



**PRACTO**

**PP-R WATER SUPPLY  
SOLUTIONS**



## 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. Smart Home 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 Smart Home 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.



## Index

---

4 - 5

### PRODUCTS

PP-R Pipes and Fittings - indoor water supply solutions .....	8
PP-R Pipes and Fittings with UV Resistance outdoor water supply solutions .....	24
Valves .....	38

### SYSTEM STRUCTURE

2.1 The Scope .....	50
2.2 Chemical Resistance .....	51
2.3. Resistance to Current Strays .....	51
2.4 . Soundproof-ness .....	51
2.5. Low Thermal Conductivity .....	51
2.6. Low Pressure Loss .....	51
2.7. No Toxicity .....	51
2.8. Easy Workability .....	51
2.9. UV Resistance .....	51
2.10. Cracking Resistance under Stress .....	51
2.11. Advantages of Smart Home Water Supply System .....	52

### Quality Assurance

3.1. System Standards .....	58
3.2. Technical Information .....	59
3.3. Chemical resistance .....	61
3.4. Range of application / Temp. tension .....	84

### Installation

4.1 Welding Process .....	100
4.2 Welding Procedure .....	102
4.3 Pressure test .....	107

---

## PRODUCTS



### INDEX

#### Products

PP-R Pipes and Fittings - indoor water supply solutions	8
PP-R Pipes and Fittings with UV Resistance outdoor water supply solutions	24
Valves	38



**Practo PP-R/ PP-RCT for Indoor Applications – hot and cold water supply**

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

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.

Practo 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:**

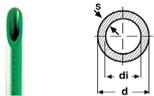
- Cold and hot potable water
- Swimming pool installation
- Rainwater application
- Heating systems
- Pipelines for industrial use
- Compressed air system

**Features of Practo – 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 - indoor water supply solutions

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
337110001	50 mm.	40.8	4.6	1.307	0.638	20
337110002	63 mm.	51.4	5.8	2.075	1.010	16
337110003	75 mm.	61.4	6.8	2.941	1.410	12
337110004	90 mm.	73.6	8.2	4.254	2.030	8
337110005	110 mm.	90	10.0	6.362	3.010	8

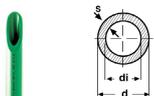
PP-RCT Pipes



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
337120101	20 mm.	14.4	2.8	0.163	0.148	160
337120102	25 mm.	18	3.5	0.254	0.230	100
337120103	32 mm.	23.2	4.4	0.415	0.370	60
337120104	40 mm.	29	5.5	0.660	0.575	40
337120105	50 mm.	36.2	6.9	1.029	0.896	20
337120106	63 mm.	45.8	8.6	1.647	1.41	16
337120107	75 mm.	54.4	10.3	2.323	2.01	12
337120108	90 mm.	65.4	12.3	3.358	2.87	8
337120109	110 mm.	79.8	15.1	4.999	4.30	8



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
337130001	20 mm.	14.4	2.8	0.163	0.148	160
337130002	25 mm.	18	3.5	0.254	0.230	100
337130003	32 mm.	23	4.5	0.415	0.370	60
337130004	40 mm.	29	5.5	0.66	0.575	40
337130005	50 mm.	36.2	6.9	1.029	0.896	20
337130006	63 mm.	45.8	8.6	1.647	1.410	16
337130007	75 mm.	54.4	10.3	2.323	2.01	12
337130008	90 mm.	65.4	12.3	3.358	2.87	8
337130009	110 mm.	79.8	15.1	4.999	4.3	8



PP-R pipe PN20 SDR 6

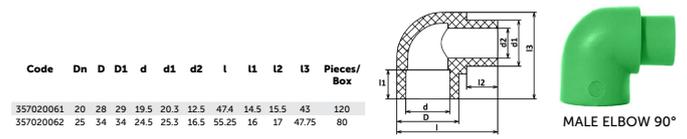
Material: PP-R  
 Pipe series: SDR 6/S 2.5  
 Standard: DIN 8077/DIN 8078, DIN EN ISO 15874  
 Color: Green with laser labeling system.  
 Form Supplied: 4 meter straight length, also in coils for some diameters

Code	d	di	S	Water content Lit/m	Kg/m.	m/bag
337120001	20 mm.	13.2	3.4	0.137	0.172	160
337120002	25 mm.	16.6	4.2	0.216	0.266	100
337120003	32 mm.	21.2	5.4	0.353	0.434	60
337120004	40 mm.	26.6	6.7	0.555	0.671	40
337120005	50 mm.	33.4	8.3	0.876	1.04	20
337120006	63 mm.	42	10.5	1.385	1.65	16
337120007	75 mm.	50	12.5	1.963	2.34	12
337120008	90 mm.	60	15	2.826	3.36	8
337120009	110 mm.	73.4	18.3	4.229	5.01	8



ELBOW 45°

Code	Dn	d	D	l	Z	Pieces/Box
357010001	20	19.5	29	21	6	120
357010002	25	24.5	34	24	8	100
357010003	32	31.5	43	28	10	50
357010004	40	39.4	52	32	11	30
357010005	50	49.4	65	37	13	18
357010006	63	62.5	82	44	16	24
357010007	75	74.7	99	50	20	15
357010008	90	89.7	120	58	25	8
357010009	110	109.7	148	69	32	4



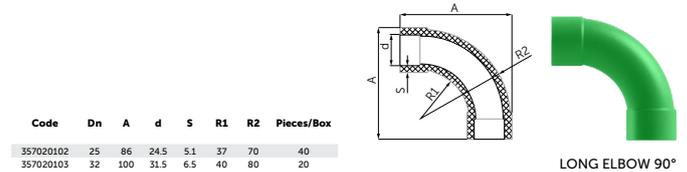
MALE ELBOW 90°

Code	Dn	D	D1	d	d1	d2	l	l1	l2	l3	Pieces/Box
357020061	20	28	29	19.5	20.3	12.5	47.4	14.5	15.5	43	120
357020062	25	34	34	24.5	25.3	16.5	55.25	16	17	47.75	80



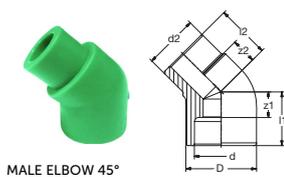
ELBOW 90°

Code	Dn	d	D	l	Z	Pieces/Box
357020001	20	19.5	29	28	13	120
357020002	25	24.5	34	32	16	80
357020003	32	31.5	43	38	20	80
357020004	40	39.4	52	44	23	50
357020005	50	49.4	66.5	52	26.5	30
357020006	63	62.5	84	62	34	20
357020007	75	74.7	101	71	41	12
357020008	90	89.7	120	83	50	6
357020009	110	109.7	148	99	62	3



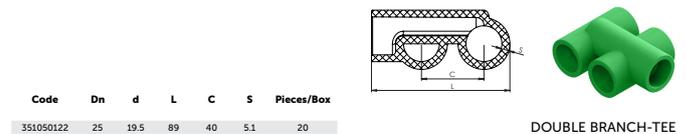
LONG ELBOW 90°

Code	Dn	A	d	S	R1	R2	Pieces/Box
357020102	25	86	24.5	5.1	37	70	40
357020103	32	100	31.5	6.5	40	80	20



MALE ELBOW 45°

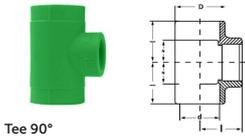
Code	Dn	d	d2	D	l1	l2	z	Pieces/Box
357010061	20	19.5	20.3	28	19.5	23.9	7	150
357010062	25	24.5	25.3	34	21	28.5	9	100



DOUBLE BRANCH-TEE

Code	Dn	d	L	C	S	Pieces/Box
351050122	25	19.5	89	40	5.1	20

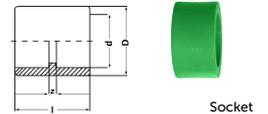
PP-R Fittings - indoor water supply solutions



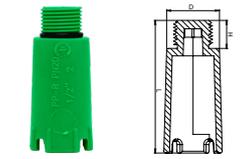
Tee 90°

Code	Dn	d	D	I	Z	Pieces/Box
357050001	20	19.5	29	28	13	80
357050002	25	24.5	33.5	31.5	16	50
357050003	32	31.5	43	38	20	30
357050004	40	39.4	52	44	23	40
357050005	50	49.4	65.7	51.7	28.2	20
357050006	63	62.5	84	61.5	32	6
357050007	75	74.7	100	71	41	10
357050008	90	89.7	120	83	50	6
357050009	110	109.7	148	99	62	2

Code	Dn	d	D	I	Z	Pieces/Box
357070001	20	19.5	29	34	5	150
357070002	25	24.5	34	37	5	120
357070003	32	31.5	43	41	5	60
357070004	40	39.4	52	46	5	80
357070005	50	49.4	65	52	5	70
357070006	63	62.5	84	60	5	36
357070007	75	74.7	99	65	5	32
357070008	90	89.7	120	76	10	14
357070009	110	109.7	148	80	6	7

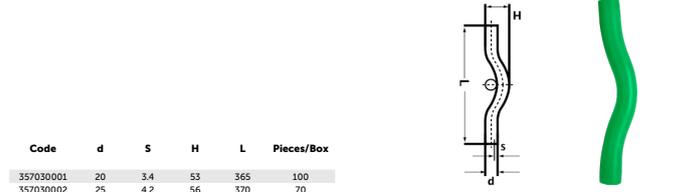


Socket



Wall inlet Plug

Code	Dn	O-Ring	H	D	L	Pieces/Box
357080012	20	21x2.5	15	28	71	120



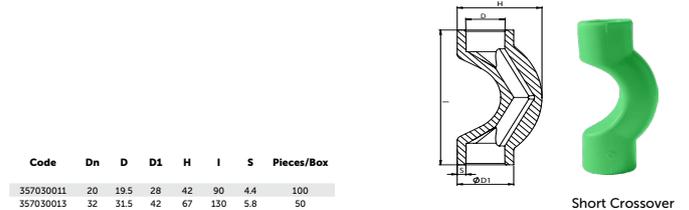
Crossover

Code	d	S	H	L	Pieces/Box
357030001	20	3.4	53	365	100
357030002	25	4.2	56	370	70
357030003	32	5.4	68	370	50



