymerisate) of high molecular weight and stabilized to high tem-perature. The material corresponds to KTW-recommendation of the German Board of Health.

Jointing:

Welding joints

Socket-welding by heating-ele-ments according to DVS (German Welding Inst.) specifications: lea- flet 2207, part 11, section 3.2.

Tools and devices for socket-wel-ding by heating-elements accor-ding to DVS leaflet 2208, part 1, section 5, schedule 2, type A.

Threaded joints:

The threaded joint of adaptor pipe-fittings correspond to the re-quirements of DIN EN 10226, i. e. cylindrical female thread, conical male thread.

Male threads for connecting back-nuts correspond to the require-ments of DIN-ISO 228, part 1.

Dimensions:

Pipes: According to DIN 8077 (Pipes of polypropylene PP). Fittings: According to DIN EN ISO 15874, (Pipe connections and fit- tings for polypropylene PP) injec- tion 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 EN ISO 15874
(Pipe connections and fittings for polypropylene PP pressure pipe-line.)
General quality standards, test.

Operating pressure:

For cold water at 20° C: up to 20 bar1.)

for hot water at 70° C: up to 10 bar1.)

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 chemi-cal resistance of polypropylene pipes and pipelines is available in DIN 8078.

Orders:

When ordering, kindly always state the dimensions and the order number in addition to the designa-tion of the piece required.

Example: Elbow 90°, d 32, No. 351020003

Marking:

The fittings are marked as follows:
Example: , 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 primarily been developped for ap-plication 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 con- stant temperature of 70 degrees Celsius.

For hot water piping, made accor-ding 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 installa- tion technics. Most of all the excel- lent resistance of corrosion gives proof of an extensively long utiliza- tion of installation tubing in the building technic, without risk of da- mages known from metallic materi- als.

Therefore PP-R as installation-mate-rial represents an excellent choice for piping of cold and hot water.

Properties	Measuring technique	Unit	PP - R Value	PP - RCT Value
Melting index MFR 190/5 MFR 230/2,16	ISO / R 1133	 g/10 min. g/10 min.	 0,5 0,24 – 0,36	 0,5 0,24 – 0,36
Density	ISO / R 1183	g/cm^3	0,895	0,905
Melting range	polarizing microscope	0°C 0°F	140 – 150 289 – 302	140 – 150 284 – 302
Yield stress Tensile strength Tensile expansion	ISO / R 527 feed speed Test bar	N/mm^2 N/mm^2 %	21 40 600	25 45 300
Bending stress at 3,5% Marginal fibre expansion	ISO 178 test specimen 5.1	N/mm^2	20	23
Modulus of elasticity	ISO 178	N/mm^2	800	900
Mechanical properties following impact bending test at 0° C	DIN 8078		no fracture	no fracture
Expansion coefficient	VDE 0304 Part 1 § 4	K^{-1}	1,5 x 10^{-4}	1,5 x 10^{-4}
Thermal conductivity at 20° C/58° F	DIN 52612	W/m K	0,24	0,24
Specific heat at 20° C68° F	adiabatic calorimeter	kJ/kg K	2,0	2,0
Pipe friction factor	–	–	0,007	0,007

3.3 Chemical Resistance

Selected chemical-resistance classification data for PP according to ISO/TR 10358

Concentration and/or purity of the fluid

Dil Sol.	Dilute aqueous solution at a concentration equal to or less than 10%
Sol.	Aqueous solution at a concentration higher than 10% but not saturated
Sat Sol.	Saturated aqueous solution, prepared at 20°C
tg	At least technical grade purity
tg-s	Technical grade, solid
tg-l	Technical grade, liquid
tg-g	Technical grade, gas
Work Sol.	Working solution of the concentration usually used in the industry concerned.
Susp.	Suspension of solid in a saturated solution at 20°C

Chemical resistance

S	**Satisfactory resistance** The pipes can be used for applications in which they are not subjected to pressure or other stresses; for applications in which they are exposed to pressure, the final assessment shall be on the basis of subsequent test under pressure.
L	**Limited resistance** The pipes can be used for applications in which they are not subjected to pressure or other stresses, but in which a certain amount of corrosion can be accepted; for applications in which they are exposed to pressure, the final assessment shall be on the basis of subsequent test under pressure.
NS	**Resistance not satisfactory** The pipes are seriously attacked: they shall not be used for either pressure or non-pressure applications. There is no point in conducting tests under pressure as the pipes would be certain to fail these tests.

• Keys for chemical resistance table

3.3 Chemical resistance

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
5	Acetone	-95	56	5	100	
				10	50	
		-95	56	tg-l	20	S
				tg-l	50	
				tg-l	60	S
11	Air			tg-g	20	S
				tg-g	50	
				tg-g	60	S
				tg-g	100	S
16	Aluminum Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	
17	Aluminum Fluoride	250		Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	
18	Aluminum Hydroxide			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	
19	Aluminum Nitrate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
20	Aluminum Oxychloride			Susp.	20	S
				Susp.	50	
				Susp.	60	S
21	Aluminum Potassium Sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	
22	Aluminum Sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
23	Ammonia, aqueous			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
24	Ammonia, Dry Gas	-78	-34	tg-g	20	S
				tg-g	50	
				tg-g	60	
25	Ammonia, Liquid	-78	-34	tg-g	20	S
				tg-g	50	
				tg-g	60	
26	Ammonium, Acetate			Sat Sol.	20	S
				Sat Sol.	60	S
				Sat Sol.	100	
28	Ammonium Carbonate (Dec. at 58°C)			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
				Sat Sol.	120	
29	Ammonium Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
34	Ammonium Nitrate	170		Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
36	Ammonium Phosphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	
				Sat Sol.	120	
37	Ammonium Sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
41	Amyl Alcohol	-79	137	tg-1	20	S
				tg-1	50	
				tg-1	60	S
				tg-1	100	S
43	Aniline	-6	184	Sat Sol.	20	
				Sat Sol.	50	
				Sat Sol.	60	
				tg-1	20	S
				tg-1	50	
				tg-1	60	S
47	Apple Juice			Work Sol.	20	S
				Work Sol.	50	
				Work Sol.	60	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
50	Barium Bromide			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
51	Barium Carbonate			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	S
52	Barium Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
53	Barium Hydroxide	78		Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
54	Barium Sulphate			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	S
55	Barium Sulphide			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
				Sat Sol.	120	
58	Benzene	6	80	tg-1	20	L
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
59	Benzonic Acid	122	250	Sat. Sol.	20	S
				Sat. Sol.	50	
				Sat. Sol.	60	S
				tg-s	120	
61	Benzoyl Alcohol	-15	205	tg-1	20	S
				tg-1	50	
				tg-1	60	L
62	Benzyl Chloride	-39	179	tg-1	20	
				tg-1	50	
				tg-1	60	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
65	Boric Acid			Dil Sol.	20	S
				Dil Sol.	50	
				Dil Sol.	60	
				Dil Sol.	100	
				Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	
				Sat Sol.	100	
66	Boron Trifluoride	-129	-101	Sat Sol.	20	S
				Sat Sol.	60	
68	Bromine Gas	-7	58	tg-g	20	NS
				tg-g	50	
				tg-g	60	NS
				tg-g	100	NS
69	Bromine Liquid	-7	58	tg-1	20	NS
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
73	Butane Gas	-135	-0.5	tg-g	20	S
				tg-g	50	
				tg-g	60	
74	n-Butanol	-80	117	tg-1	20	S
				tg-1	50	
				tg-1	60	L
				tg-1	80	
				tg-1	100	
83	Calcium Carbonate			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	S
84	Calcium Chlorate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	120	
85	Calcium Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	S
88	Calcium Nitrate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				50	100	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
101	Chlorine Dry Gas			tg-g	20	NS
				tg-g	50	
				tg-g	60	NS
				tg-g	100	NS
102	Chlorine Water			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	L
				Sat Sol.	80	
				Sat Sol.	100	
103	Chlorine Wet Gas			tg-g	20	
				tg-g	50	
				tg-g	60	
				tg-g	80	
105	Chlorobenzene	-45	132	tg-1	20	
				tg-1	50	
				tg-1	60	
				tg-1	80	
				tg-1	100	
107	Chloroform	-64	62	tg-1	20	L
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
110	Chlorosulphonic Acid	68	147	50	20	
			in	50	20	NS
			vac.	tg-s	50	
				tg-s	60	NS
				tg-s	100	NS
141	Diesel Fuel			Work Sol.	20	
				Work Sol.	60	
				Work Sol.	100	
155	Ethanol	-114	78	40	20	
				40	50	
				40	60	
				95	20	S
				95	50	
				95	60	S
				tg-1	20	
				tg-1	50	
				tg-1	60	
				tg-1	100	
176	Formaldehyde	-92	-19	Dil Sol.	20	
				Dil Sol.	60	
				Dil Sol.	80	
				30 to 40	20	S
				30 to 40	50	
				30 to 40	60	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
185	Gasoline (Fuel)			Work Sol.	20	NS
				Work Sol.	50	
				Work Sol.	60	NS
				Work Sol.	100	NS
186	Gelatine			Sol.	20	S
				Sol.	50	
				Sol.	60	S
187	Ginger Ale			Work Sol.	20	
188	Glucose (Dec. at >200 °C)	146		Sol.	20	S
				Sol.	50	
				Sol.	60	S
				Sol.	100	S
				Sol.	120	
189	Glycerine	20	290	tg-1	20	S
				tg-1	50	
				tg-1	60	S
				tg-1	100	S
				tg-1	120	
190	Glycolic acid	80		Sol.	20	
				Sol.	60	
				Sol.	100	
				30	20	S
				30	60	
				65	100	
192	Heptane	-90	98	tg-1	20	L
				tg-1	60	NS
				tg-1	80	
				tg-1	100	NS
194	Hexane	-94	69	tg-1	20	S
				tg-1	50	
				tg-1	60	L
				tg-1	80	
195	1- Hexanol	-52	158	tg-1	20	
				tg-1	60	
196	Honey			Work Sol.	20	S
					50	
					60	S

