KONTI HIDROPLAST®

PRODUCTION OF POLYETHYLENE
AND POLYPROPYLENE PIPES

PP-R PIPES

FOR HOT & COLD WATER AND HEATING SYSTEMS

www.konti-hidroplast.com.mk

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KONTI HIDROPLAST®

WELCOME TO OUR WORLD

Konti Hidroplast is part of the world's largest manufacturer and supplier of high performance plastic pipes and offers the best and the most cost effective pipe systems for its customers.

Konti Hidroplast specialises in polyethylene pipe systems for gas and water transportation in the utilities and industrial markets.

MARKET ORIENTED

Konti Hidroplast products find a broad range of applications in the industrial and utilities market on a worldwide scale.

The water and gas distribution enterprises are important sectors for high integrity products where the maintenance of water quality and the safe transport of gaseous fuels are of paramount importance.

Industrial applications include alternative energy installations in landfill gas systems to effluent transportation and mineral slurry.

Products are widely used in pipeline installation, repair and maintenance.

Many of the brands in the Konti Hidroplast portfolio have a long record of innovation in meeting the needs of the water and gas utilities.

Being one of the foremost pioneers in polyethylene pipe systems, Konti Hidroplast is continually improving and updating its offer to meet the ever growing needs of the distribution engineer, ensuring they stay at the forefront of world gas and water distribution/treatment systems.

CUSTOMER FOCUS

The key to our success lies in the commitment to provide the highest quality service and support. We are a team of highly motivated and experienced individuals.

We place the utmost importance on meeting the needs of our customers, constantly evolving our extensive product portfolio to meet the ever changing demands of the water and gas utilities, industrial and foreign markets.

QUALITY

Konti Hidroplast is a result-driven busines – its people, products and service. Designed, manufactured and supplied under EN ISO 9001:2000 accredited Quality Management Systems, Konti Hidroplast products comply with relevant national, European and international product standards to ensure complete reliability for our customers.

Besides the ISO certificates for Quality Management Systems and ecology, the gas pipes are also certified by DVGW CERT GmbH.

THE ENVIRONMENT

Committed to sustainable manufacture and systems, Konti Hidroplast operates and maintains an environmental policy fully accredited by ISO 14001.

APPLIED NORMS

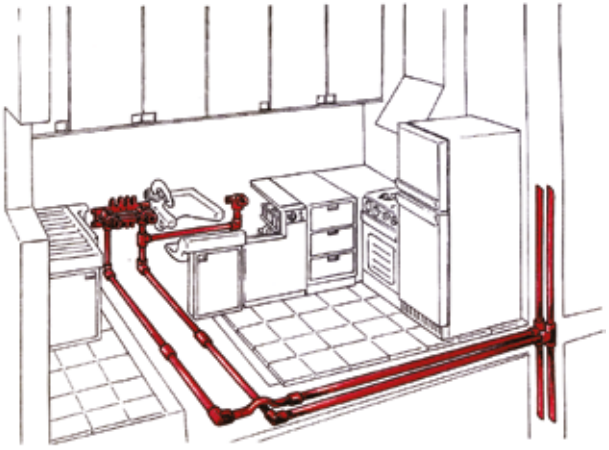
DIN 8077 – Polypropylene (PP) pipes' dimensions

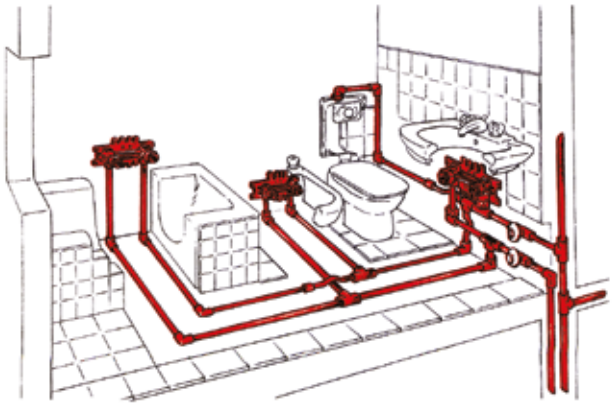
DIN 8078 – Polypropylene (PP) pipes' general quality requirements and testing

DIN 16962 – Pipe joints and elements for polypropylene (PP) pressure pipelines, type 1 and 2;

DIN 1988 – Drinking water line installation

DV S2207 – Welding regulation for plastic pipes





ADVANTAGES

- Long duration, more than 50 years of good flexibility
- Resistance at low temperatures, high heat and pressure resistance
- Surface electric power resistance
- Friction and corrosion resistance
- Earthquakes resistance
- High sound and thermic isolation

RAW MATERIAL

POLYPROPYLENE RANDOM COPOLIMER (PP-R TYPE 3)

Polypropylene Random Copolimer (PP-R type 3) is widely used in hot water floor – and radiator heating systems as well. The thermic and chemical resistance of the material allows application in the industry for transport of pressurized air, gas, liquid human food and similar.