Reducing Tee 90°

Code	Dn - Dn1 - Dn2	d - d1 - d2	D	D1	I	I1	Z	Z1	Pieces/Box
357060001	25-20-25	24.5-19.5-24.5	34	29	32	32	16	17	140
357060002	32-20-32	31.5-19.5-31.5	43	34	38	36	20	21	80
357060003	32-25-32	31.5-24.5-31.5	43	34	38	36	20	20	80
357060004	40-20-40	39.4-19.5-39.4	52	43	44	39	24	24	60
357060005	40-25-40	39.4-24.5-39.4	52	43	44	40	23	24	50
357060006	40-32-40	39.4-31.5-39.4	52	43	44	40	23	22	50
357060007	50-20-50	49.4-19.5-49.4	65	43	52	46	28	31	30
357060008	50-25-50	49.4-24.5-49.4	65	43	52	46	28	30	30
357060009	50-32-50	49.4-31.5-49.4	65	43	52	46	28	28	30
357060010	50-40-50	49.4-39.4-49.4	85	85	62	62	39	35	30
357060011	63-20-63	62.5-19.5-62.5	85	43	62	62	35	48	16
357060012	63-25-63	62.5-24.5-62.5	85	43	62	62	35	46	16
357060013	63-32-63	62.5-31.5-62.5	85	43	62	62	35	44	16
357060014	63-40-63	62.5-39.4-62.5	85	85	62	62	35	42	16
357060015	63-50-63	62.5-49.4-62.5	85	85	62	62	35	39	16
357060016	75-20-75	74.7-19.5-74.7	100	43	71	71	41	57	12
357060017	75-25-75	74.7-24.5-74.7	100	43	71	71	41	55	12
357060018	75-32-75	74.7-31.5-74.7	100	43	71	71	41	53	12
357060019	75-40-75	74.7-39.4-74.7	100	65	71	71	41	51	12
357060020	75-50-75	74.7-49.4-74.7	100	65	71	71	41	48	12
357060021	75-63-75	74.7-62.5-74.7	100	101	71	71	41	44	12
357060022	90-63-90	89.7-62.5-89.7	120	120	83	83	50	55	6
357060023	90-75-90	89.7-74.7-89.7	120	120	83	83	50	53	6
357060024	110-63-110	109.7-62.5-109.7	148	85	99	99	62	71	4
357060025	110-75-110	109.7-74.7-109.7	148	100	99	99	62	69	4
357060026	110-90-110	109.7-89.7-109.7	148	120	99	99	62	66	4

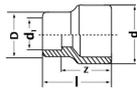


Short Crossover

Code	Dn	D	D1	H	I	S	Pieces/Box
357030011	20	19.5	28	42	90	4.4	100
357030013	32	31.5	42	67	130	5.8	50



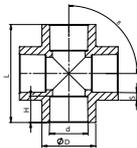
Reducer



Code	Dn-Dn1	d	d1	D	L	Z	Pieces/Box
357040001	25-20	25.3	19.5	29	36	22	180
357040002	32-20	32.3	19.5	29	37	23	120
357040003	32-25	32.3	24.5	34	39.4	23	120
357040004	40-20	40.4	19.5	34	43	28	90
357040005	40-25	40.4	24.5	34	43	27	80
357040006	40-32	40.4	31.5	43	45	27	60
357040007	50-20	50.5	19.5	43	51	36	50
357040008	50-25	50.5	24.5	43	51	35	50
357040009	50-32	50.5	31.5	43	51	33	40
357040010	50-40	50.5	39.4	52	53	33	30
357040011	63-20	63.6	19.5	34	56	42	25
357040012	63-25	63.6	24.5	34	56	40	25
357040013	63-32	63.6	31.5	43	58	40	25
357040014	63-40	63.6	39.4	52	60	40	20
357040015	63-50	63.6	49.4	65	63	40	20
357040016	75-50	75.7	49.4	65	67	44	16
357040017	75-63	75.7	62.5	80	71	44	12
357040018	90-63	90.9	62.5	80	78	51	12
357040019	90-75	90.9	74.7	99	81	51	12
357040022	110-90	111.0	89.7	110	93	61	4



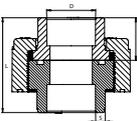
Cross Tee



Code	Dn	D	d	H	L	S	B	Pieces/Box
357050062	25	34.5	24.5	16	60	4.4	90*	100
357050063	32	43	31.5	18	75	5.8	90*	50

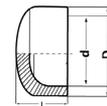


Union



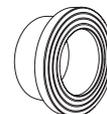
Code	D	H	L	S	Pieces/Box
371080201	20	20	45	4.3	140
371080202	25	23	51	4.8	100
371080203	32	27	61	5.5	60

Code	Dn	d	D	L	Pieces/Box
357080001	20	19.5	28.6	25	250
357080002	25	24.5	34	28	150
357080003	32	31.5	43	31.3	100
357080004	40	39.4	52	36	60
357080005	50	49.4	65	40	80
357080006	63	62.5	79	48	60
357080007	75	74.7	99	54	16
357080008	90	89.7	120	66	8
357080009	110	109.7	148	79	8



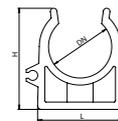
Cap

Code	Dn	d	D	D1	L	Z	h	Pieces/Box
357090001	63	62.5	89.5	75.6	40.9	12.9	15.5	24
357090002	75	74.7	105	89	37	7.5	15	18
357090003	90	89.7	125.5	110	43.5	9.5	19.5	10
357090004	110	109.7	158	132	51	13.35	18	7

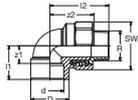


Flange

Code	Dn	d	L	I	Pieces/Box
351099948	20	33	26	14	250
351099949	25	38	36	14	200
351099950	32	46	38	15	150

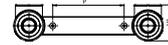
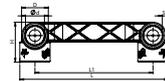


Pipe Clamps



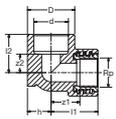
Elbow 90° Male Thread

Code	Dn - Dn1	d	D	l1	l2	Z	Z1	SW	Pieces/Box
367010001	20-1/2	19.5	29	28	34	14	49	36	70
367010003	25-1/2	24.5	34	32.27	38	16	53	36	60
367010004	25-3/4	24.5	34	32	40	16	56	44	40
367010006	32-1	31.5	43	38	48	20	66	51	30



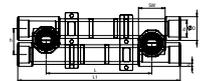
Code	Dn-Rp	D	d	H	H1	L	L1	S	P	Pieces/Box
371070101	20-1/2	29	19.5	41	46	186	150	4.4	90	48
367020006	25-1/2	34	24.5	53	47	186	150	4.8	90	32

Double Elbow with Female Thread



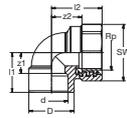
Bracket Elbow Female thread

Code	Dn - Rp	d	D	D1	L	L1	h	T	Z	Z1	Pieces/Box
367020001	20-1/2	19.5	35	29	35	27	15	40	21	11	40
367020002	25-1/2	24.5	35	29	37	30	17	40	23	14	40
367020003	25-3/4	24.5	43	34	43	35	22	50	28	19	20
367020004	32-3/4	31.5	43	43	43	35	22	50	28	17	20
367020005											



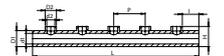
Code	Dn-Rp	L adjustable	D	d	SW	L1	S	h	Pieces/Box
371070102	20-1/2	100 - 135 - 150	29	19.5	38	230	4.4	30.5	28
371070103	25-1/2	100 - 135 - 150	34	24.5	38	230	4.8	37.5	20

Adjustable Water Battery



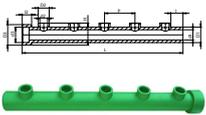
Elbow 90 female thread

Code	Dn - Rp	d	SW	D	l2	l1	z1	z2	Pieces/Box
367020127	20-1/2	19.5	36	29	34	28	15	16	40
367020128	25-1/2	24.5	36.5	35	36	32.5	16.5	21	20
367020129	25-3/4	24.5	44.5	35	39	32	16	21	20
367020132	32-1/2	31.5	37	45.3	43.8	36.5	17.5	29	20



Code	Dn-Dn1	D1	d1	D2	d2	L	P	I	H	Pieces/Box
358091043	50 - 32	50.2	33.2	43	31.5	650	123	50	70	19
358091041	63 - 32	63.2	42	43	31.5	650	123	50	83	15

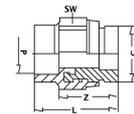
Manifold welding without end socket



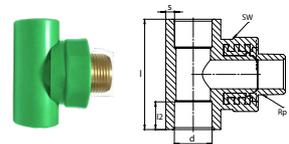
Manifold welding - End socket

Code	Dn- Dn1	D1	d1	D2	d2	D3	d3	L	P	I	I2	H	Pieces/ Box
358091042	50-32	50.2	33.2	43	31.5	66	49.4	650	123	50	31.5	78	19
358091044	63-32	63.2	42	43	31.5	83	62.5	650	123	50	37.5	93	12

Code	Dn-R	d	L	Z	Pieces/Box
367050001	20-1/2	19.5	50	34	60
367050002	20-1/4	19.5	53	38	60
367050003	25-1/2	24.5	51	35	80
367050004	25-1/4	24.5	54	38	40
367050005	32-1/4	31.5	56	37	50
367050006	32-1	31.5	62	46	40
367050007	40-1 1/4	39.4	72	51	27
367050009	50-1 1/2	49.4	77	53	24
367050010	63-2	62.5	88	60	12
367050011	75-2 1/2	74.7	102	71	2
367050012	90-3	89.7	143	111	4
367050013	110-4	109.7	161	124	3



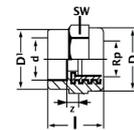
Adaptor Socket Male Thread



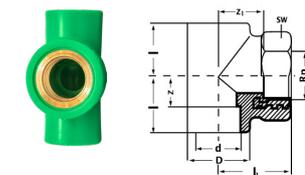
Tee 90° Male Thread

Code	Dn-Rp	SW	I2	I	S	d	Pieces/Box
367030011	20-1/2	38	14.5	56	4.4	19.5	60
367030012	20-3/4	45	14.5	56	4.4	19.5	40
367030013	25-1/2	38	16	61	4.9	24.5	40
367030014	25-3/4	45.2	16	69	4.9	24.5	40

Code	Dn-Rp	d	D	D1	I	Z	SW	Pieces/Box
367060001	20-1/2	19.5	35	29	40	11	36	60
367060003	25-1/2	24.5	35	34	41	11	36	60
367060004	25-3/4	24.5	43	34	42	11	44	50
367060005	32-3/4	31.5	43	44	11	44	60	40
367060009	32-1/2	31.5	45	36	50	11	37	40
367060006	32-1	31.5	50	43	48	12	51	40
367060008	40-1 1/4	39.4	62	52	54	13	63	36
367060010	50-1 1/2	49.4	69	64	57	14	70	27
367060011	63-2	62.5	84	79	68	19	85	12
367060012	75-2 1/2	74.7	113	99	82	22	114	4
367060013	90-3	89.7	129	124	92	27	-	8
367060014	110-4	109.7	160	151	165	27	-	4