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
199	Hydrochloric acid	-112	-85	Up to 10	20	S
				Up to 10	50	
				Up to 10	60	S
				Up to 10	80	
				Up to 10	100	S
				20	20	S
				20	50	
				20	60	S
				20	80	
				20	100	S
				10 to 20	20	S
				10 to 20	50	
				10 to 20	60	S
				10 to 20	80	
				10 to 20	100	S
				Up to 25	20	S
				Up to 25	60	
				Up to 25	80	
				Up to 25	100	
				30	20	S
				30	60	L
				30	100	L
				>30	20	S
				>30	60	
				>30	80	
				>30	100	
				36	20	S
				36	50	
				36	60	
				36	80	
				38	100	
		-112	-85	Conc.	20	S
				Conc.	50	
				Conc.	60	
				Conc.	80	
200	Hydrochloric Acid, Dry Gas			tg-g	20	S
				tg-g	50	
				tg-g	60	S
201	Hydrochloric Acid, Wet Gas			tg-g	20	S
				tg-g	50	
				tg-g	60	S
204	Hydrofluoric Acid, Gas			tg-g	20	
				tg-g	40	
				tg-g	60	
205	Hydrogen			tg-g	20	S
				tg-g	60	
				tg-g	120	
213	Iodine, in Alcohol	114	183	Work Sol.	20	S
				Work Sol.	60	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
216	Isooctane		99	tg-1	20	L
					60	NS
					100	NS
220	Kerosene		150	Work Sol.	20	
			to 250	Work Sol.	100	
239	Mercurous Nitrate			Sol.	20	S
				Sol.	50	
				Sol.	60	S
				Sol.	100	
				Sat Sol.	20	S
				Sat Sol.	60	S
				Sat Sol.	100	
240	Mercury			tg-1	20	S
					60	S
					120	
244	Methyl Acetate	-98	57	tg-1	20	S
				tg-1	50	
				tg-1	60	S
245	Methyl Alcohol	-97	65	5	20	S
				5	50	
				5	60	L
				5	100	L
		-97	65	tg-1	20	S
				tg-1	50	
				tg-1	60	
				tg-1	80	
254	Milk			Work Sol.	20	S
				Work Sol.	50	
				Work Sol.	60	S
				Work Sol.	100	S
260	Nickel Acetate			Sat Sol.	20	
				Sat Sol.	40	
				Sat Sol.	60	
261	Nickel Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
262	Nickel Nitrate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	120	
263	Nickel Sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
265	Nitric acid			5	20	S
				5	50	
				5	60	
				5	80	
				10	20	S
				10	50	
				10	60	NS
				10	80	
				10	100	NS
				20	20	S
				20	50	
				20	60	NS
				20	80	
				20	100	NS
				25	20	S
				25	50	
				25	60	NS
				25	80	
				25	100	NS
				30	20	S
				30	50	
				30	60	NS
				30	80	
				30	100	NS
				30	120	
				35	20	
				35	50	
				35	60	NS
				35	80	
				35	100	NS
				40	20	
				40	50	
				40	60	
				40	80	
				40	120	
				up to 45	20	
				up to 45	50	
				up to 45	60	
				up to 45	80	
				50	20	L
				50	50	
				50	60	NS
				50	80	
				50	100	NS
				>50	20	NS
				>50	50	
				>50	60	NS
				>50	100	NS
				65	120	
				85	20	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
266	Nitrobenzene	6	210	tg-1	20	S
				tg-1	50	
				tg-1	60	L
272	Oxalic Acid (Subl.)	102		Dil Sol.	20	
				Dil Sol.	60	
				Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	L
				Sat Sol.	10	NS
				50	100	
273	Oxygen, Gas			tg-g	20	S
				tg-g	50	
				tg-g	60	
				tg-g	100	
283	Petroleum Ether (Ligroin)			Work Sol.	20	L
				Work Sol.	60	L
				Work Sol.	100	
284	Phenol	41	182	Sol.	20	
				Sol.	60	
				Sol.	80	
				5	20	S
				5	60	S
				5	120	
				50	80	
				90	20	S
				90	40	
				90	60	
		41	182	tg-s	20	
				tg-s	50	
				tg-s	60	
287	Phosphine	-134	-88	tg-g	20	S
				tg-g	40	
				tg-g	60	S
288	Phosphoric Acid	42		Up to 50	20	S
				Up to 50	50	
				Up to 50	60	S
				Up to 50	80	
				Up to 50	100	S
				50 to 75	20	S
				50 to 75	50	
				50 to 75	60	S
				50 to 75	80	
				50 to 75	100	
				25 to 85	20	S
				25 to 85	50	
				25 to 85	60	S
				25 to 85	80	
				25 to 85	100	S
				98	100	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
328	Propane, Gas	-190	-45	tg-g	20	S
				tg-g	120	
329	Propionic Acid	-20	141	50	20	
				50	60	
				>50	20	S
				tg-1	20	
				tg-1	60	
335	Silicone Oil			tg-1	20	S
				tg-1	60	S
				tg-1	100	S
340	Sodium Acetate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
				tg-s	80	
341	Sodium Acid Sulphate (See346)					
342	Sodium Antimonate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
343	Sodium Arsenite			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
344	Sodium Benzoate			Sat Sol.	20	
				Sat Sol.	40	
				Sat Sol.	60	
				35	20	S
				35	60	L
				50	100	
345	Sodium Bicarbonate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S
346	Sodium Bisulphate			Sat Sol.	20	S
				Sat Sol.	40	
				Sat Sol.	50	
				Sat Sol.	60	S
				50	100	
347	Sodium Bromide			Sat Sol.	20	S
				Sat Sol.	40	
				Sat Sol.	50	
				Sat Sol.	60	S
				50	120	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
348	Sodium Carbonate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	
				25	20	S
				25	50	
				25	60	S
				25	80	
				25	100	
				Up to 50	20	S
				Up to 50	50	
				Up to 50	60	S
				Up to 50	80	
				Up to 50	100	L
349	Sodium Chlorate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	
350	Sodium Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	80	
				Sat Sol.	100	
				10	20	S
				10	50	
				10	60	S
				10	80	
				10	100	S
351	Sodium Chlorite			Dil Sol.	80	
				2	20	S
				2	60	L
				2	100	NS
				20	20	S
				20	40	
				20	60	L
				20	100	NS
352	Sodium Chromate			Dil Sol.	20	S
				Dil Sol.	50	
				Dil Sol.	60	S
				Dil Sol.	80	
357	Sodium Fluoride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
362	Sodium Hydrogen Sulphite			Sat Sol.	20	S
				Sat Sol.	60	
				50	100	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
363	Sodium Hydroxide			Sol.	20	S
				Sol.	50	
				Sol.	60	S
				Sol.	80	
				Sat Sol.	20	
				Sat Sol.	60	
				1	20	S
				1	50	
				1	60	S
				1	100	S
				5	20	
				10 to 35	20	S
				10 to 35	50	
				10 to 35	60	
				10 to 35	80	
				30	80	
				40	20	S
				40	50	
				40	60	
				40	80	
				10 to 60	20	S
				10 to 60	50	
				10 to 60	60	S
				10 to 60	100	S
364	Sodium Hypochlorite			2	100	
				5	20	S
				5	50	
				5	60	S
				10 to 15	20	S
				10 to 15	50	
				10 to 15	60	
366	Sodium Nitrate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
367	Sodium Nitrite			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
371	Sodium Phosphate, Acid			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
372	Sodium Phosphate, Neutral			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	S