Stable at low temperatures up to -35°C.
Usually, this material can be found in:

- Drinking water installation
- Sanitary installation
- Under floor heating
- Heating
- Industry

MECHANICAL AND THERMAL PROPERTIES OF POLYPROPILENE RANDOM COPOLIMER AT °C

PROPERTIES	TESTING METHODS	UNIT	VALUE
DENSITY, AT 23°C	ISO R 11 83	g/cm^3	0,9
MELT FLOW INDEX, (MFI)			
MFI 190°C/5kg	ISO 1133	g/10min.	0,7
MFI 230°C/2,16kg	ISO 1133	g/10min.	0,50
THERMAL CONDUCTIVITY AT 23°C	DIN 52652	W/mK	0,2 - 0,4
COEFFICIENT OF LINEAR THERMAL EXPANSION	DIN 53752	K^{-1}	$1,5 \times 10^{-4}$
ELONGATION AT BREAK AT 50mm/min. AT 100mm/min.	ISO R 527	%	 >500 >500
MODUL OF ELASTICITY	ISO 178	N/mm^2	800
TENSILE STRESS AT YEALD	ISO R 527	N/mm^2	21
TENSILE STRENGHT AT BREAK	ISO R 527	N/mm^2	40

Besides by the ISO standars, the PP-R pipes are also certified by:

FACULTY OF MECHANICAL ENGINEERING – SKOPJE,

IGH CROATIA,

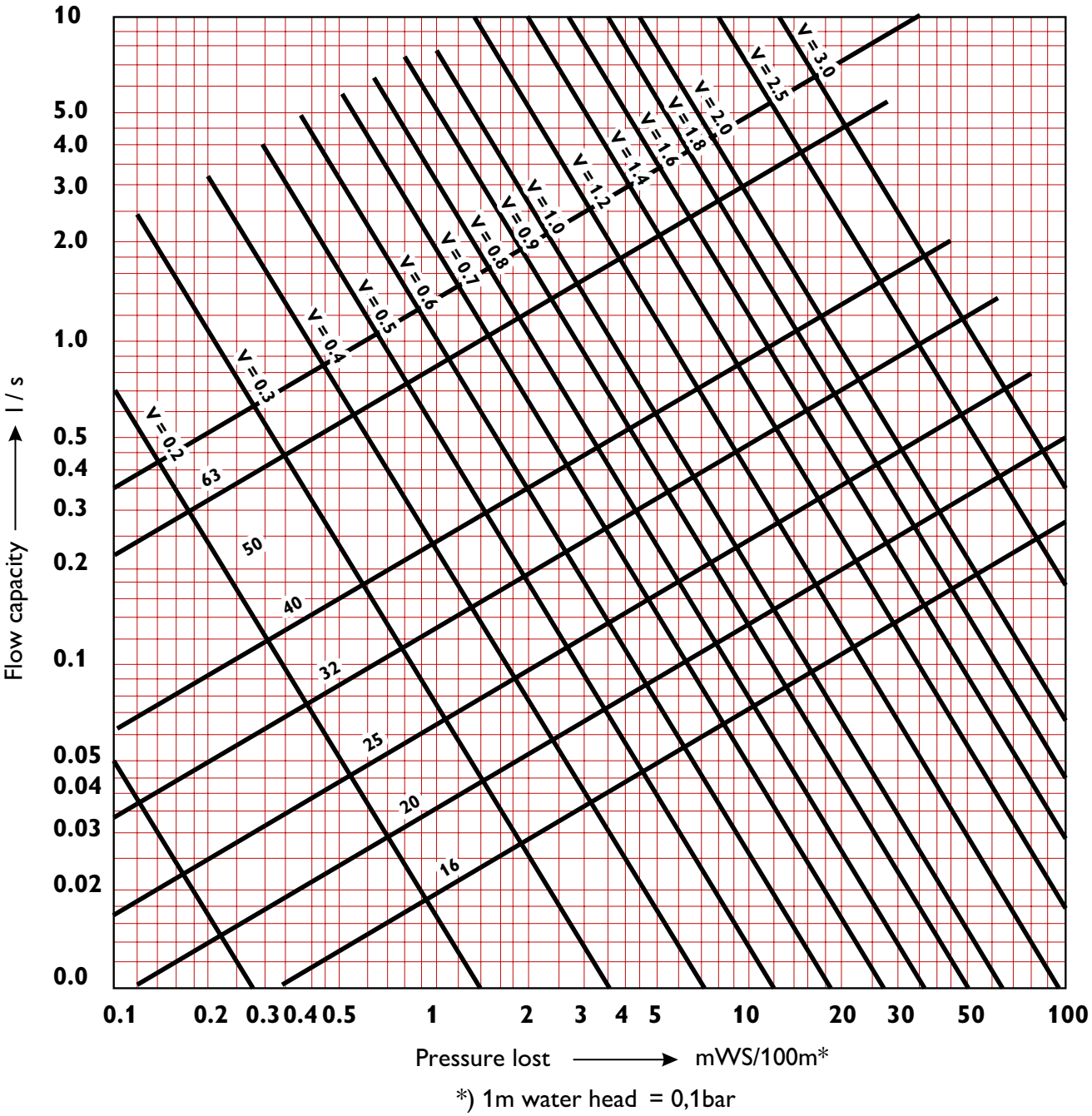
EXACT SERTIFICATION SAC. BULGARIA.