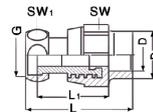
Adaptor Socket Female Thread



Tee 90° Female Thread

Code	Dn-Rp	d	D	I	I1	Z	Z1	SW	Pieces/Box
367030001	20-1/2	19.5	29	28	34	14	20	36	60
367030003	25-1/2	24.5	34	32	38	16	24	36	50
367030004	25-3/4	24.5	34	32	40	16	25	44	40
367030005	32-1/4	31.5	43	38	45	20	30	44	20
367030006	32-1	31.5	43	38	48	20	30	51	20

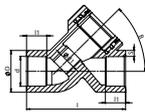
Code	Dn-Rp	D1	D	H	SW1	SW2	L	Pieces/ Box
357070021	20-1/2	20	19.5	14	36	23	35	60
357070061	20-3/4	20	19.5	14	36	31	35	60
357070062	25-3/4	25	24.5	14	36	31	35	60



Socket with loose nut

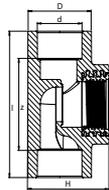


PP-R Fittings - indoor water supply solutions



Y Filter Female Thread

Code	Dn - Rp	D	d	d1	s	l	l1	B	Pieces / Box
367040011	20 - 1/2"	28	19.5	12	4.25	70	14.5	45°	100
367040012	25 - 3/4"	34	24.5	14	4.75	80	16	45°	80
367040013	32 - 3/4"	42.7	31.5	14	5.6	80	18	45°	60



Tee female valve

Code	Dn	D	d	l	Z	H	Pieces / Box
367040001	20-3/4	32	19.5	82.5	53.5	50.5	80
367040002	25-3/4	36	24.5	82.5	51.5	52.5	80
367040003	32-3/4	42.5	31.5	82.5	45.5	56.8	60





**Practo PP-R/ PP-RCT for Outdoor Applications – UV-Resistant system for hot 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.

**Practo – 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 UV fittings are injected with UV-resistant material to ensure long-term durability**

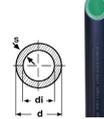
PP-R Pipes with UV resistance / outdoor water supply solutions



**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
337140001	20 mm	13.2	3.4	0.187	0.137	160	
337140002	25 mm	16.6	4.2	0.278	0.216	100	
337140003	32 mm	21.2	5.4	0.451	0.353	60	
337140004	40 mm	26.6	6.7	0.711	0.637	40	
337140005	50 mm	33.4	8.3	1.068	0.988	20	
337140006	63 mm	42.0	10.5	1.695	1.336	16	
337140007	75 mm	50.0	12.5	2.404	1.963	12	
337140008	90 mm	60.0	15.0	3.452	2.827	8	
337140009	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 Aluminum reinforced layer and external polypropylene layer  
**Pipe series:** SDR 7.4/S3.2  
**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
337080001	20	14.4	2.8	0.165	0.160	160	
337080002	25	18	3.5	0.251	0.242	100	
337080003	32	23.2	4.4	0.415	0.392	60	
337080004	40	29	5.5	0.66	0.597	40	
337080005	50	36.2	6.9	1.029	0.949	20	
337080006	63	45.8	8.6	1.647	1.434	16	

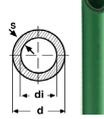
Multilayer pipes with Aluminum Reinforced UV in Black PN 16 SDR 7.4



**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.  
**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
337150001	20 mm	14.4	2.8	0.163	0.160	160	
337150002	25 mm	18	3.5	0.254	0.242	100	
337150003	32 mm	23.2	4.4	0.415	0.392	60	
337150004	40 mm	29	5.5	0.66	0.597	40	
337150005	50 mm	36.2	6.9	1.029	0.949	20	
337150006	63 mm	45.8	8.6	1.647	1.434	16	
337150007	75 mm	54.4	10.3	2.323	2.127	12	
337150008	90 mm	65.4	12.3	3.358	2.956	8	
337150009	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-R with integrated fiber-reinforced layer and external UV layer  
**Pipe series:** SDR6/S2.5  
**Standard:** DIN 8077/DIN 8078, DIN EN ISO 15874  
**Color:** internal layer is green and outer layer is Green  
**Pipe:** Green pipes with a laser labeling system  
**Form Supplied:** 4 meters straight length

Code	d	di	S	Water Capacity Lit/m		Kg/m.	m/bag
337160001	20 mm	13.2	3.4	0.187	0.172	160	
337160002	25 mm	16.6	4.2	0.278	0.266	100	
337160003	32 mm	21.2	5.4	0.451	0.434	60	
337160004	40 mm	26.6	6.7	0.711	0.671	40	
337160005	50 mm	33.4	8.3	1.068	1.04	20	
337160006	63 mm	42	10.5	1.695	1.65	16	
337160007	75 mm	50	12.5	2.404	2.34	12	
337160008	90 mm	60	15	3.452	3.36	8	
337160009	110 mm	73.2	18.3	5.148	5.01	8	

Multilayer pipes with fiber-reinforced UV in Green PN 20 SDR 6



**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.

Code	d	di	S	Water Capacity Lit/m		Kg/m.	m/bag
337080101	20 mm.	13.2	3.4	0.187	0.137	160	
337080102	25 mm.	16.6	4.2	0.278	0.216	100	
337080103	32 mm.	21.2	5.4	0.451	0.353	60	
337080104	40 mm.	26.6	6.7	0.711	0.637	40	
337080105	50 mm.	33.4	8.3	1.068	0.988	20	
337080106	63 mm.	42.0	10.5	1.695	1.336	16	

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

**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

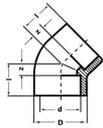
**Multilayer pipes with Aluminum Reinforced UV**

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





ELBOW 45°



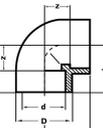
Code	Dn	d	D	l	z	Pieces/Box
357510001	20	19.5	29	21	6	120
357510002	25	24.5	34	24	8	100
357510003	32	31.5	43	28	10	50
357510004	40	39.4	52	32	11	30
357510005	50	49.4	65	37	13	18
357510006	63	62.5	82	44	16	24
357510007	75	74.7	99	50	20	15
357510008	90	89.7	120	58	25	8
357510009	110	109.7	148	69	32	4

Code	Dn	D	D1	d	d1	d2	l	l1	l2	l3	Pieces/Box
357520061	20	28	29	19.5	20.3	12.5	47.4	14.5	15.5	43	120
357520062	25	34	34	24.5	25.3	16.5	55.25	16	17	47.75	80

MALE ELBOW 90°



ELBOW 90°



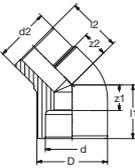
Code	Dn	d	D	l	z	Pieces/Box
357520001	20	19.5	29	28	13	120
357520002	25	24.5	34	32	16	80
357520003	32	31.5	43	38	20	60
357520004	40	39.4	52	44	23	50
357520005	50	49.4	66.5	52	26.5	30
357520006	63	62.5	84	62	34	20
357520007	75	74.7	101	71	41	12
357520008	90	89.7	120	83	50	6

Code	Dn	A	d	S	R1	R2	Pieces/Box
355120102	25	86	24.5	5.1	37	70	40
355120103	32	100	31.5	6.5	40	80	20

LONG ELBOW 90°



MALE ELBOW 45°

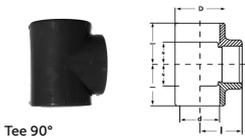


Code	Dn	d	d2	D	l1	l2	z	Pieces/Box
357510061	20	19.5	20.3	28	19.5	23.9	7	150
357510062	25	24.5	25.3	34	21	28.5	9	100

Code	Dn	d	L	C	S	Pieces/Box
355050122	25	19.5	89	40	5.1	20

DOUBLE BRANCH-TEE

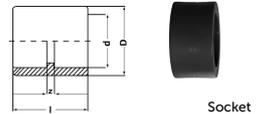
PP-R Fittings - indoor water supply solutions



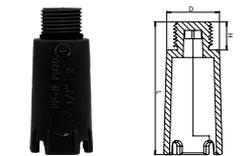
Tee 90°

Code	Dn	d	D	I	Z	Pieces/Box
35750001	20	19.5	29	28	13	80
35750002	25	24.5	33.5	31.5	16	50
35750003	32	31.5	43	38	20	30
35750004	40	39.4	52	44	23	40
35750005	50	49.4	65.7	51.7	28.2	20
35750006	63	62.5	84	61.5	32	6
35750007	75	74.7	100	71	41	10
35750008	90	89.7	120	83	50	6
35750009	110	109.7	148	99	62	2

Code	Dn	d	D	I	Z	Pieces/Box
35750001	20	19.5	29	34	5	150
35750002	25	24.5	34	37	5	120
35750003	32	31.5	43	41	5	60
35750004	40	39.4	52	46	5	80
35750005	50	49.4	65	52	5	70
35750006	63	62.5	84	60	5	36
35750007	75	74.7	99	65	5	32
35750008	90	89.7	120	76	10	14
35750009	110	109.7	148	80	6	7



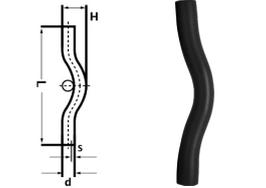
Socket



Wall inlet Plug

Code	Dn	O-Ring	H	D	L	Pieces/Box
357580012	20	21x2.5	15	28	71	120

Code	d	S	H	L	Pieces/Box
357530001	20	3.4	53	365	100
357530002	25	4.2	56	370	70
357530003	32	5.4	68	370	50