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
373	Sodium silicate			Sol.	20	S
				Sol.	50	
				Sol.	60	S
				Sat Sol.	20	
				Sat Sol.	50	
				Sat Sol.	60	
				50	100	
374	Sodium sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
				0,1	20	S
				0,1	50	
				0,1	60	S
375	Sodium sulphide			Sat Sol.	20	S
				Sat Sol.	60	
376	Sodium sulphite			Sat Sol.	20	S
				Sat Sol.	60	S
				Sat Sol.	100	
				40	20	S
				40	60	S
				40	100	S
380	Sulphar dioxide, dry gas	-73	-10		20	S
					60	
381	Sulphar dioxide, wet gas	-73	-10		20	S
					40	
					60	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
383	Sulphuric acid			up to 10	20	S
				up to 10	50	
				up to 10	60	S
				up to 10	80	
				up to 10	100	S
				15	20	S
				15	50	
				15	60	
				15	80	
				15	100	
				10 to 30	20	S
				10 to 30	60	S
				10 to 30	80	
				10 to 50	20	S
				10 to 50	60	
				10 to 50	80	
				10 to 50	120	
				50	20	S
				50	50	
				50	60	L
				50	80	
				50	100	L
				60	120	
				50 to 75	20	
				50 to 75	60	
				50 to 75	80	
				80	120	
				50 to 90	20	
				50 to 90	60	
				50 to 90	80	
				90	100	
				75 to 90	20	
				75 to 90	50	
				75 to 90	60	
				75 to 90	80	
				95	20	
				95	50	
				95	60	
				95	80	
				95	100	
				96	20	S
				96	50	
				96	60	L
				96	80	
				96	100	NS
				98	20	L
				98	40	
				98	50	
				98	60	NS
				98	80	
				98	100	NS
				fuming	20	L
				fuming	50	
				fuming	60	NS
				fuming	100	NS

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
393	Toluene	-95	111	tg-1	20	L
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
394	Trichloroacetic Acid	58	197	Up to 50	20	S
				Up to 50	40	
				Up to 50	60	S
				tg-s	40	
396	Trichloroethylene	-85	87	tg-1	20	NS
				tg-1	50	
				tg-1	60	NS
				tg-1	80	
				tg-1	100	NS
401	Turpentine			tg-1	20	NS
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
402	Urea	133		Sol.	20	
				Sol.	50	
				Sol.	60	
				Sol.	80	
				Sol.	100	
				Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	
				Sat Sol.	80	
		133		10	20	
				10	50	
				10	60	
				10	80	
				10	100	
404	Urine			10	20	S
				10	50	
				10	60	S
406	Vinegar			Work Sol.	20	S
				Work Sol.	60	S
408	Water				20	S
					50	
					60	S
					80	
					100	S
					120	
414	Water, Sea				20	S
					50	
					60	S
					80	
					100	S
					120	

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
420	Zinc Carbonate			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	
421	Zinc Chloride			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
				58	20	S
				58	50	
				58	60	S
422	Zinc Chromate			Sat Sol.	20	
				Sat Sol.	60	
423	Zinc Cyanide			Sat Sol.	20	
				Sat Sol.	60	
424	Zinc Nitrate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
425	Zinc Oxide			Susp.	20	S
				Susp.	50	
				Susp.	60	S
				Susp.	100	
426	Zinc Stearate	125		Susp.	20	
				Susp.	50	
				tg-s	100	
427	Zinc Sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	

Allowable operating pressures for **PP-R** pipes conveying water, safety factor (SF) = 1,5

Temperature 0c	Years of service	Pipe series S									
		20	16	12,5	8,3	8	5	4	3,2	2,5	2
		Standard dimension ratio SDR									
		41	33	26	17,6	17	11	9	7,4	6	5
		Allowable operating pressure bar									
10	1	4,4	5,5	7,0	10,5	11,1	17,5	22,1	27,8	35,1	44,1
	5	4,1	5,2	6,6	9,9	10,4	16,5	20,8	26,2	33,0	41,6
	10	4,0	5,1	6,4	9,7	10,1	16,1	20,3	25,6	32,2	40,5
	25	3,9	4,9	6,2	9,3	9,8	15,6	19,6	24,7	31,1	39,2
	50	3,8	4,8	6,0	9,1	9,6	15,2	19,1	24,1	30,3	38,2
	100	3,7	4,6	5,9	8,9	9,3	14,8	18,6	23,5	29,6	37,2
20	1	3,7	4,7	5,9	9,0	9,4	15,0	18,8	23,7	29,9	37,7
	5	3,5	4,4	5,6	8,4	8,9	14,1	17,7	22,3	28,1	35,4
	10	3,4	4,3	5,4	8,2	8,6	13,7	17,2	21,7	27,4	34,5
	25	3,3	4,1	5,2	7,9	8,3	13,2	16,6	21,0	26,4	33,3
	50	3,2	4,0	5,1	7,7	8,1	12,9	16,2	20,4	25,7	32,4
	100	3,1	3,9	5,0	7,5	7,9	12,5	15,8	19,9	25,0	31,5
30	1	3,2	4,0	5,0	7,6	8,0	12,7	16,0	20,2	25,4	32,0
	5	3,0	3,7	4,7	7,2	7,5	11,9	15,0	18,9	23,8	30,0
	10	2,9	3,6	4,6	7,0	7,3	11,6	14,6	18,4	23,2	29,2
	25	2,8	3,5	4,4	6,7	7,0	11,2	14,1	17,7	22,3	28,1
	50	2,7	3,4	4,3	6,5	6,8	10,9	13,7	17,2	21,7	27,4
	100	2,6	3,3	4,2	6,3	6,6	10,6	13,3	16,8	21,1	26,6
40	1	2,7	3,4	4,3	6,5	6,8	10,8	13,6	17,1	21,6	27,2
	5	2,5	3,2	4,0	6,0	6,3	10,1	12,7	16,0	20,2	25,4
	10	2,4	3,1	3,9	5,9	6,2	9,8	12,3	15,5	19,6	24,7
	25	2,3	2,9	3,7	5,6	5,9	9,4	11,9	15,0	18,8	23,7
	50	2,3	2,9	3,6	5,5	5,8	9,2	11,5	14,5	18,3	23,1
	100	2,2	2,8	3,5	5,3	5,6	8,9	11,2	14,1	17,8	22,4
50	1	2,3	2,8	3,6	5,5	5,7	9,1	11,5	14,5	18,2	23,0
	5	2,1	2,7	3,4	5,1	5,3	8,5	10,7	13,5	17,0	21,4
	10	2,0	2,6	3,3	4,9	5,2	8,2	10,4	13,1	16,5	20,8
	25	2,0	2,5	3,1	4,7	5,0	7,9	10,0	12,6	15,9	20,0
	50	1,9	2,4	3,0	4,6	4,8	7,7	9,7	12,2	15,4	19,4
	100	1,8	2,3	2,9	4,5	4,7	7,5	9,4	11,8	14,9	18,8
60	1	1,9	2,4	3,0	4,6	4,8	7,7	9,7	12,2	15,4	19,4
	5	1,8	2,2	2,8	4,3	4,5	7,1	9,0	11,3	14,3	18,0
	10	1,7	2,2	2,7	4,1	4,3	6,9	8,7	11,0	13,9	17,5
	25	1,6	2,1	2,6	4,0	4,2	6,6	8,4	10,5	13,3	16,7
	50	1,6	2,0	2,5	3,8	4,0	6,4	8,1	10,2	12,9	16,2
70	1	1,6	2,0	2,5	3,9	4,1	6,5	8,1	10,3	12,9	16,3
	5	1,5	1,9	2,4	3,6	3,8	6,0	7,5	9,5	12,0	15,1
	10	1,4	1,8	2,3	3,5	3,6	5,8	7,3	9,2	11,6	14,6
	25	1,2	1,5	2,0	3,0	3,1	5,0	6,3	8,0	10,0	12,7
	50	1,0	1,3	1,7	2,5	2,6	4,2	5,3	6,7	8,5	10,7
80	1	1,3	1,7	2,1	3,2	3,4	5,4	6,8	8,6	10,8	13,7
	5	1,2	1,5	1,9	2,9	3,0	4,8	6,0	7,6	9,6	12,1
	10	1,0	1,2	1,6	2,4	2,5	4,0	5,1	6,4	8,1	10,2
	25	0,8	1,0	1,2	1,9	2,0	3,2	4,1	5,1	6,5	8,1
95	1	0,9	1,2	1,5	2,3	2,4	3,8	4,8	6,1	7,6	9,6
	5	0,6	0,8	1,0	1,5	1,6	2,6	3,2	4,1	5,2	6,5
	(10)[a]	(0,5)	(0,6)	(0,8)	(1,3)	(1,3)	(2,2)	(2,7)	(3,4)	(4,3)	(5,5)

[a] The values in brackets apply where testing can be shown to have been carried out for longer than one year at 110 oc.