OPERATING LIFE ACCORDING TO DIN 8077

TEMPERATURE °C	OPERATION LIFE/ YEARS	SERIES S							
		20	16	12.5	8.3	5	3.2	2.5	2
		STANDARD DIMENSION RATE SDRR							
		41	33	26	17.6	11	7.4	6	5
		PRESSURE BAR							
10	1	4.4	5.6	7.0	10.6	17.6	27.8	35.0	44.2
	5	4.2	5.3	6.6	10.0	16.6	26.4	33.2	41.8
	10	4.0	3.1	6.4	9.7	16.1	25.5	32.1	40.4
	25	3.9	4.9	6.2	9.4	15.6	24.7	31.1	39.1
	50	3.8	4.8	6.0	9.1	15.2	24.0	30.3	38.1
	100	3.7	4.7	5.9	8.9	14.8	23.4	29.5	37.1
20	1	3.8	4.8	6.0	9.0	15.0	23.8	30.0	37.8
	5	3.5	4.5	5.6	8.5	14.1	22.3	28.1	35.4
	10	3.4	4.3	5.5	8.2	13.7	21.7	27.3	34.4
	25	3.3	4.2	5.3	8.0	13.3	22.1	26.5	33.4
	50	3.2	4.1	5.1	7.8	12.9	20.4	25.7	32.4
	100	3.1	4.0	5.0	7.5	12.5	19.8	24.9	31.4
30	1	3.2	4.0	5.1	7.7	12.8	20.2	25.5	32.1
	5	3.0	3.8	4.8	7.2	12.0	19.0	23.9	30.1
	10	2.9	3.7	4.6	7.0	11.6	18.3	23.1	29.1
	25	2.8	3.5	4.4	6.7	11.2	17.7	22.3	28.1
	50	2.7	3.4	4.3	6.6	10.9	17.3	21.8	27.4
	100	2.7	3.4	4.2	6.4	10.6	16.9	21.2	26.4
40	1	2.7	3.4	4.3	6.5	10.8	17.1	21.5	27.1
	5	2.5	3.2	4.0	6.1	10.1	16.0	20.2	25.4
	10	2.5	3.1	3.9	5.9	9.8	15.6	19.6	24.7
	25	2.4	3.0	3.8	5.7	9.4	15.0	18.8	23.7
	50	2.3	2.9	3.7	5.5	9.2	14.5	18.3	23.1
	100	2.2	2.8	3.5	5.4	8.9	14.1	17.8	22.4
50	1	2.3	2.9	3.7	5.5	9.2	14.5	18.3	23.1
	5	2.1	2.7	3.4	5.1	8.5	13.5	17.0	21.4
	10	2.1	2.6	3.3	5.0	8.2	13.1	16.5	20.7
	25	2.0	2.5	3.2	4.8	8.0	12.6	15.9	20.0
	50	1.9	2.4	3.1	4.6	7.7	12.2	15.4	19.4
	100	1.9	2.4	3.0	4.5	7.4	11.8	14.9	18.7
60	1	1.9	2.4	3.1	4.6	7.7	12.2	15.4	19.4
	5	1.8	2.3	2.9	4.3	7.2	11.4	14.3	18.0
	10	1.7	2.2	2.8	4.2	6.9	11.0	13.8	17.4
	25	1.7	2.1	2.6	4.0	6.7	10.5	13.3	16.7
	50	1.6	2.0	2.5	3.8	6.4	10.1	12.7	16.0
70	1	1.6	2.1	2.6	3.9	6.5	10.3	13.0	16.4
	5	1.5	1.9	2.4	3.6	6.0	9.5	11.9	15.0
	10	1.5	1.9	2.3	3.5	5.9	9.3	11.7	14.7
	25	1.3	1.6	2.0	3.0	5.1	8.0	10.1	12.7
	50	1.1	1.3	1.7	2.6	4.3	6.7	8.5	10.7
80	1	1.4	1.7	2.2	3.3	5.5	8.6	10.9	13.7
	5	1.2	1.5	1.9	2.9	4.8	7.6	9.6	12.0
	10	1.0	1.3	1.6	2.4	4.0	6.3	8.0	10.0
	25	-	1.0	1.3	1.9	3.2	5.1	6.4	8.0
90	1	1.0	1.2	1.5	2.3	3.9	6.1	7.7	9.7
	5	-	-	1.0	1.5	2.5	4.0	5.0	6.3
	(10)1)	-	-	-	(1.3)1)	(2.1)1)	(3.4)1)	(4.2)1)	(5.3)1)