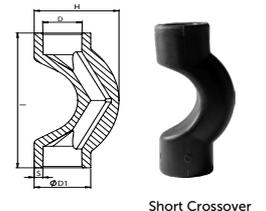
Crossover



Reducing Tee 90°

Code	Dn - Dn1 - Dn2	d - d1 - d2	D	D1	I	I1	Z	Z1	Pieces/Box
357560001	25-20-25	24.5-19.5-24.5	34	29	32	32	16	17	140
357560002	32-20-32	31.5-19.5-31.5	43	34	38	36	20	21	80
357560003	32-25-32	31.5-24.5-31.5	43	34	38	36	20	20	80
357560004	40-20-40	39.4-19.5-39.4	52	43	44	39	24	24	60
357560005	40-25-40	39.4-24.5-39.4	52	43	44	40	23	24	50
357560006	40-32-40	39.4-31.5-39.4	52	43	44	40	23	22	50
357560007	50-20-50	49.4-19.5-49.4	65	43	52	46	28	31	30
357560008	50-25-50	49.4-24.5-49.4	65	43	52	46	28	30	30
357560009	50-32-50	49.4-31.5-49.4	65	43	52	46	28	28	30
357560010	50-40-50	49.4-39.4-49.4	85	85	62	62	39	35	30
357560011	63-20-63	62.5-19.5-62.5	85	43	62	62	35	48	16
357560012	63-25-63	62.5-24.5-62.5	85	43	62	62	35	46	16
357560013	63-32-63	62.5-31.5-62.5	85	43	62	62	35	44	16
357560014	63-40-63	62.5-39.4-62.5	85	85	62	62	35	42	16
357560015	63-50-63	62.5-49.4-62.5	85	85	62	62	35	39	16
357560018	75-20-75	74.7-19.5-74.7	100	43	71	71	41	57	12
357560020	75-25-75	74.7-24.5-74.7	100	43	71	71	41	55	12
357560021	75-32-75	74.7-31.5-74.7	100	43	71	71	41	53	12
357560022	75-40-75	74.7-39.4-74.7	100	65	71	71	41	51	12
357560023	75-50-75	74.7-49.4-74.7	100	65	71	71	41	48	12
357560024	75-63-75	74.7-62.5-74.7	100	101	71	71	41	44	12
357560026	90-63-90	89.7-62.5-89.7	120	120	83	83	50	55	6
355060123	90-75-90	89.7-74.7-89.7	120	120	83	83	50	53	6
355060124	110-63-110	109.7-62.5-109.7	148	85	99	99	62	71	4
355060125	110-75-110	109.7-74.7-109.7	148	100	99	99	62	69	4
355060126	110-90-110	109.7-89.7-109.7	148	120	99	99	62	66	4

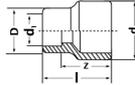
Code	Dn	D	D1	H	I	S	Pieces/Box
357530011	20	19.5	28	42	90	4.4	100
357530013	32	31.5	42	67	130	5.8	50



Short Crossover

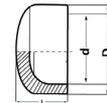


Reducer



Code	Dn - Dn1	d	d1	D	L	Z	Pieces/Box
357540001	25-20	25.3	19.5	29	36	22	180
357540002	32-20	32.3	19.5	29	37	23	120
357540003	32-25	32.3	24.5	34	39.4	23	120
357540004	40-20	40.4	19.5	34	43	28	90
357540005	40-25	40.4	24.5	34	43	27	80
357540006	40-32	40.4	31.5	43	45	27	60
357540007	50-20	50.5	19.5	43	51	36	50
357540008	50-25	50.5	24.5	43	51	35	50
357540009	50-32	50.5	31.5	43	51	33	40
357540010	50-40	50.5	39.4	52	53	33	30
357540011	63-20	63.6	19.5	34	56	42	25
357540012	63-25	63.6	24.5	34	56	40	25
357540013	63-32	63.6	31.5	43	58	40	25
357540014	63-40	63.6	39.4	52	60	40	20
357540015	63-50	63.6	49.4	65	63	40	20
357540016	75-50	75.7	49.4	65	67	44	16
357540017	75-63	75.7	62.5	80	71	44	12
357540018	90-63	90.9	62.5	80	78	51	12
357540019	90-75	90.9	74.7	99	81	51	12
357540022	110-90	111	89.7	110	93	61	4

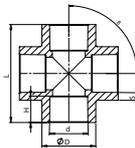
Code	Dn	d	D	L	Pieces/Box
357580001	20	19.5	28.6	25	250
357580002	25	24.5	34	28	150
357580003	32	31.5	43	31.3	100
357580004	40	39.4	52	36	60
357580005	50	49.4	65	40	80
357580006	63	62.5	79	48	60
357580007	75	74.7	99	54	16



Cap

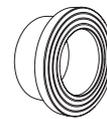


Cross Tee



Code	Dn	D	d	H	L	S	B	Pieces/Box
357550062	25	34.5	24.5	16	60	4.4	90°	100
357550063	32	43	31.5	18	75	5.8	90°	50

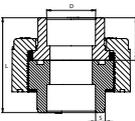
Code	Dn	d	D	D1	L	Z	h	Pieces/Box
355090101	63	62.5	89.5	75.6	40.9	12.9	15.5	24
355090102	75	74.7	105	89	37	7.5	15	18
355090103	90	89.7	125.5	110	43.5	9.5	19.5	10
355090104	110	109.7	158	132	51	13.35	18	7



Flange

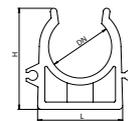


Union

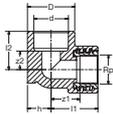


Code	D	H	L	S	Pieces/Box
371580201	20	20	45	4.3	140
371580202	25	23	51	4.8	100
371580203	32	27	61	5.5	60

Code	Dn	d	L	I	Pieces/Box
351599949	25	38	36	14	200
351599950	32	46	38	15	150

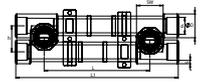


Pipe Clamps



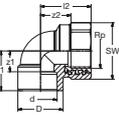
Bracket Elbow Female thread

Code	Dn-Rp	d	D	D1	L	L1	h	T	Z	Z1	Pieces/Box
367520001	20-1/2	19.5	35	29	35	27	15	40	21	11	40
367520002	25-1/2	24.5	35	29	37	30	17	40	23	14	40
367520003	25-3/4	24.5	43	34	43	35	22	50	28	19	20
367520004	32-3/4	31.5	43	43	43	35	22	50	28	17	20



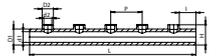
Adjustable Water Battery

Code	Dn-Rp	Ladjustable	D	d	SW	L1	S	h	Pieces/Box
371570102	20-1/2	100-135-150	29	19.5	38	230	4.4	30.5	28
371570103	25-1/2	100-135-150	34	24.5	38	230	4.8	37.5	20



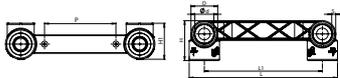
Elbow 90 female thread

Code	Dn-Rp	d	SW	D	l2	l1	z1	z2	Pieces/Box
367520127	20-1/2	19.5	36	29	34	28	15	16	40
367520129	25-3/4	24.5	44.5	35	39	32	16	21	20
367520128	25-1/2	24.5	37	35	39	33	16	39	40
367520130	32-1/2	31.5	37	45.3	43.8	36.5	17.5	29	20



Manifold welding without end socket

Code	Dn-Dn1	D1	d1	D2	d2	L	P	I	H	Pieces/Box
358091033	50-32	50.2	33.2	43	31.5	650	123	50	70	19
358091031	63-32	63.2	42	43	31.5	650	123	50	83	15



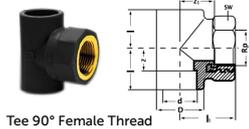
Double Elbow with Female Thread

Code	Dn-Rp	D	d	H	H1	L	L1	S	P	Pieces/Box
367520006	25-1/2"	34	24.5	53	47	186	150	4.8	90	32



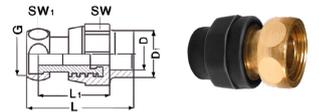
Manifold welding - End socket

Code	Dn-Dn1	D1	d1	D2	d2	D3	d3	L	P	I	I2	H	Pieces/Box
358091034	50-32	50.2	33.2	43	31.5	66	49.4	650	123	50	31.5	78	19
358091032	63-32	63.2	42	43	31.5	83	62.5	650	123	50	37.5	93	12



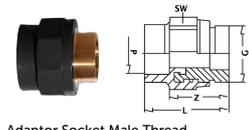
Tee 90° Female Thread

Code	Dn-Rp	d	D	I	I1	Z	Z1	SW	Pieces/Box
367530001	20- 1/2	19.5	29	28	34	14	20	36	60
367530003	25- 1/2	24.5	34	32	38	16	24	36	50
367530004	25- 3/4	24.5	34	32	40	16	25	44	40
367530006	32- 1	31.5	43	38	48	20	30	51	20
367530007	32- 1/2	31.5	45	33	45	14	30	37	20



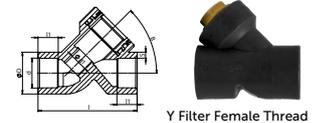
Socket with loose nut

Code	Dn-Rp	D1	D	H	SW1	SW2	L	Pieces/Box
357570062	25- 3/4	25	24.5	14	36	31	35	60



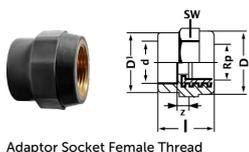
Adaptor Socket Male Thread

Code	Dn-R	d	L	Z	Pieces/Box
367550001	20- 1/2	19.5	50	34	60
367550004	25- 1/2	24.5	51	35	80
367550005	25- 3/4	24.5	54	38	40
367550006	32- 1/4	31.5	56	37	50
367550007	32- 1	31.5	62	46	40
367550009	40- 1 1/4	39.4	72	51	27
367550010	50- 1 1/2	49.4	77	53	24
367550011	63- 2	62.5	88	60	12
367550012	75- 2 1/2	74.7	102	71	2
365050113	90- 3	89.7	143	111	4



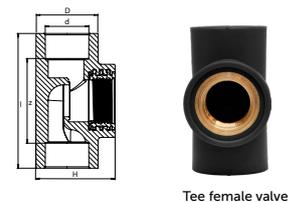
Y Filter Female Thread

Code	Dn-Rp	D	d1	s	l	l1	B	Pieces/Box
367540012	25- 3/4"	34	24.5	14	4.75	80	16	45° 80
367540013	32- 3/4"	42.7	31.5	14	5.6	80	18	45° 60



Adaptor Socket Female Thread

Code	Dn-Rp	d	D1	I	Z	SW	Pieces/Box
367560001	20- 1/2	19.5	35	29	40	11	36
367560003	25- 1/2	24.5	35	34	41	11	36
367560004	25- 3/4	24.5	43	34	42	11	44
367560005	32- 3/4	31.5	43	43	44	11	44
367560007	32- 1/2	31.5	45	36	50	11	37
367560006	32- 1	31.5	50	43	48	12	51
367560008	40- 1 1/4	39.4	62	52	54	13	63
367560010	50- 1 1/2	49.4	69	64	57	14	70
367560011	63- 2	62.5	84	79	68	19	85
367560012	75- 2 1/2	74.7	113	99	82	22	114
367560013	90- 3	89.7	129	124	92	27	-