Allowable operating pressures for **PP-RCT** pipes conveying water, safety factor (SF) = 1,5

Temperature 0c	Years of service	Pipe series S									
		20	16	12,5	8,3	8	5	4	3,2	2,5	2
		Standard dimension ratio SDR									
		41	33	26	17,6	17	11	9	7,4	6	5
		Allowable operating pressure bar									
10	1	4,7	6,0	7,5	11,4	12,0	19,0	24,0	30,2	38,0	47,9
	5	4,6	5,8	7,3	11,1	11,6	18,4	23,2	29,3	36,9	46,4
	10	4,5	5,7	7,2	10,9	11,5	18,2	22,9	28,9	36,4	45,8
	25	4,5	5,6	7,1	10,7	11,3	17,9	22,5	28,4	35,7	45,0
	50	4,4	5,5	7,0	10,6	11,1	17,7	22,2	28,0	35,3	44,4
	100	4,3	5,5	6,9	10,5	11,0	17,4	21,9	27,6	34,8	43,8
20	1	4,1	5,2	6,6	9,9	10,4	16,6	20,9	26,3	33,1	41,7
	5	4,0	5,0	6,4	9,6	10,1	16,0	20,2	25,4	32,0	40,4
	10	3,9	5,0	6,3	9,5	10,0	15,8	19,9	25,1	31,6	39,8
	25	3,9	4,9	6,1	9,3	9,8	15,5	19,6	24,6	31,0	39,1
	50	3,8	4,8	6,1	9,2	9,6	15,3	19,3	24,3	30,6	38,5
	100	3,8	4,7	6,0	9,1	9,5	15,1	19,0	24,0	30,2	38,0
30	1	3,6	4,5	5,7	8,6	9,0	14,3	18,1	22,7	28,7	36,1
	5	3,4	4,3	5,5	8,3	8,7	13,9	17,4	22,0	27,7	34,9
	10	3,4	4,3	5,4	8,2	8,6	13,6	17,2	21,7	27,3	34,4
	25	3,3	4,2	5,3	8,0	8,4	13,4	16,9	21,2	26,8	33,7
	50	3,3	4,1	5,2	7,9	8,3	13,2	16,6	20,9	26,4	33,2
	100	3,2	4,1	5,1	7,8	8,2	13,0	16,4	20,6	26,0	32,7
40	1	3,1	3,9	4,9	7,4	7,8	12,3	15,5	19,6	24,6	31,0
	5	2,9	3,7	4,7	7,1	7,5	11,9	15,0	18,9	23,8	29,9
	10	2,9	3,7	4,6	7,0	7,4	11,7	14,7	18,6	23,4	29,5
	25	2,8	3,6	4,5	6,9	7,2	11,5	14,4	18,2	22,9	28,9
	50	2,8	3,5	4,5	6,8	7,1	11,3	14,2	17,9	22,6	28,4
	100	2,8	3,5	4,4	6,7	7,0	11,1	14,0	17,6	22,2	28,0
50	1	2,6	3,3	4,2	6,3	6,6	10,5	13,3	16,7	21,0	26,5
	5	2,5	3,2	4,0	6,1	6,4	10,1	12,8	16,1	20,3	25,5
	10	2,5	3,1	3,9	6,0	6,3	10,0	12,6	15,8	19,9	25,1
	25	2,4	3,0	3,8	5,8	6,1	9,7	12,3	15,5	19,5	24,6
	50	2,4	3,0	3,8	5,7	6,0	9,6	12,1	15,2	19,2	24,2
	100	2,3	2,9	3,7	5,7	5,9	9,4	11,9	15,0	18,9	23,8
60	1	2,2	2,8	3,5	5,3	5,6	8,9	11,2	14,2	17,8	22,5
	5	2,1	2,7	3,4	5,1	5,4	8,6	10,8	13,6	17,1	21,6
	10	2,1	2,6	3,3	5,0	5,3	8,4	10,6	13,4	16,8	21,2
	25	2,0	2,6	3,2	4,9	5,2	8,2	10,4	13,1	16,5	20,7
	50	2,0	2,5	3,2	4,8	5,1	8,1	10,2	12,8	16,2	20,4
70	1	1,8	2,3	3,0	4,5	4,7	7,5	9,4	11,9	15,0	18,9
	5	1,8	2,2	2,8	4,3	4,5	7,2	9,1	11,4	14,4	18,1
	10	1,7	2,2	2,8	4,2	4,4	7,0	8,9	11,2	14,1	17,8
	25	1,7	2,1	2,7	4,1	4,3	6,9	8,7	10,9	13,8	17,4
	50	1,7	2,1	2,7	4,0	4,2	6,8	8,5	10,7	13,5	17,0
80	1	1,5	1,9	2,5	3,7	3,9	6,2	7,9	9,9	12,5	15,8
	5	1,5	1,9	2,3	3,6	3,7	6,0	7,5	9,5	12,0	15,1
	10	1,4	1,8	2,3	3,5	3,7	5,9	7,4	9,3	11,7	14,8
	25	1,4	1,8	2,2	3,4	3,6	5,7	7,2	9,1	11,4	14,4
95	1	1,1	1,4	1,8	2,8	2,9	4,7	5,9	7,4	9,4	11,8
	5	1,1	1,4	1,7	2,6	2,8	4,4	5,6	7,1	8,9	11,2
	(10)[a]	(1,1)	(1,3)	(1,7)	(2,6)	(2,7)	(4,3)	(5,5)	(6,9)	(8,7)	(11,0)

[a] The values in brackets apply where testing can be shown to have been carried out for longer than one year at 110 oc.

7. Form supplied

The pipes are to be supplied in coils or as straight pipes supplied in fixed lengths, within the tolerances specified.

Tolerances on nominal lengths

Form supplied		Tolerance
Coils, unwound length		Actual lengths less than nominal length not permitted
Straight pipes, fixed length	up to 12 m	10 mm
	over 12 m	By agreement

3.4 Range of application / Temp. tension

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

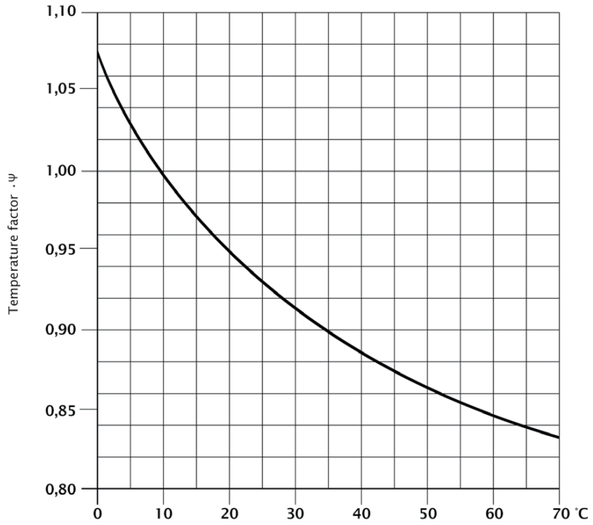


Fig. 2: Temperature of the flow medium

For the individual fitting resistance, values are given in the chart below (fig.3) can be applied by approximation.

Fig. 3: Pressure drop in fittings

Outside pipe diameter	16			
d	20	32	50	≥ 63
mm	25	40	63	
Fitting Type		Drag cofficient ζ		
	1.5	1.0	0.6	0.5
	2.0	1.7	1.1	0.8
			0.3	
			1.5	
Steam in			0.5	
Steam out			1.0	

The individual joint resistance values can be determined altogether.
As a standard value adds an extra of 3% to 5% to the overall pressure drop.

Minimum flow pressures

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

Minimum flow pressure Pmin Fl bar	**Type of drinking water service points**		**Calculated flow for outlet of**		
			Mixed water		**Either cold or hot water**
			Volume flow cold l/s	**Volume flow cold l/s**	**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 riner in acc. to DIN 3265 part 1	DN 15	-	-	0.70
1.2	Pressure riner in acc. to DIN 3265 part l	DN 20	-	-	1.00
0.4	Pressure riner in acc. to DIN 3265 part 1	DN 25	-	-	1.00
1.0	Pressure riner 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 dishwasher 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	DN15	-	-	0.10'
	electric hot water tank and boiler				
1.1**	with nominal contents 5 - 1 5 l	DN 15	-	-	0.10
1.2**	with nominal contents 30 - 1 50 l	DN 15	-	-	0.20
	electric flow water heater with hydraulic test, without flow limitation				
1.5	normal 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 unfavorable conditions (shower)
Note: Service points which are not included in the table and devices of a 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 arran- gement planning stage each possibility should therefore be utilized fully to compensate all extension processes within a pipe section.

Polypropylene pipes mechanically stabilized by an aluminium Layer on the pipe periphery have a reduced thermal expansion coefficient.The aluminium Layer prevents linear extension at about4/5.