PRESSURE LOST

The pressure lost per meter as a function of the flow can be seen in the following diagram



THERMAL EXPANSION OF THE PIPE

PIPELINES IN INTERIORS

Special attention is given to the appearances and to the stability of pipeline when laid in interiors (and basement sand and boiler rooms etc.). The elongation coefficient of PP-R pipe amounts as follows

$$\alpha = 1.5 \times 10^{-1}(K)$$

The elongation value calculation can be supported by other examples that follow.

The difference between the working temperature and the temperature when laying the pipe appears to be very important in calculating the elongation value.

ELONGATION VALUES ESTIMATION

Known and requested values:

DESIGNATION	DEFINITION	VALUE	UNIT
ΔL	LENGTH VARIATION (mm)	–	mm
α	COEFFICIENT OF EXPANSION PPR - PIPES	0.15	mm/m°C
L	INITIAL PIPE LENGTH	10	m
tr	WORKING TEMPERATURE	50	°C
tm	STARTING TEMPERATURE	25	°C
Δt	TEMPERATURE DIFFERENCE ΔT=TR-TM	25	°C

CALCULATION IS DONE BASED ON THE FOLLOWING EQUATIONS:

MATERIAL PP-R PIPES

$$\Delta l = \alpha \times L \times \Delta t$$

$$\alpha = 0.15 mm/m°C$$

$$\Delta l = 0.15 mm/m°C \times 10 mm \times 25°C$$

$$\Delta l = 37.5 mm$$

COMPENSATION ELONGATION

Holders are very easily mounted and fixed on the PP-R pipes as well as on the metal ones. At installations laid in interiors, the ΔL elongation must be taken in view at the very beginning of pipeline planning. Leading the pipeline should be in such a way that it could allow for pipe elongation and pipe free movement in the scope of calculated elongation values ΔL.

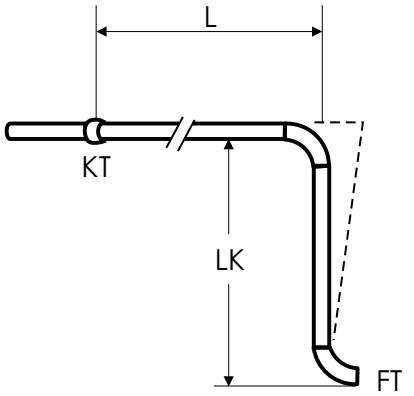
Only two simple possibilities can be taken in view regarding the compensation change in length. They should meet the PP-R elements standards.

1 DIRECTIONAL CHANGING

COMPENSATORS

All types of metal pipeline compensators cannot be recommended for the PP-R pipelines.

In most cases direction changing of the pipeline could be used in elongation changing. The distance to the fixing holder (clamp), i.e. the console length can easily be calculated using the following equation.



DIRECTIONAL CHANGING

EXAMPLE CALCULATION:
CONSOLE LENGTH

Known and values required:

DESIGNATION	DEFINITION	VALUE	UNIT
LK	CONSOLE LENGTH	–	mm
K	CONSTANT VALUE FOR PP-R	20	/
D	OUTSIDE DIAMETER OF PIPE	32	mm
Δt	TEMPERATURE DIFFERENCE	20	mm

The calculation of the console length is done based on the following equations:

LK=K√D x Δt

LK = 20√32 mm x 20mm

LK = 506.0mm

Console length LK (according to the above calculation example) amounts to 506mm.