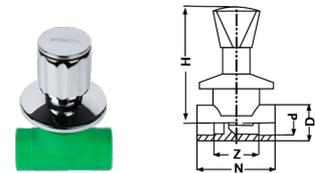
Tee female valve

Code	Dn	D	d	I	Z	H	Pieces/Box
367540001	20- 3/4	32	19.5	82.5	53.5	50.5	80
367540002	25- 3/4	36	24.5	82.5	51.5	52.5	80
367540003	32- 3/4	42.5	31.5	82.5	45.5	56.8	60



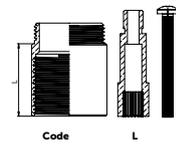
Practo Valves

Practo Valves



Concealed Valve

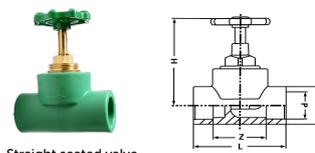
	Dn-Rp	d	D	Z	N	H
371040021	20- 3/4	19.5	32	53.5	82.5	112
371040022	25- 3/4	24.5	36	51.5	82.5	112



Code	L
371010003	29



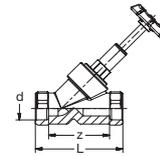
Elongation Kit



Straight seated valve

Dn-Rp	d	D1	Z	L	H	Pieces/Box
32- 3/4	31.5	42.5	45.5	82.5	69	150

Dn - Rp	Dn - Rp	d	L	Z	Pieces / Box
371060251	20 - 1/2"	19.5	70	41	60
371060252	25 - 3/4"	24.5	80	48	40
371060253	32 - 3/4"	31.5	80	44	40



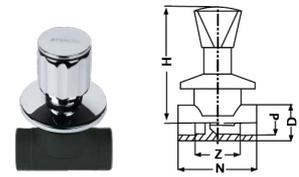
Y Seated Valve



Ball Valve

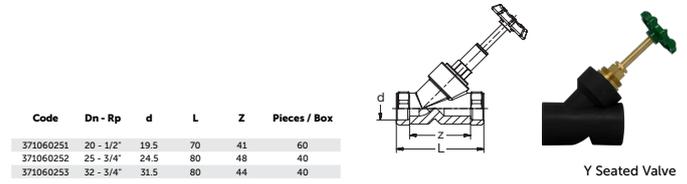
d	d1	d2	D	L	S
20	19.5	28.5	33.85	20.55	4.6
25	24.5	33.2	38.8	22.7	5.5
32	31.5	43	49.4	27	6.1
40	39.4	54.5	61.2	29.5	7.7
50	49.4	67.7	77	32.2	9
63	62.5	87	96	36	11
75	74.7	103	115	43.7	13.15
90	89.7	117	131	45.7	15
110	109.7	145	162.25	48	16

Practo Valves



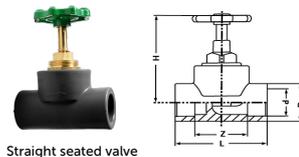
Concealed Valve

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
32- 1	31.5	44	60	97	154.3



Y Seated Valve

Code	Dn - Rp	d	L	Z	Pieces / Box
371060251	20 - 1/2"	19.5	70	41	60
371060252	25 - 3/4"	24.5	80	48	40
371060253	32 - 3/4"	31.5	80	44	40



Straight seated valve

Dn-Rp	d	D1	Z	L	H	Pieces/Box
20- 1/2	19.5	32	53.5	82.5	69	150
25- 1/2	24.5	36	51.5	82.5	69	150
32- 3/4	31.5	42.5	45.5	82.5	69	150



Ball Valve with UV resistance

d	d1	d2	D	L	S
32	31.5	43	49.4	27	6.1
50	49.4	67.7	77	32.2	9
63	62.5	87	96	36	11

An Environmentally Responsible Product





## INDEX

### Product features

2.1	The Scope	50
2.2	Chemical Resistance	51
2.3	Resistance to Current Strays	51
2.4	Soundproof-ness	51
2.5	Low Thermal Conductivity	51
2.6	Low Pressure Loss	51
2.7	No Toxicity	51
2.8	Easy Workability	51
2.9	UV Resistance	51
2.10	Cracking Resistance under Stress	51
2.11	Advantages of Practo Water Supply System	52

Product features



#### Raw materials

Pipes and fittings of Practo 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.

## Product features

50 - 51

### 2.1 Scope

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

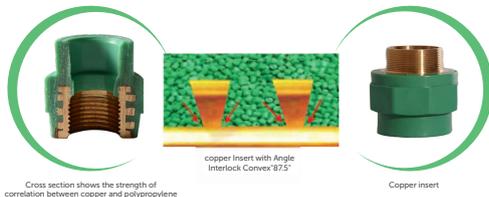
- Sanitary applications.
- Heating & air-conditioning systems.
- Compressed air installations.
- Watering systems for greenhouses and gardens.
- Transporting liquid material.
- Vacuum installations.
- In the chemical industry for the flow of various fluids.

Practo is an excellent choice for piping of clean hot & cold water. (Fig. A)

Practo is certified by the European Water Authority (DVGW) under standard DIN 50930 -6

Practo 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.



(Fig. A)

### 2.2 Chemical resistance

Practo 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, Practo is a poor electrical conductor. Therefore, there is no risk of stray currents occurring.

### 2.4 Soundproofing

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

### 2.5 low thermal conductivity

Practo 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 Practo 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 Practo 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 Practo 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

Practo black coated pipes are UV-resistant but must not be installed in an exposed area. Practo 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. Practo minimum resistance values have been determined through internal pressure tests, at various temperature intervals: 20, 40,

## Product features

52 - 53

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)

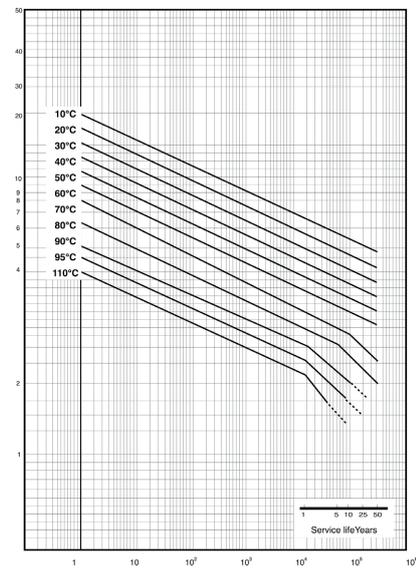
### 2.11 Advantages of Practo Piping System

Practo 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 Practo piping system. Practo is manufactured with Superior German quality. Practo is made of corrosion resistant material, putting an end to old corrosion complications. Enjoy some serenity and peacefulness with Practo because it is not as noisy as metal pipes. Unlike the alternatives, Practo is made of opaque polypropylene, which is a nonpolluting material, preventing algae from growing.

Practo 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 Practo



Utilization section for pipes and fittings of Practo 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**

## Product features

54 - 55

### Physical Characteristics

CHARACTERISTICS	METHODS	UNITS	VALUES
Specific weight	ISO/R 1183	g/cm <sup>3</sup>	0.897
Melt index at 190°C with 5 KG.	ISO 1133	g/10 min	0.5
Melt index at 230°C 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 <sup>2</sup> K	0,24
Specific heat at 20°C	Adiabatic calorimeter	KJ/Kg*°K	2,0
Linear expansion coefficient	VDE 0304	K1	1,5x 10
Heat 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/mm <sup>2</sup>	21
Ultimate tensile strength	DIN 53455	N/mm <sup>2</sup>	40
Ultimate elongation	DIN 53455	%	600
Modulus of elasticity	ISO 178	N/mm <sup>2</sup>	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 (-20°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/R1133		
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 <sup>3</sup>	0.895
Melting range	Polarizing microscope	°c	140 - 150
Yield stress	ISO/R527	N/mm <sup>2</sup>	21
Tensile strength	Feed speed	N/mm <sup>2</sup>	40
Tensile expansion	Test bar	%	600
Bending stress at 3.5%	ISO 178	N/mm <sup>2</sup>	20
Marginal fiber Expansion	Test specimen 5.1		
Modulus of elasticity	ISO 178	N/mm <sup>2</sup>	800
Mechanical properties			
Following impact			
Bending test at 0°C	DIN 8078		No fraction
Expansion coefficient	VDE 0304		1.5 x 10 <sup>-4</sup>
	Part 1 §4	K <sup>-1</sup>	
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



INDEX	
Quality Assurance	
3.1 System Standards	58
3.2 Technical Information	59
3.3 Chemical resistance	61
3.4 Range of application / Temp. tension	84

## 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 Part 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
SASO-ISO-15874-2	Plastics piping systems for hot and cold water installations – Polypropylene (PP) – Part 2: Pipes



3.2 Technical Information

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

**Jointing:**  
**Welding joints**  
Socket-welding by heating-elements according to DVS (German Welding Inst.) specifications: leaflet 2207, part 11, section 3.2.

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

**Threaded joints:**  
The threaded joint of adaptor pipe-fittings correspond to the requirements of DIN EN 10226, i. e. cylindrical female thread, conical male thread.

Male threads for connecting backnuts correspond to the requirements of DIN-ISO 228, part 1.

**Dimensions:**  
Pipes: According to DIN 8077 (Pipes of polypropylene PP). Fittings: According to DIN EN ISO 15874. (Pipe connections and fittings for polypropylene PP) injection moulded fittings, z-dimensions tolerance  $\pm 3$  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 pipeline.) General quality standards, test.

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

**Chemical Resistance:**  
Detailed information on the chemical resistance of polypropylene pipes and pipelines is available in DIN 8078.

**Orders:**  
When ordering, kindly always state the dimensions and the order number in addition to the designation of the piece required.  
Example: Elbow 90°, d 32, No. 351020003

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

**Signs and Symbols:**  
d = nominal size = pipe diameter  
R = male thread-conical  
Rp = female thread-cylindrical  
Rc = female thread-conical  
G = male thread-cylindrical  
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 developed for application in the sanitary field for cold and hot water.  
This system can be applied as well in the industrial section.

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

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

Tubes are available in lengths of 4 m. Plastic pipes and fittings of PP-R generally have all advantages which have been registered in all sections of industry and of installation technicians. Most of all the excellent resistance of corrosion gives proof of an extensively long utilization of installation tubing in the building technic, without risk of damages known from metallic materials.