Δl= Linear extension in (mm)

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

L= Pipe length (m)

Δt= Temperature difference (K)

The linear thermal expansion co-efficient for PP-R and PP-RCT pipes is::

$$\alpha = 0.15 \frac{mm}{mK}$$

The linear thermal expansion co-efficient for PP-R alumium-Pipes can by approximation assumed as:

$$\alpha = 0.03 \frac{mm}{mK}$$

The linear thermal expansion co-efficient for PP-RCT Fibre-Pipes is::

$$\alpha = 0.035 \frac{mm}{mK}$$

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

$$\Delta l = \alpha \; L \bullet \Delta l \; (mm)$$

The calculation of the linear deformation is based on the laying temperature.
The following example gives you an idea of how to calculate.
Example of a pipe length of 8 m:

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: 8m . 7 . 0.03 = 1.68 mm

To 3. Extension of the pipe: 8m . 54 . 0.03 = 12.96

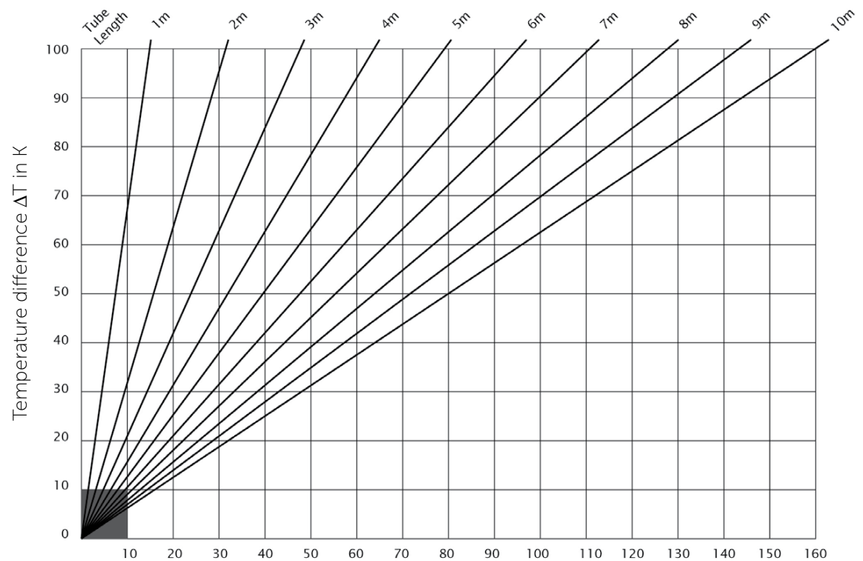


Fig. 4a

Tube Length	Temperature difference ΔT in K									
	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

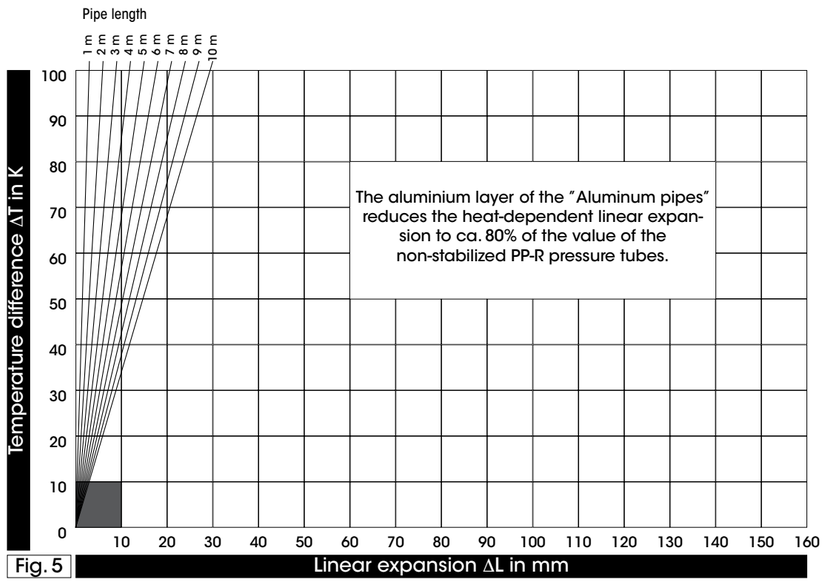


Fig. 5

Fig. 5a

Pipe 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					

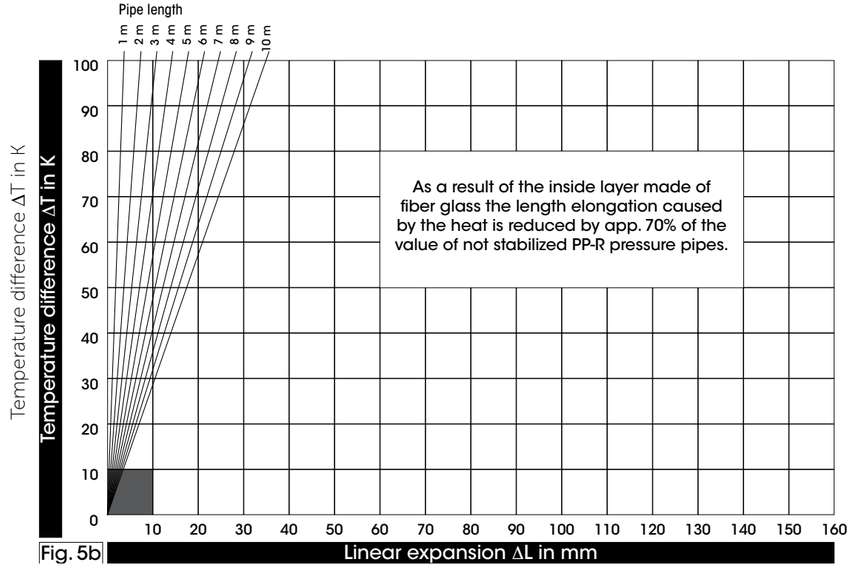
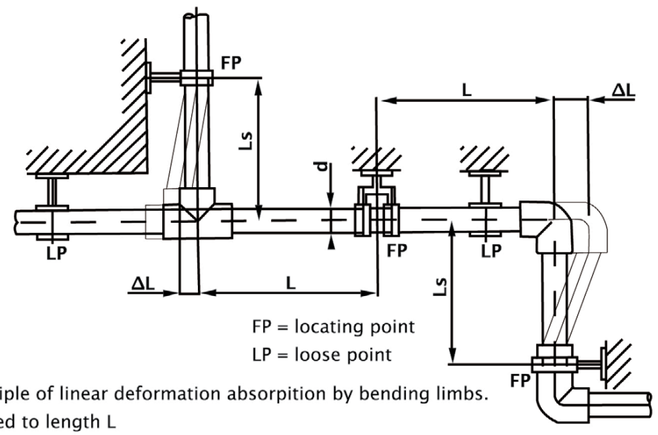


Fig. 5b

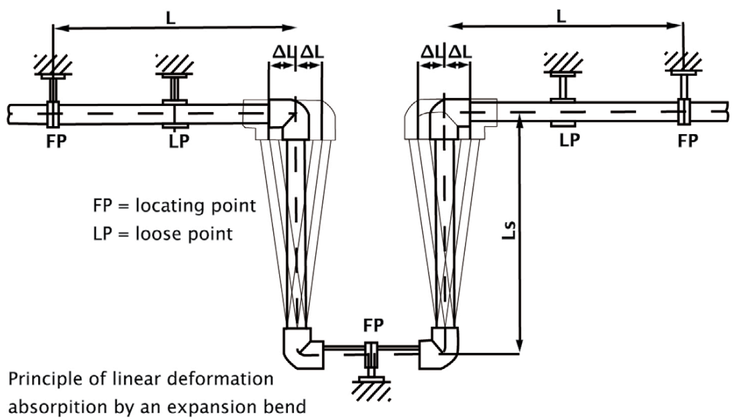
Tube Length	Temperature difference ΔT in K									
	10	20	30	40	50	60	70	80	90	100
0,1 m	0,04	0,07	0,11	0,14	0,18	0,21	0,25	0,28	0,32	0,35
0,2 m	0,07	0,14	0,21	0,28	0,35	0,42	0,49	0,56	0,63	0,70
0,3 m	0,11	0,21	0,32	0,42	0,53	0,63	0,74	0,84	0,95	1,05
0,4 m	0,14	0,28	0,42	0,56	0,70	0,84	0,98	1,12	1,26	1,40
0,5 m	0,18	0,35	0,53	0,70	0,88	1,05	1,23	1,40	1,58	1,75
0,6 m	0,21	0,42	0,63	0,84	1,05	1,26	1,47	1,68	1,89	2,10
0,7 m	0,25	0,49	0,74	0,98	1,23	1,47	1,72	1,96	2,21	2,45
0,8 m	0,28	0,56	0,84	1,12	1,40	1,68	1,96	2,24	2,52	2,80
0,9 m	0,32	0,63	0,95	1,26	1,58	1,89	2,21	2,52	2,84	3,15
1,0 m	0,35	0,70	1,05	1,40	1,75	2,10	2,45	2,80	3,15	3,50
2,0 m	0,70	1,40	2,10	2,80	3,50	4,20	4,90	5,60	6,30	7,00
3,0 m	1,05	2,10	3,15	4,20	5,25	6,30	7,35	8,40	9,45	10,50
4,0 m	1,40	2,80	4,20	5,60	7,00	8,40	9,80	11,20	12,60	14,00
5,0 m	1,75	3,50	5,25	7,00	8,75	10,50	12,25	14,00	15,75	17,50
6,0 m	2,10	4,20	6,30	8,40	10,50	12,60	14,70	16,80	18,90	21,00
7,0 m	2,45	4,90	7,35	9,80	12,25	14,70	17,15	19,60	22,05	24,50
8,0 m	2,80	5,60	8,40	11,20	14,00	16,80	19,60	22,40	25,20	28,00
9,0 m	3,15	6,30	9,45	12,60	15,75	18,90	22,05	25,20	28,35	31,50
10,0 m	3,50	7,00	10,50	14,00	17,50	21,00	24,50	28,00	31,50	35,00
Fig. 5b					Linear expansion ΔL in mm					