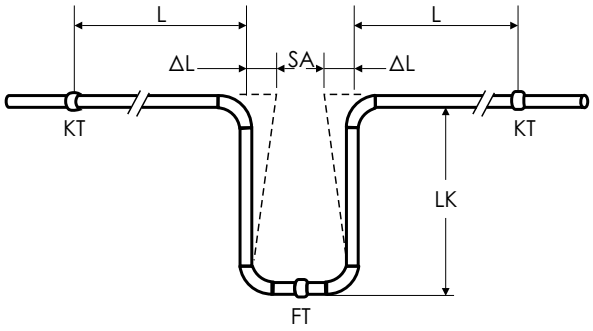
Where:

KT – sliding point

FT – fixing point

2 ELASTIC ("U") BEND

If the elongation compensation at direction changing is not possible, an elastic ("U") bend needs to be performed.



ELASTIC ("U") BEND

CALCULATION EXAMPLE:
ELASTIC ("U") BEND

Known and values required

DESIGNATION	DEFINITION	VALUE	UNIT
AMIN	MINIMUM ("U") BEND WIDTH	?	mm
ΔI	ELONGATION	20	mm
SA	SAFE LENGTH	100	mm

The elastic ("U") bend width can be calculated by the following equations:

Amin = 2 x ΔI + SA

Amin = 2 x 20 mm + 100mm

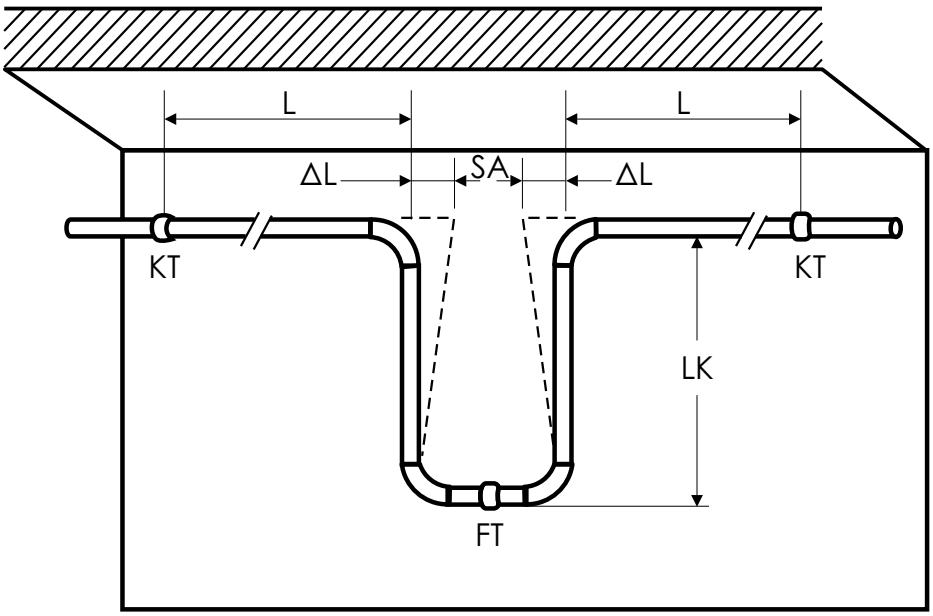
Amin = 140mm

In that case the elastic ("U") bend width is minimum 140mm.

Where:

KT – sliding point

FT – fixing point



DISTANCE OF THE SUPPORTS OF PP-R PIPES

The way and frequency of PP-R pipeline fixing depends among other things, of the elongation extent caused by the temperature differences. The fixing support divides the pipeline in many single sections where the elongation possibility is enabled. Sliding supports lead the pipeline inside each single section.

Support distance depends on the conditions in which the pipeline is used, the pipe-material and the weight of the pipeline, including the filling (carrying) weight of the pipeline itself. In practice, the most useful distances appear to be as follows:

DIFFERENCES IN TEMPERATURE Δt (°C)	DIAMETER OF PIPE D(mm) PN 20BAR													
	20	25	32	40	50	63	75	90	110	125	140	160	180	200
	DISTANCE OF THE SUPPORT IN cm													
0	85	105	125	140	165	190	205	225	245	265	285	310	335	365
20	60	75	90	100	120	140	150	165	180	195	210	225	245	265
30	60	75	90	100	120	140	150	165	180	195	210	220	245	265
40	60	70	80	90	110	130	140	150	165	180	195	210	225	245
50	60	70	80	90	110	130	140	150	165	180	195	210	225	245
60	60	65	75	85	100	115	125	135	150	165	180	195	210	225
70	55	60	70	80	95	105	115	112	140	150	165	180	195	210
80	50	55	65	75	90	100	110	115	125	140	150	165	180	195

TRANSPORTING AND STORING

PP-R pipes can be stored at any outdoor temperature, but not directly exposed to on sunlight. At storing, they should always be placed all along their entire length on the floor. Any kind of pipe-benching should be avoided during transport and storing.