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

Properties	Measuring technique	Unit	PP - R Value	PP - RCT Value
Melting index MFR 190/15 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 <sup>3</sup>	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 <sup>2</sup> N/mm <sup>2</sup> %	21 40 600	25 45 300
Bending stress at 3.5% Marginal fibre expansion	ISO 178 test specimen 5.1	N/mm <sup>2</sup>	20	23
Modulus of elasticity	ISO 178	N/mm <sup>2</sup>	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 <sup>-1</sup>	1,5 x 10 <sup>-4</sup>	1,5 x 10 <sup>-4</sup>
Thermal conductivity at 20° C/58° F	DIN 52612	W/m K	0.24	0.24
Specific heat at 20° C/68° 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	Chemical resistance	
	Key	Description
Dil Sol. Sol. Sat Sol. tg tg-s tg-l tg-g Work Sol. Susp.		Dilute aqueous solution at a concentration equal to or less than 10%
		Aqueous solution at a concentration higher than 10% but not saturated
		Saturated aqueous solution, prepared at 20°C
		At least technical grade purity
		Technical grade, solid
		Technical grade, liquid
		Technical grade, gas
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
L		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
NS		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

Quality Assurance

3.3 Chemical resistance

No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
5	Acetone	-95	56	5	100	
				10	50	
				20	50	S
				60	50	S
11	Air			tg-g	20	S
				tg-g	50	S
				tg-g	60	S
				tg-g	100	S
16	Aluminum Chloride			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
17	Aluminum Fluoride	250		Susp.	20	S
				Susp.	50	S
				Susp.	60	S
				Susp.	100	S
18	Aluminum Hydroxide			Susp.	20	S
				Susp.	50	S
				Susp.	60	S
				Susp.	100	S
19	Aluminum Nitrate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
20	Aluminum Oxychloride			Susp.	20	S
				Susp.	50	S
				Susp.	60	S
				Susp.	100	S
21	Aluminum Potassium Sulphate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
22	Aluminum Sulphate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
23	Ammonia, aqueous			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	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	S
				tg-g	60	S
25	Ammonia, Liquid	-78	-34	tg-g	20	S
				tg-g	50	S
				tg-g	60	S
26	Ammonium, Acetate			Sat Sol.	20	S
				Sat Sol.	60	S
				Sat Sol.	100	S
28	Ammonium Carbonate (Dec. at 58°C)			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	100	S
				Sat Sol.	120	S
29	Ammonium Chloride			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	100	S
34	Ammonium Nitrate	170		Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
36	Ammonium Phosphate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	120	S
37	Ammonium Sulphate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
41	Amyl Alcohol	-79	137	tg-1	20	S
				tg-1	50	S
				tg-1	60	S
				tg-1	100	S
43	Aniline	-6	184	Sat Sol.	20	S
				Sat Sol.	50	S
				tg-1	20	S
				tg-1	50	S
				tg-1	60	S
47	Apple Juice			Work Sol.	20	S
				Work Sol.	50	S
				Work Sol.	60	S

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

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

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.	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	
107	Chloroform	-64	62	tg-1	20	L
				tg-1	50	
				tg-1	60	NS
				tg-1	100	NS
110	Chlorosulphonic Acid	68	147 in vac.	50	20	
				50	20	NS
				tg-s	50	
				tg-s	60	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	
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
190	Glycolic acid	80		Sol.	20	
				Sol.	60	
				Sol.	100	
				30	20	S
				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

Quality Assurance

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	S
				Up to 10	60	S
				Up to 10	80	S
				Up to 10	100	S
				20	20	S
				20	50	S
				20	60	S
				20	80	S
				20	100	S
				10 to 20	20	S
				10 to 20	50	S
				10 to 20	60	S
				10 to 20	80	S
				10 to 20	100	S
				Up to 25	20	S
				Up to 25	60	S
				Up to 25	80	S
				Up to 25	100	S
				30	20	S
				30	60	L
				30	100	L
				>30	20	S
				>30	60	S
				>30	80	S
				>30	100	S
				36	20	S
				36	50	S
				36	60	S
				36	80	S
				38	100	S
				-112	-85	Conc.
		Conc.	50	S		
		Conc.	60	S		
		Conc.	80	S		
200	Hydrochloric Acid, Dry Gas			tg-g	20	S
				tg-g	50	S
				tg-g	60	S
201	Hydrochloric Acid, Wet Gas			tg-g	20	S
				tg-g	50	S
				tg-g	60	S
204	Hydrofluoric Acid, Gas			tg-g	20	S
				tg-g	40	S
				tg-g	60	S
205	Hydrogen			tg-g	20	S
				tg-g	60	S
				tg-g	120	S
213	Iodine, in Alcohol	114	183	Work Sol.	20	S
				Work Sol.	60	S

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 to 250	Work Sol.	20	
				Work Sol.	100	
239	Mercurous Nitrate			Sol.	20	S
				Sol.	50	S
				Sol.	60	S
				Sol.	100	S
				Sat Sol.	20	S
				Sat Sol.	60	S
		Sat Sol.	100	S		
240	Mercury			tg-1	20	S
				60	S	
				120	S	
244	Methyl Acetate	-98	57	tg-1	20	S
				tg-1	50	S
				tg-1	60	S
245	Methyl Alcohol	-97	65	5	20	S
				5	50	L
				5	60	L
		-97	65	tg-1	20	S
				tg-1	50	S
				tg-1	60	S
		tg-1	80	S		
254	Milk			Work Sol.	20	S
				Work Sol.	50	S
				Work Sol.	60	S
				Work Sol.	100	S
260	Nickel Acetate			Sat Sol.	20	S
				Sat Sol.	40	S
				Sat Sol.	60	S
261	Nickel Chloride			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S
262	Nickel Nitrate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	120	S
263	Nickel Sulphate			Sat Sol.	20	S
				Sat Sol.	50	S
				Sat Sol.	60	S
				Sat Sol.	100	S

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
273	Oxygen, Gas			50	100	NS
				tg-g	20	S
				tg-g	50	
283	Petroleum Ether (Ligroin)			tg-g	60	
				tg-g	100	
				Work Sol.	20	L
284	Phenol	41	182	Work Sol.	60	L
				Work Sol.	100	
				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
		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			

Quality Assurance

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	S
				Sat Sol.	60	S
				Sat Sol.	100	S
341	Sodium Acid Sulphate (See346)			tg-s	80	
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
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	
				50	100	S
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	S
				Sol.	60	
				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

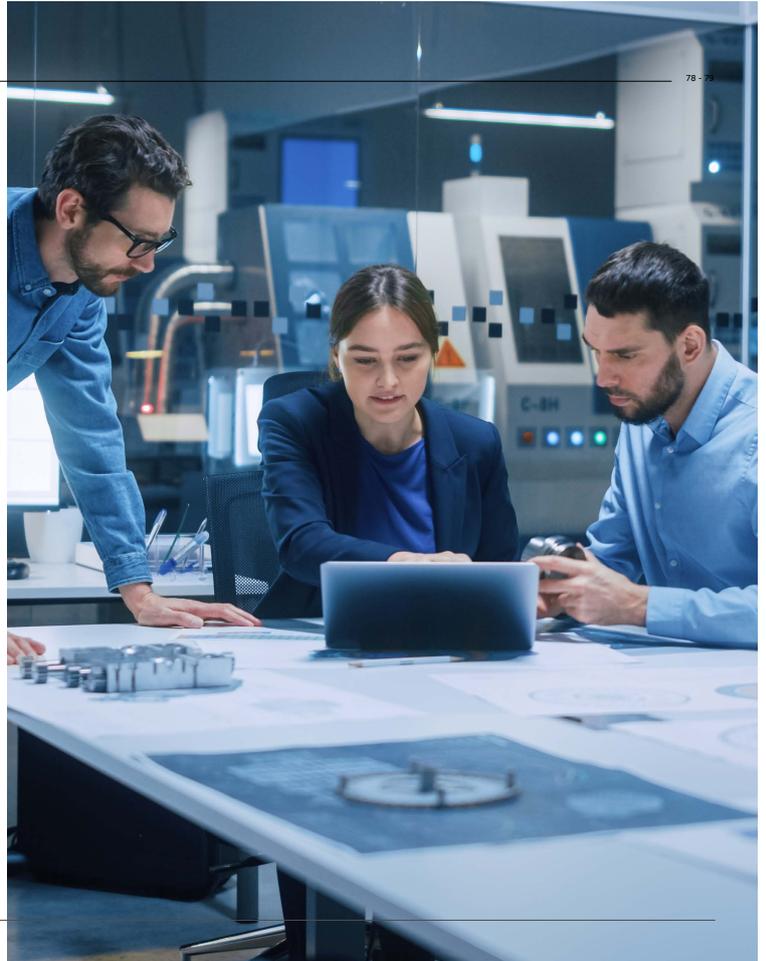
No.	Chemical	m.p. °c	b.p °c	Concentration %	T °c	Resistance
373	Sodium silicate			Sol.	20	S
				Sol.	50	
				Sol.	60	S
				Sat Sol.	20	
				Sat Sol.	50	
				Sat Sol.	60	
		50	100			
374	Sodium sulphate			Sat Sol.	20	S
				Sat Sol.	50	
				Sat Sol.	60	S
				Sat Sol.	100	
				0.1	20	S
				0.1	50	
		0.1	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	100	NS
394	Trichloroacetic Acid	58	197	Up to 50	20	S
				Up to 50	40	
				Up to 50	60	S
396	Trichloroethylene	-85	87	tg-1	20	NS
				tg-1	50	
				tg-1	60	NS
				tg-1	80	
401	Turpentine			tg-1	100	NS
				tg-1	20	NS
				tg-1	50	
				tg-1	60	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	
				Sat Sol.	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
414	Water, Sea				120	
					20	S
					50	
					60	S
					80	
				100	S	
				120		

## Quality Assurance

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



Quality Assurance

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) <sup>a</sup>	(0,5)	(0,6)	(0,8)	(1,3)	(1,3)	(2,2)	(2,7)	(3,4)	(4,3)	(5,5)

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

Quality Assurance

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									
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
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) <sup>a</sup>	(1.1)	(1.3)	(1.7)	(2.6)	(2.7)	(4.3)	(5.5)	(6.9)	(8.7)	(11.0)

<sup>a</sup> 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

<sup>1)</sup> SDR = Standard Dimension Ratio = diameter / wall thickness

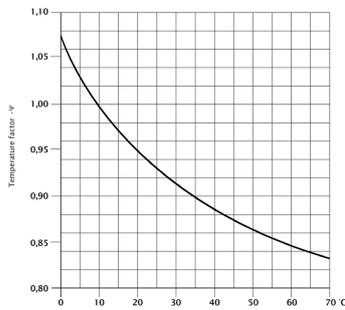


Fig. 2: Temperature of the flow medium

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 coefficient 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 P <sub>min FI</sub> 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 rinsing showers	DN 15	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 I	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 <sup>1)</sup>
	electric hot water tank and boiler			
1.1**	with nominal contents 5 - 15 l	DN 15	-	0.10
1.2**	with nominal contents 30 - 150 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 arrangement 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 about 4/5.