Mostly the linear extension of a PP-R / PP-RCT pipe line can be compen- sated by changing the direction. At- tention has to be paid to the fact that the pipeline can easily move in axial direction. In case linear exten- sion com- pensation of a changed direction is not possible installation of an expansi- on bend is necessary. An axial com- pensation is mostly not suitable and uneconomical.	**For spring deflexion of a pipeline the size of the bending limb has to be con- sidered which is calcula- ted with the adjoining formula.** **Figures 6 and 7 show the mode of action of a change of length and its compensation. The correct choice of the fixed points with re- gard to the necessary bending limbs Ls has to be considered.**	$L_S = C \cdot \sqrt{d \cdot \Delta L}$ (mm) Ls = Lenghts of bending limb (mm) d = outiside pipe diameter (mm) DL = Linear deformation (mm) C = Material-depending constant for PP-R



FP = locating point
LP = loose point

Principle of linear deformation absorpition by bending limbs. related to length L



FP = locating point
LP = loose point

Principle of linear deformation absorpition by an expansion bend

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 Ls is calculated in dependence on the linear de- formation ΔL. As standard value, the Ls value given in the Fig. 8 dia- gram can be used.
Spacing Bmin should be at least 210 mm.

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

d = Outer diameter op pipe
L = Length of pipe
ΔL = Linear elongation of pipe (longitudinal)
Ls = Length of bending shank Bmin = Width of bending shank
BS = Safety distance (min.150 mm)
Calculation of expansion bend:

Bmin = 2 x ΔL + BS

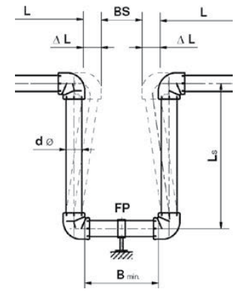
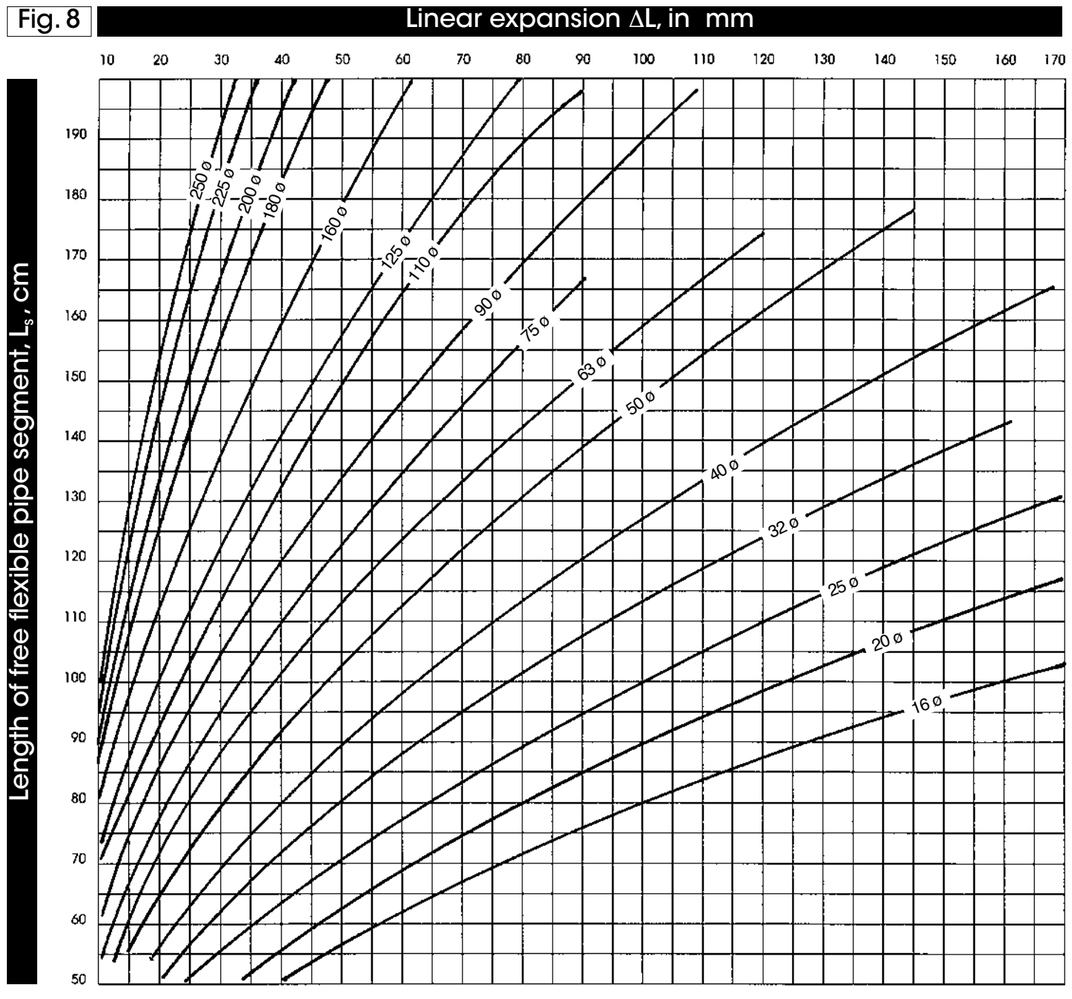


Fig. 8



Example for concealed piping

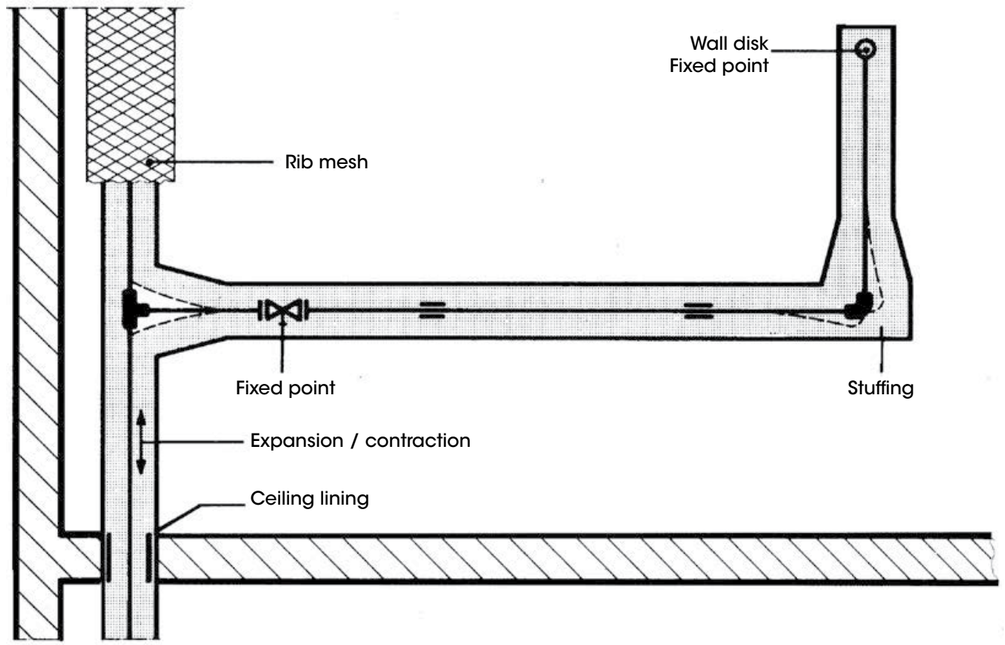


Fig. 9

Installation in Sanitary Installation Shaft:

Risers in pipe shafts have to be installed in such a way that the diverting pipeline can adjust the longitudinal expansion of the risers.