At temperatures below 0°C pipes could suffer and be damaged on impact. Because of this careful manipulation at low temperatures is recommended.

Regardless of PP-R pipes being high resistant, their careful handling is also recomended. UV-rays affect all high-contents polymer-plastic materials. There is a UV-stabilizer which enables outside storking for 6 months of the PP-pipes and their accessories.

INSTALATION

SEMI-FUSION WELDING

Welding is carried out using a welding device and simultaneous heating of the two elements to be connected. When the welding temperature is reached, elements should be affixed to each other resulting in an absolutely sealed connection.

PREPARATION

The outside of the pipes has to be thoroughly clean and smooth. Face edges of the pipes have to be cut under right angle. Prior to welding make sure the device is in good condition and that the welding temperature has been reached.

Recommended parameters for welding, if the manufacturer hasn't recomend others: Welding temperature of 260°C, and heating time 8sec.

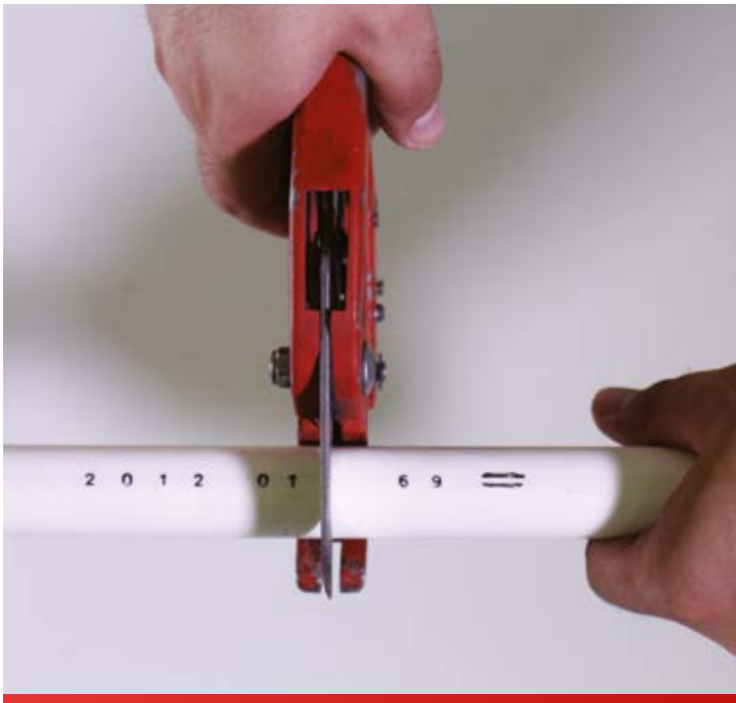
PERFORMANCE

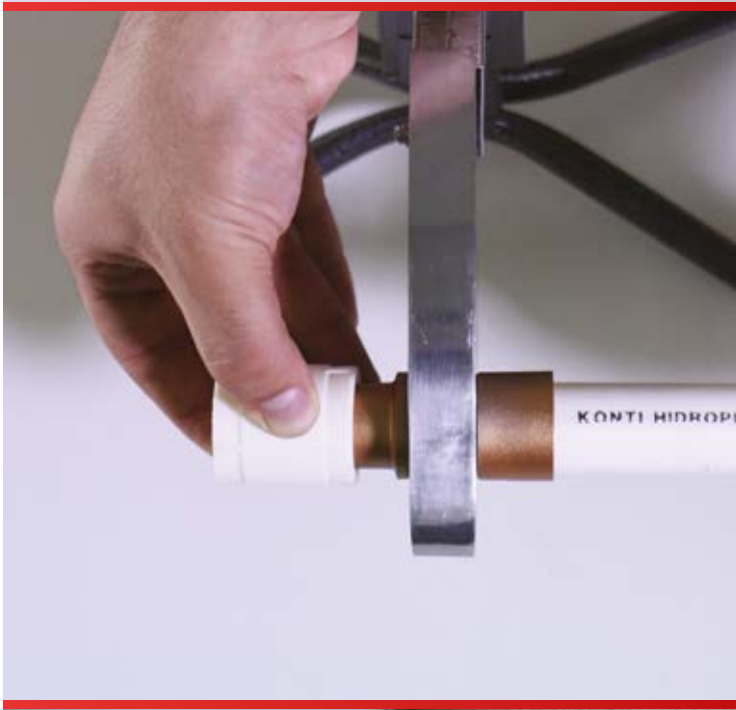
Pipes and other attaching parts should with no delay and no axial displacement be inserted into the heating elements up to the boundary marker.