$\Delta l$ = Linear extension in (mm)  
 $\alpha$ = Thermal expansion coefficient in  $\frac{mm}{mK}$   
 L= Pipe length (m)  
 $\Delta t$ = Temperature difference (K)

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

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

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

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

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

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

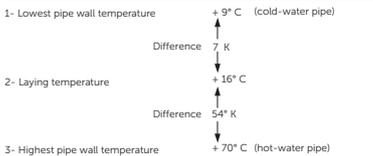
The linear deformation of a pipe is thus calculated according to the following formula:

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

The calculation of the linear deformation is based on the laying temperature.

The following example gives you an idea of how to calculate.

Example of a pipe length of 8 m:



To 1. Shortening of the pipe:  $8m \cdot 7 \cdot 0.03 = 1.68 \text{ mm}$

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

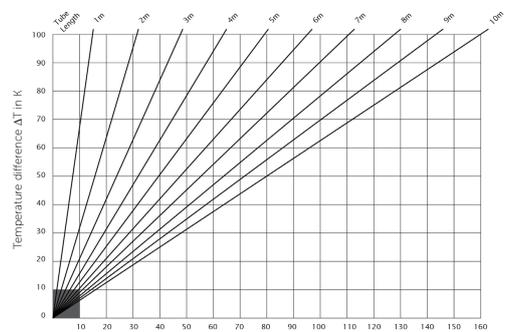


Fig. 4a

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

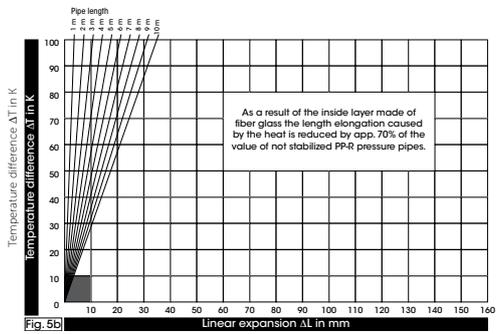
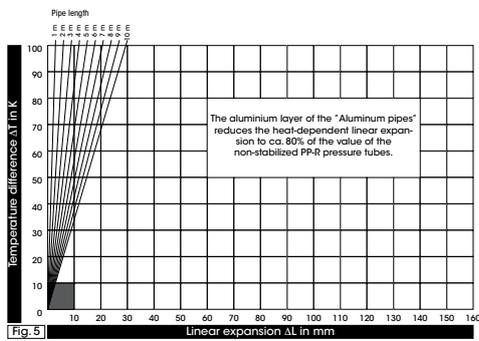


Fig. 5a

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	12.60	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

Quality Assurance

Mostly the linear extension of a PP-R / PP-RCT pipe line can be compensated by changing the direction. Attention has to be paid to the fact that the pipeline can easily move in axial direction. In case linear extension compensation of a changed direction is not possible installation of an expansion bend is necessary. An axial compensation is mostly not suitable and uneconomical.

For spring deflexion of a pipeline the size of the bending limb has to be considered which is calculated 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 regard to the necessary bending limbs Ls has to be considered.

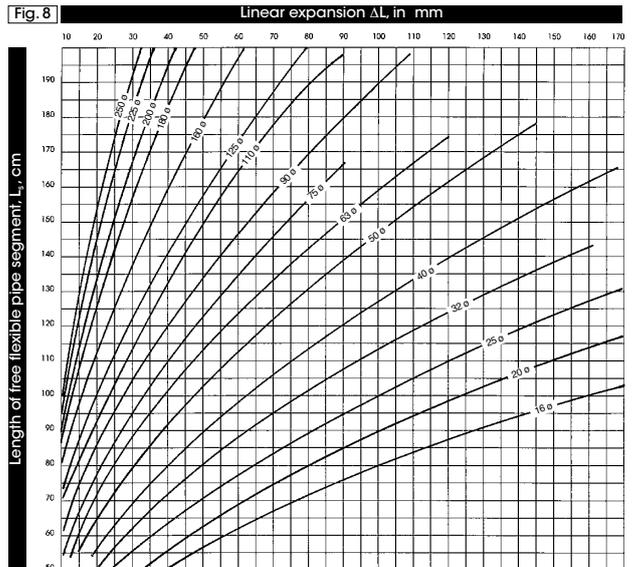
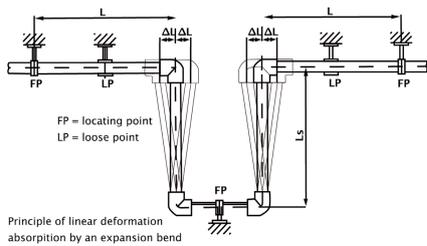
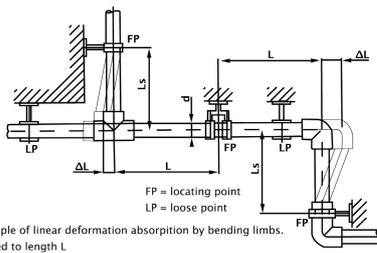
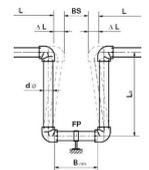
$$L_s = C \cdot \sqrt{d} \cdot \Delta L \text{ (mm)}$$

Ls = Lengths of bending limb (mm)  
 d = outside pipe diameter (mm)  
 DL = Linear deformation (mm)  
 C = Material-depending constant for PP-R

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 deformation ΔL. As standard value, the Ls value given in the Fig. 8 diagram 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 of 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:  
 $B_{min} = 2 \times \Delta L + BS$



Example for concealed piping

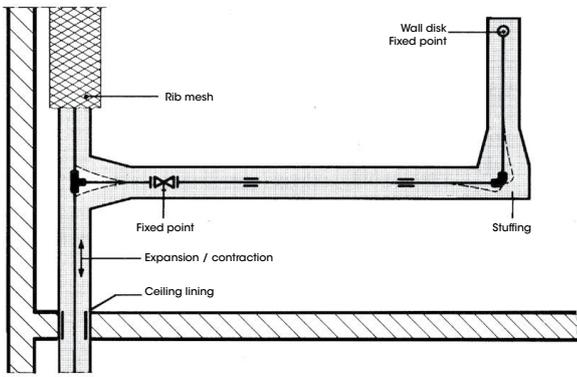


Fig. 9

**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.

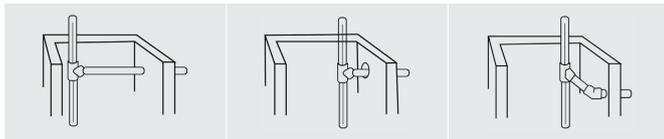


Fig. 1  
Best positioning in the pipe shaft

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 mm.	Spans L at cm bei T°C						
	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.

d mm.	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 ø	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 Aluminium-Pipes

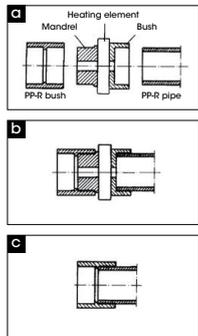
d ø	Spans L at cm bei T°C						
	20°C	30°C	40°C	50°C	60°C	70°C	80°C
20	70	66	62	59	56	54	52
25	81	76	71	68	65	63	60
32	90	85	80	76	73	70	67
40	104	98	92	88	84	81	77
50	117	111	106	102	97	94	89
63	131	125	119	116	111	109	104
75	143	137	130	126	121	118	114
90	157	150	143	138	133	130	125
110	173	165	158	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 ø	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 Climtec

Welding Procedure	Preparations	Welding
<p>The Smart Home PP-R/PP-RCT pipe-work is coupled by socket fusion welding. The pipes and fittings are connected longitudinally overlapping. The heating of pipe ends and sockets is done by a heating element with fitted bushes. After the necessary welding temperature is reached the joining process is done. The pipe and socket diameter as well as the respective heated bush diameters are matched to build up the necessary pressure during the joining process.</p> <p>The heating element is electrically heated. It has to comply with DVS Directive 2208 part 1 in construction and accuracy.</p> <p>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).</p> <p>Figures a, b and c schematically show the 3 welding process stages: a = Welding preparation b = Warming up c = Welded joint</p>	<p>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.</p> <p>Bring the heating element to <math>220^{\circ} \text{C} \pm 10^{\circ} \text{C}</math>. Check the set temperature before the welding process.</p> <p>Temperature tolerance <math>\pm 10^{\circ} \text{C}</math>. The heating element should have an integrated thermometer, otherwise the temperature of the heating element must be controlled by an appropriate measuring device.</p> <p>Do not start heating the joint parts before the heating temperature has reached <math>260^{\circ} \text{C}</math>. The mandrel and bush must be clean and have to be cleaned before each following welding process.</p>	<p>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.</p> <p>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.</p> <p>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).</p> <p>The welded joint must not be stressed mechanically before end of the cooling time.</p>



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

Fig. 14  
Standard values for socket fusion welding at a room temperature of  $20^{\circ} \text{C}$ . At a room temperature below  $45^{\circ} \text{C}$  the heating phases should be increased by up to 100%.

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

Fig. 15:  
Bush depths for PP-R and PP-RCT fittings



<b>INDEX</b>	
<b>INSTALLATION</b>	
4.1 Welding Process	100
4.2 Welding Procedure	102
4.3 Pressure test	107

## Installation

4.1 Welding Process



1. Pipes are measured and cut to the required length. Cutting should be rectangular 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 simultaneously. Push in parts to be joined axially.