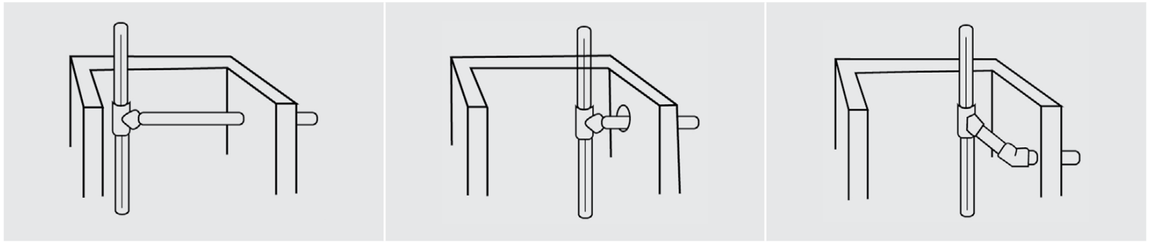


Fig. 1
Best positioning in the pipe shaft

Fig. 2
Sufficient dimensioning of the casing pipe for the diverting pipeline

Fig. 3
Installation of a spring leg.

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 allowing expansion or contraction. The guidance of such sections is made with loose clips. The clip distances or spans depend on operation conditions, pipe material, and weight of the filled pipe. In practical use the spans given in figures 10, 10a, 11, 11a and 11b proved to be appropriate.

d	Spans L at cm bei T°C						
mm.	20°C	30°C	40°C	50°C	60°C	70°C	80°C
16	62	59	55	53	50	48	46
20	73	68	64	61	58	56	54
25	84	79	74	71	67	65	62
32	98	92	87	83	79	76	73
40	111	106	100	96	91	88	84
50	124	118	113	109	105	101	97
63	139	133	127	123	118	115	111
75	152	145	138	134	129	126	121
90	166	159	152	147	141	138	133
110	184	176	168	162	156	152	147
125	208	198	189	183	176	172	166

Fig. 10: Spans for PP-R and PP-RCT pipes.

d	Spans L at cm bei T°C				
⌀.	20°C	30°C	40°C	50°C	60°C
20	64	60	57	54	51
25	73	69	65	62	59
32	86	81	76	73	69
40	100	94	88	84	80
50	113	108	101	97	92
63	127	121	115	111	107
75	138	132	125	121	117
90	151	144	137	133	128
110	167	159	152	147	142
125	188	180	171	166	160
140	208	199	190	184	177
160	223	213	203	197	189
200	249	238	227	220	212
250	279	266	254	246	237
280	295	282	269	260	251
315	313	299	285	276	266
355	332	317	302	293	282
400	353	337	321	311	300
450	374	357	341	330	318
500	394	377	359	348	335

Fig.10a: Spans for PP-RCT.

d	Spans L at cm bei T°C						
⌀	20°C	30°C	40°C	50°C	60°C	70°C	80°C
16	60	56	53	51	48	47	44
20	70	66	62	59	56	54	52
25	77	72	68	65	62	60	57
32	90	85	80	76	73	70	67
40	104	98	92	88	84	81	77
50	117	111	106	102	97	94	89
63	131	125	119	116	111	109	104
75	143	137	130	126	121	118	114
90	157	150	143	138	133	130	125
110	173	165	158	153	147	143	138
125	195	187	178	172	166	162	156

Fig. 11: Spans for PP-RCT Alumium-Pipes

d	Spans L at cm bei T°C						
⌀	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	70	66	62	59	56	54	52
25	81	76	71	68	65	63	60
32	90	85	80	76	73	70	67
40	104	98	92	88	84	81	77
50	117	111	106	102	97	94	89
63	131	125	119	116	111	109	104
75	143	137	130	126	121	118	114
90	157	150	143	138	133	130	125
110	173	165	158	153	147	143	138
125	195	187	178	172	166	162	156
160	223	213	203	197	189	185	178
200	249	238	227	220	213	206	199
250	279	266	254	246	237	231	223
315	313	299	285	276	266	259	250
355	332	317	302	293	282	275	265
400	353	337	321	311	300	292	282
450	374	357	341	330	318	310	299
500	394	377	359	348	335	327	315

Fig. 11a: Spans for PP-RCT Fibre pipes Watertec.

d	Spans L at cm bei T°C						
⌀	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	70	66	62	59	56	54	52
25	81	76	71	68	65	63	60
32	90	85	80	76	73	70	67
40	100	94	88	84	80	77	74
50	113	108	101	97	92	89	85
63	127	121	115	111	107	104	99
75	138	132	125	121	117	114	110
90	151	144	137	133	128	125	121
110	167	159	152	147	142	138	133
125	188	180	171	166	160	156	150
160	205	196	187	181	172	166	159
200	229	219	209	202	195	190	182
250	256	245	233	226	217	212	205
315	288	275	262	254	244	238	230
355	306	292	278	270	260	253	244
400	324	310	295	286	275	268	259
450	344	329	313	303	292	285	275
500	363	346	330	320	308	300	290

Fig. 11b: Spans for PP-RCT Fibre pipes Climatec

Welding Procedure

The Bänninger PP-R/PP-RCT pipe- work is coupled by socket fusion welding.The pipes and fittings are connected longitudinally overlap- ping. The heating of pipe ends and sockets is done by a heating ele- ment with fitted bushes. After the ne- cessary welding temperature is reached the joining process is done.The pipe and socket diame- ter as well as the respective heated bush diameters are matched to build up the necessary pressure du- ring the joining process.

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

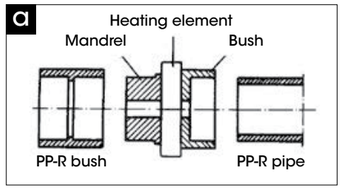
Note on the welding process:

The heating elements (mandrel and bush) must correspond to DVS 2208 part 1, par. 5, table 2, type A (excluding mechanical processing 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 socket with spirit and absorbent paper. Mark socket 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, other- wise the temperature of the hea- ting element must be controlled by an appropriate measuring de- vice.

Do not start heating the joint parts before the heating temperature has reached 260° C. The mandrel and bush must be clean and have to be cleaned before each follo- wing welding process.

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. At a room temperature below +5° C the heating phases should be increased by up to 100%.

Welding

Push the pipe and fitting quickly and axially up to the stop of the mandrel and the marked insertion depth respectively and hold 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 off the heating element and join them immediately axially aligned and without torsion.

In considering the correct insertion depth (fig. 15).The pipe must be pushed in up to marked insertion depth respectively up to the socket bottom. We recommend to fix the two joint parts again for a certain time (approximately the heating period).

The welded joint must not be stres- sed mechanically before end of the cooling time.

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 and PP-RCT fittings

INDEX

INSTALLATION

Installation

4.1 Welding Process

1. Pipes are measured and cut to the required length. Cutting sho¬¬uld be rec- tancular to the pipe axis (90°).

2. Clean the joint area with cleaner. Mark the insert depth of the fitting on the pipe.

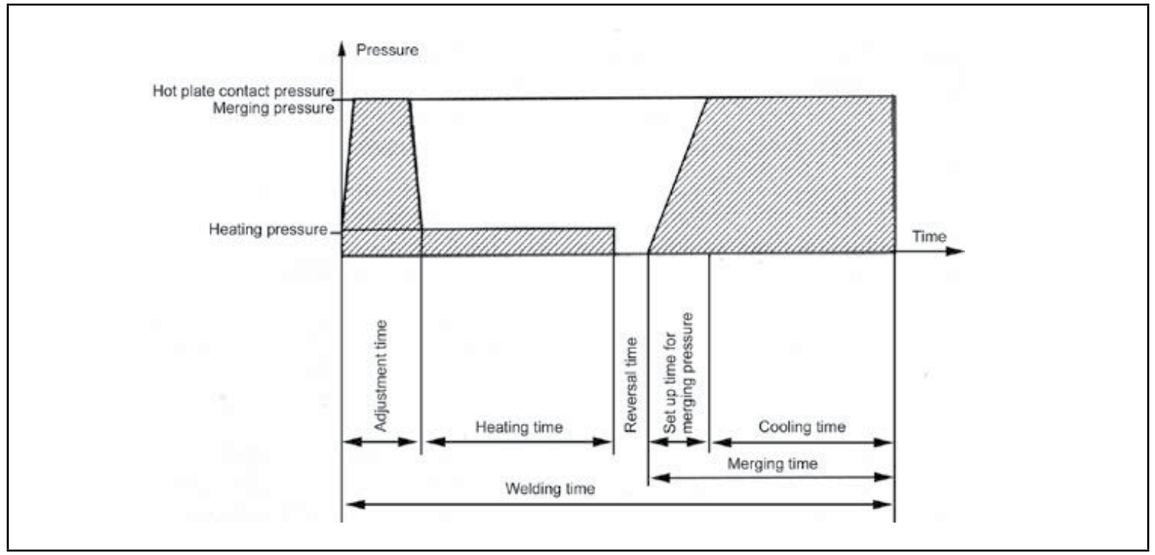
3. Pipe and fitting have to be heated si- multaneously. Push in parts to be joi- ned axially.