After heating time is over, the heated pipe and the attaching part are taken out of the apparatus and should immediately be attached to each other without any moving them.

It is very important to respect the recommended depth of insertion.

Avoiding above mentioned installation procedure can lead to bad connection of pipes and leakage at the joint spot after the installation. Therefore, the installater has to be trained for this type of pipe welding.





ELECTROFUSION – WELDING

The electric muff is primarily used in repairing and welding the existing facilities.

The procedure is easy and simple if some simple rules are respected. Jointing parts have to be axially directed.

After attaching them into E-joining pipe (muff) they are to be connected to the welding apparatus.

The following steps of the procedure continue automatically, except that the connection performed should not be loaded until it cools down.

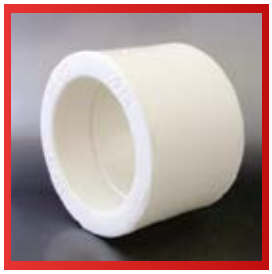
PP-R PIPE

MATERIAL: PP-R
COLOR: BLUE OR WHITE
DIMENSIONS: DIN 8077/8078
EXECUTION: HOT WATER

	PN10 SDR11 s=5		PN16 SDR7.4 s=3.2		PN20 SDR6 s=2.5	
D	e/mm	kg/m	e/mm	kg/m	e/mm	kg/m
16	1.80	0.08	2.20	0.09	2.70	0.11
20	1.90	0.11	2.80	0.15	3.40	0.17
25	2.30	0.16	3.50	0.23	4.20	0.26
32	2.90	0.26	4.40	0.37	5.40	0.43
40	3.70	0.41	5.50	0.58	6.70	0.67
50	4.60	0.62	6.90	0.89	8.40	1.04
63	5.80	1.00	8.60	1.40	10.50	1.65
75	6.80	1.41	10.30	2.00	12.50	2.34
90	8.20	2.03	12.30	2.86	15.00	3.34
110	10.00	3.00	15.10	4.29	18.40	5.04
125	11.40	3.91	17.10	5.53	20.80	6.47
140	12.70	4.87	19.20	6.95	23.30	8.11
160	14.60	6.38	21.90	9.06	26.60	10.66
180	16.40	8.07	24.60	11.45	29.00	13.17
200	18.20	9.95	27.40	14.17	33.20	16.65

D – nominal diameter, mm
e – wall thickness, mm
kg/m – meter lenght weight

PP COUPLING



PN 20

Dn (mm)
20
25
32
40
50
63
75
90

PP REDUCER

PN 20

Dn D1 (mm)	Dn D2 (mm)
25	20
32	20
32	25
40	20
40	25
40	32
50	20
50	25
50	32
50	40
63	25
63	32

PP UNION (FEMALE THREAD)

PN 20

Dn (mm)	Dn INSERT
20	1/2"
20	2/4"
20	1"
25	1/2"
25	3/4"
25	1"
32	1/2"
32	3/4"
32	1"
40	1.1/4"
50	1.1/2"
63	2"
75	2.1/2"

PP UNION (MALE THREAD)

PN 20

Dn (mm)	Dn INSERT
20	1/2"
20	2/4"
20	1"
25	1/2"
25	3/4"
25	1"
32	1/2"
32	3/4"
32	1"
40	1.1/4"
50	1.1/2"
63	2"
75	2.1/2"

PP ELBOW 90°

PN 20

Dn (mm)
20
25
32
40
50
63
75
90

PP ELBOW 45°

PN 20

Dn (mm)
20
25
32
40
50
63
75
90

PP ELBOW 90° WITH FEMALE TREAD

PN 20

Dn (mm)	DN INSERT
20	1/2"
25	3/4"
25	1/2"
32	1"

PP ELBOW FOR WALL MOUNTING

PN 20

Dn (mm)	Dn INSERT
20	1/2"

PP THREADED MALE ELBOW

PN 20

Dn (mm)	DN INSERT
20	1/2"
25	3/4"
32	1"

PP TEE

PN 20

Dn (mm)
20
25
32
40
50
63
75
90

PP THREADED FEMALE UNION TEE

PN 20

Dn (mm)	Dn INSERT
20	1/2"
25	1/2"
25	3/4"
32	1"