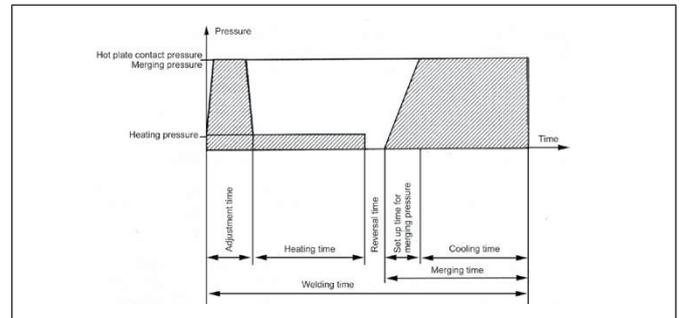
4. At the end of heating period fitting and pipe end from the heating elements have to be pulled off fully and simultaneously.



5. Adapt and join pipe and fitting within 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.

Permissible misalignment of wall  $0,1 \times$  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  $210^{\circ} \text{C} \pm 10^{\circ} \text{C}$  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 ( $0,10 \pm 0,01 \text{ N/mm}^2$ ) 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.

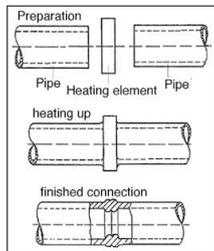


Fig. 2

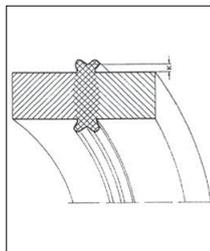


Fig. 3

**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  $260^{\circ} \text{C}$  ( $\pm 10^{\circ} \text{C}$ ). Check the temperature before the welding process.

Selection of welding elements:

Repair -Set:  $d = 7 \text{ mm}$

For welding of holes up to  $6 \text{ mm}$

Repair-Set:  $d = 11 \text{ mm}$  For

welding of holes up to  $10 \text{ mm}$

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 weld- ing 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



**Installation**

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 material 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 testing of parts of plastic pipe systems should therefore be done at an as much as possible constant test medium temperature.

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

**Filling of the Pipe System**

Fill the pipes with filtered water until they are free of air. Use pressure 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 leakage must have occurred.

**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.

**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:  $\varnothing$  16 \_\_\_\_\_  $\varnothing$  20 \_\_\_\_\_ m  $\varnothing$  25 \_\_\_\_\_ m  $\varnothing$  32 \_\_\_\_\_ m  
 $\varnothing$  40 \_\_\_\_\_ m  $\varnothing$  50 \_\_\_\_\_ m  $\varnothing$  63 \_\_\_\_\_ m  $\varnothing$  75 \_\_\_\_\_ m  
 $\varnothing$  90 \_\_\_\_\_ m  $\varnothing$  110 \_\_\_\_\_ m  $\varnothing$  125 \_\_\_\_\_ m  $\varnothing$  140 \_\_\_\_\_ m  
 $\varnothing$  160 \_\_\_\_\_ m  $\varnothing$  225 \_\_\_\_\_ m  $\varnothing$  250 \_\_\_\_\_ m  $\varnothing$  280 \_\_\_\_\_ m  
 $\varnothing$  315 \_\_\_\_\_ m

Joining: Welding \_\_\_\_\_ pcs Gluing \_\_\_\_\_ pcs

Number of tapping points: \_\_\_\_\_ pcs Highest tapping point above pressure gauge: \_\_\_\_\_ pcs Total pipe length: \_\_\_\_\_ m

<b>Preliminary test:</b>		<b>Preliminary test:</b>	
Test pressure	bar	Test pressure	bar
1 <sup>st</sup> regulation after 10 minutes	bar		
2 <sup>nd</sup> regulation after 10 minutes	bar	Pressure decrease after 2 hours	bar
Pressure after 30 minutes	bar	(0.2 bar max.)	
Pressure decrease	bar		
<b>Result of preliminary:</b>		<b>Result of preliminary:</b>	
_____		_____	
_____		_____	
_____		_____	

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

**General provisions**

New pipeline facilities may only be put into operation if the compulsory pressure test is successfully passed. No leakages are allowed. The pressure test should be carried out before the lines are buried. The tests on the new line facility can be implemented either on the whole facility or in line sections. The division into smaller test sections (small pressure / liter product) provides higher level of reliability and is more precise while testing. On the pressure gauge leaks can be identified faster compared to bigger and widely branched voluminous sections. Hence leak locations can be determined faster.

Apparatuses, drinking water warmers, armatures or pressure tanks must be disconnected from the pipelines prior to the air pressure test in case they have larger capacity and can affect reliability and test accuracy. All pipeline openings must be directly closed with metallic plugs, metallic blanking plates or blank flanges that withstand the testing pressure. Closed shut-off valves do not count as leak-proof closures. Exhaust valves for deflation of the testing pressure should be installed in sufficient quantity and on appropriate locations where the air can be deflated in a safe manner.

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

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

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

**Leak tightness test**

The leak tightness test is implemented with a pressure test of 110 mbar prior to the load test.

The applied pressure gauge must have an appropriate precision of 1 mbar (10 mmWS) display range for the pressure that will be measured. For this purpose the U-pipe pressure gauges known from the TRGI test or the standpipes can be used. The components on the pipeline facility must be suitable for the test pressures or have to be dismantled before the test.

After application of the test pressure the testing period for up to 100 liter line volume must be at least 30 minutes. For every additional 100 liters the testing period must be increased by 10 minutes. The leak tightness test starts once the test pressure is achieved and taking into consideration the respective waiting period for adjusting 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 display range of 0.1 bar. The load test is combined with a visual inspection of all pipe connections during which it is checked whether welding, solder pressure and clamp connections as well as adhesive and screwed joints are performed in a proper manner in order to be leak-proof.

The load test with diameter increased pressure should be:  
 – at nominal up to DN 50 maximum 3 bar and  
 – at nominal diameter over DN 50 – DN 100 maximum 1 bar.

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

**Selection of the test medium**

For leak tightness and load test the following media can be used:  
 – oil-free compressed air,  
 – inert gas  
 e.g. Nitrate and carbon dioxide  
 – inert gas  
 with 5% hydrogen in the nitrogen (applied at the procedure for locating the leakage)

By means of technical security equipment like pressure reducing regulator or 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 Ambient temperature: \_\_\_\_\_ °C Temperature of the control medium: \_\_\_\_\_ °C

Control medium  Oil-Free compressed air  Nitrogen  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. Apparatuses, 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	<input style="width: 80%;" type="text" value="Liter"/>	Testing period	<input style="width: 80%;" type="text" value="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, condensation water. For the minimum insulation layer standard values see table (fig. 16).

Installation mode	Insulation layer thickness $\lambda = 0,040 \text{ W/(m} \cdot \text{K)}$
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  $d = 20 \text{ mm}$ .

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 $0,035 \text{ W m}^{-1}\text{K}^{-1}$
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 in ceiling and wall cut-throughs, pipe-crossing sections, with central distributing pipes, radiator connection pipes of maximally 8 m length	1/2 of the requirements given in lines 1 to 4

Fig. 17

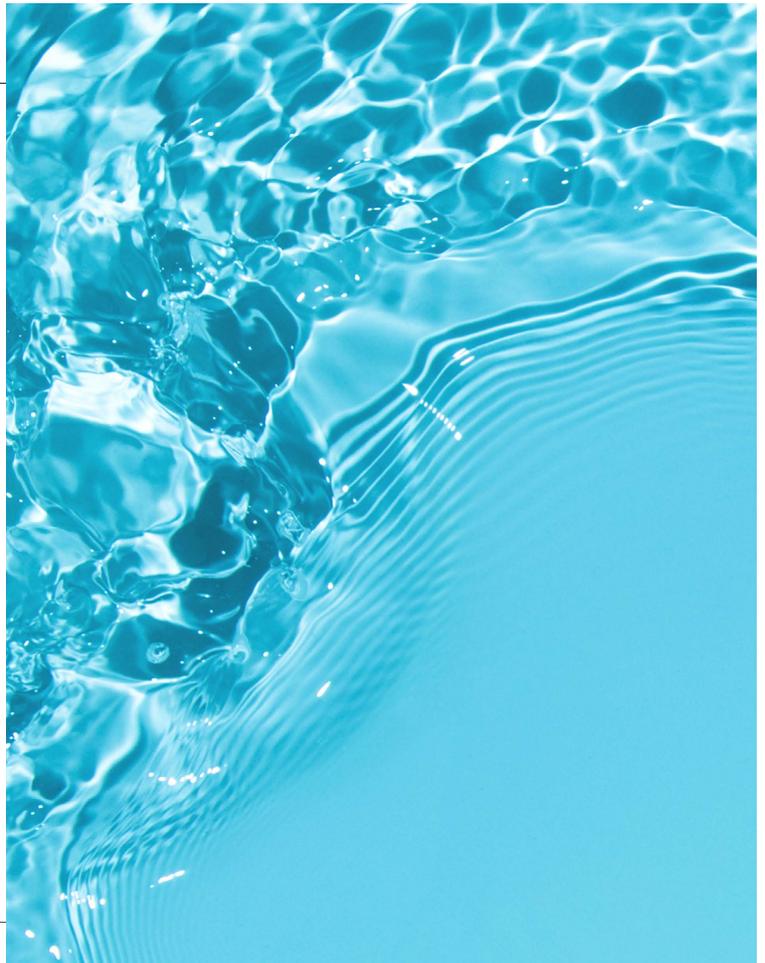
	d x s	DN	Insulation layer thickness $\lambda = 0,035 \text{ W/(m} \cdot \text{K)}$
Pipes PN 20	16 x 2,7	10,6	20 mm
	20 x 3,4	13,2	
	25 x 4,2	16,6	
	32 x 5,4	21,2	
	40 x 6,7	26,6	30 mm
	50 x 8,4	33,2	
	63 x 10,5	42,0	
	75 x 12,5	50,0	
	90 x 15,0	60,0	

Fig. 18

Polypropylene pipes according to DIN 8077 are highly self-insulating in respect to their heat transfer. Thus PN 20 PP-R/PP-RCT pipes in continuous operation at a passing medium temperature of  $80^\circ \text{C}$  show an about  $2^\circ \text{C}$  lower temperature at their outside diameter. This proves their heat insulation to be much more effective than that of metal pipes.

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

### Fire Protection



Ver.1



*Zero Leakage, Zero Contamination, Zero Corrosion, Zero Blockage*



[www.egic.com.eg](http://www.egic.com.eg)

**Address:** 6th of October - industrial Zone no. 4  
Bani sweif - industrial Zone no. 2.  
[info@egic.com.eg](mailto:info@egic.com.eg)