4. At the end of heating period fitting and pipe end from the heating ele- ments have to be pulled off fifully and simultaneously.

5. Adapt and join pipe and fitting wit- hin the max. allowed period without turning the parts against each other.

Immediately after the cooling time the fused joints can fully work under pressure. The fusion of the joint parts results in a unique longitudinally force-locked joint

Parameters for PP-butt welding with heating element at 20° C outside temperature From 125mm diameter and up According to DVS data sheet 2207, part 11



Preparation before welding

Before start the temperature of the heating element should be controlled. In order to have optimal welding connections, the heating element should be cleaned with a non-fuzzing paper before each welding.

The wall thickness of the fittings that shall be welded should be conform in the welding area.

Pipes and fittings have to be aligned axial.

The areas that shall be welded should be planed with a tool, which has to be clean and free of grease. So they should be plane parallel in the plane condition.

The roundness of the pipe has to be ensure either by the clamping de- vice of the welding machine or extra clamps.

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.

4.2 Welding Procedure:

During butt welding with heating elements the areas to be joined are ad- justed 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 procdure.

After merging a double bead (K) has to exist over the complete perime- ter. 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.

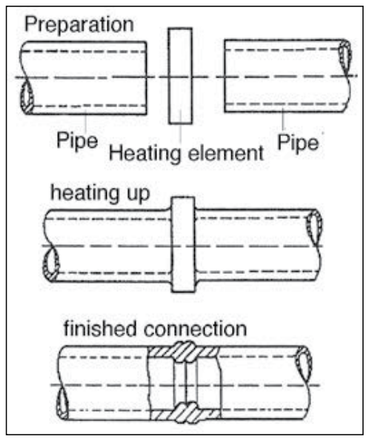


Fig. 2

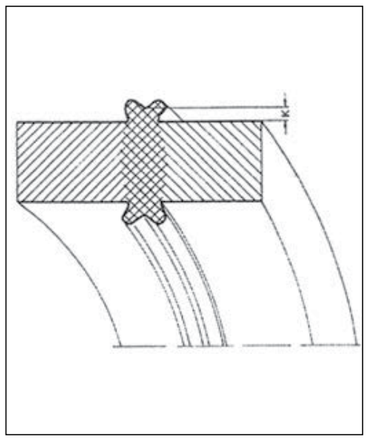


Fig. 3

Application area:
Repair of bored 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 re- pair plug.

Distance tool to be fixed accor- ding to the wall thickness of the pipe and tighten the screw.

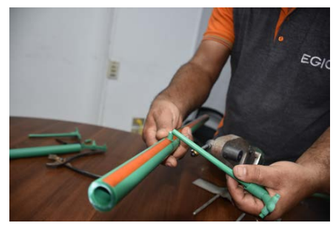
Fig. 2

Heat up the borehole and the wel- ding plugs with the repair-set for 15 seconds.

Fig. 3

Remove the welding device and set in the repair plug precisely wit- hout twisting it.

After cooling time of 5 minutes re- move the protruding end of the re- pair plug, and the repaired part can again work under pressure



For completely installed but not yet concealed pipes DIN 1988 (Technische Regeln für Trinkwasser Installation/Technical Regulations for Drinking Water Installations) requires a hydraulic pressure test.

Under pressure testing the properties of the PP-R/PP-RCT pipe mate- rial cause an expansion of the pipe affecting the test result. The difference between pipe and test medium temperatures can additionally influence the test result.

Due to the thermal expansion coefficient a change in temperature of 10 K results in a change in pressure of 0,5 to 1 bar. The pressure te- sting of parts of plastic pipe systems should therefore be done at an as much as possible constant test medium temperature.

Filling of the Pipe System

Fill the pipes with filtered water until they are free of air. Use pres- sure gauges allowing to clearly read pressure changes of 0.1 bar. Install the pressure gauge at the lowest point of the pipe system.

The pressure test must be done as a preliminary test and a principal test, whereas a preliminary test only may be considered sufficient for smaller installations such as supply and distributing pipes in moist rooms.

Preliminary Test

For the preliminary test a test pressure corresponding to the allowed working pressure plus 5 bar is applied which has to be renewed 2 times at 10-minute intervals within 30 minutes. After another 30 minutes the test pressure shall not have dropped by more than 0.6 bar (0.1 bar per 5 minutes) and no lea- kage must have occured.

Principal Test

Directly after the preliminary test the principal test has to be carried out. The test period is 2 hours. The test pressure determined after the preliminary test shall not have dropped by more than 0.2 bar after 2 hours.

No leakage shall be found at any section of the tested installation.

To avoid stagnation of residual water and damages caused by frost a pressure test as dry leak test with compressed air (or inert gas) can be carried out

TEST SHEET (draft)

(According to the standards given in DIN 1988)

Object description :

Executing company:

Client:

Object:

Raw material: PP-R / PP-RCT ☐ _____ ☐

Pipe length:

Ø 16	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
Ø 160 m	Ø 225 m	Ø 250 m	Ø 280 m
Ø 315 m			

Joining: Welding pcs Gluing pcs

Number of tapping points: pcs.

Highest tapping point above pressure gauge: pcs.

Total pipe length: m

Preliminary test:		**Preliminary test:**	
Test pressure	bar	Test pressure	bar
1st regulation after 10 minutes	bar		
2nd regulation after 10 minutes	bar	Pressure decrease after 2 hours (0.2 bar max.)	bar
Pressure after 30 minutes	bar		
Pressure decrease	bar		
Result of preliminary:		**Result of preliminary:**	

Pressure test acknowledged:

Beginning of the test h End of test h Test period h

Place Date Time

Signatures:

Customer Contractor

Leak test with compressed air or inert gas

General

Because of compressibility of gases during proceeding pressure tests with air the provisions for pre- vention of accidents “Working on gas facilities” as well as the regu- lation “Technical rules for gas in- stallations DVGW-TRGI (German Technical and Scientific Associa- tion 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 organiza- tion and following this regulation the testing pressure was set at max. 3 bar as during load and leak tests for gas pipelines.

General provisions

New pipeline facilities may only be put into operation if the compul- sory 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 secti- ons (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 branched volu- minous sections. Hence leak loca- tions can be determined faster. Apparatuses, drinking water war- mers, armatures or pressure tanks must be disconnected from the pipelines prior to the air pressure test in case they have larger capa- city and can affect reliability and test accuracy. All pipeline ope- nings must be directly closed with metallic plugs, metallic blanking plates or blank flanges that with- stand 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 quantity and on appropriate loca- tions where the air can be defla- ted in a safe manner.

If leaks are observed during the vi- sual or noise inspections or if a pressure drop is identified above the allowed values all connections should be checked with regard to leak tightness with test equipment that creates bubbles. After removal of possible leaks the pressure test should be repeated. During the te- sting period no single leak may be detected on any location of the in- spected 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 any doubts 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 per- mitted.

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 imple- mented with a pressure test of 110 mbar prior to the load test.

The applied pressure gauge must have an appropriate precision of 1 mbar (10 mmWS) display range for the pressure that will be measu- red. 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 suitable for the test pressures or have to be dismounted before the test.

After application of the test pres- sure the testing period for up to 100 liter line volume must be at least 30 minutes. For every addi- tional 100 liters the testing period must be increased by 10 minutes. The leak tightness test starts once the test pressure is achieved and taking into consideration the re- spective waiting period for adju- sting the medium to the ambient temperature.

Load test

The load test is implemented with a maximum test pressure of 3 bar and a pressure gauge with a dis- play range of 0,1 bar. The load test is combined with a visual inspec- tion of all pipe connections during which it is checked whether wel- ding, 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 increa- sed 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 pres- sure the testing period is 10 minu- tes.

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 lo- cating the leakage)

By means of technical security equipment like pressure reducing regulator on compressors it has to be ensured that the specified test pressure for the pipe facility is not exceeded.

4.3 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 type: _____

Pressure on the facility: _____ bar Ambien temperature:: _____ °C Temperature 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

Temperature balance and steady-state condition are 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

Installation

Authoritative for the insulation of pipework 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, conden- sation water. For the minimum insu- lation 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 connec- tion pipes of maxi mally 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 in re- spect to their heat transfer.Thus PN 20 PP-R/PP-RCT pipes in continuous ope- ration 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 that of metal pipes.

Fire Protection

PP-R/PP-RCT is classified under building material class 2 - normal flamma- bility.The respective national building laws (building regulations on all ad- ministrative levels and their implementing regulations) must be adhered to. The application of approved fire protection measures prevent the pas- sing of smoke and fire for the pipes through walls and ceilings.

Ver.1

Zero Leakage, Zero Contamination, Zero Corrosion, Zero Blockage

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