PP TEE

PN 20

Dn D1 (mm)	Dn D2 (mm)
25	20
32	20
32	25
40	20
40	25
40	32
50	20
50	25
50	32
50	40
63	25
63	32
63	40
63	50
75	32
75	40
75	50
75	63

PP THREADED MALE UNION TEE

PN 20

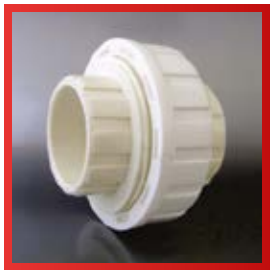
Dn (mm)	Dn IN-SERT
20	1/2"
25	3/4"
32	1"

PP CROSS

PN 20

Dn (mm)
20
25
32
40
50
63

PP UNION (WELDING AT BOTH ENDS)



PN 20

Dn (mm)
20
25
32
40
50
63
75

PP CAP

PN 20

Dn (mm)
20
25
32
40
50
63
75
90

PP SURMOUNTING CURVE

PN 20

Dn (mm)	L (mm)
20	395
25	395
32	395

PP PLUG

PN 20

Dn (mm)	Dn INSERT
20	1/2"
25	3/4"
32	1"

PP VALVE

PN 20

Dn (mm)
20
25
32

PP VALVE (CHROME PLATED)

PN 20

Dn (mm)
20
25

PP BRACKET

PN 20

Dn (mm)
20
25
32
40
50

WELDING MACHINE (COMPLETE WELDING CASE)

Material: Teflon
Execution: welding of PP pipes
*Included welding dies 20-40mm and pipe cuter for PP pipes

WELDING DIES

Dn (mm)
20
25
32
40
50
63
75

PIPE CUTERS

Dn (mm)
20-40

CHEMICAL RESISTANCE

Polypropylene is one of the polymers with highest chemical resistance. The chemical resistance of pipes and fittings made of Polypropylene Random Copolymer according to the German Standard DIN 8078 is given in the following table. Chemical resistance is dependent on the kind of chemical, its composition, concentration, temperature and the duration of exposure. Therefore, the table includes the chemicals concentrations and resistance at tree different temperatures.

Chemical resistance is presented in the following four groups:

● Resistive
◐ Limited resistance
○ Nonresistive
— Insufficient information

The following symbols describe the chemicals concetration:

VL: Diluted (mass ratio ≤ 10%)
L: Diluted (mass ratio > 10%)
GL: Saturated dilution at 20°C
H: Commercial grade
TR: Technically pure

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
ACETALDEHYDE	RARE	○	○	○
ACETALDEHYDE	TR	◐	–	–
ACETEPHENON	TR	●	●	–
ACETIC ACID ANHYDRIDE	TR	●	–	–
ACETIC ACID, DILUTED	TR	●	◐	○
ACETIC ACID, DILUTED	40%	●	●	–
ACETONE	TR	●	–	–
ACID-ACETANHYDRIDE	40%	●	●	–
ACRILONITRILE	TR	●	◐	–
ADIPIC ACID	TR	●	●	–
AIR	TR	●	●	●
ALAUNE ME - ME III SULPHATE	GL	●	●	–
ALLYL ALCOHOL, DILUTED	96%	●	●	–
ALUM	GL	●	●	–
ALUMINIUM CHLORIDE	GL	●	●	–
ALUMINIUM SULPHATE	GL	●	●	–
AMBER ACID	GL	●	●	–
2-AMINO-ETHANOL	TR	●	–	–
AMMONIA, GAS	TR	●	●	–
AMMONIA, LIQUID	TR	●	●	–
ANILIN	TR	●	–	–
AMMONIA, WATER	GL	●	●	–
AMMONIUM ACETATE	GL	●	●	–
AMMONIUM CARBONATE	GL	●	●	–
AMMONIUM CHLORIDE	GL	●	●	–
AMMONIUM FLORIDE	L	●	●	–
AMMONIUM NITRATE	GL	●	●	●
AMMONIUM PHOSPHATE	GL	●	●	●
AMMONIUM SULPHATE	GL	●	●	●
AMYL ACETATE	TR	◐	–	–
AMYL ALCOHOL	TR	●	●	●
ANILINE	TR	◐	◐	–
ANILIN HYDROCHLORIDE	GL	●	●	–
ANON	TR	◐	◐	–
ANON (CYCLOHEXANONE)	TR	◐	◐	○
ANTIFREEZE	H	●	○	●
ANTIMONY TRICHLORIDE	90%	●	●	–
APPLE ACID	L	●	●	–
APPLE ACID	GL	●	●	–
APPLE WINE (ORTHO)	H	●	●	–
AQUA REGIA	H	●	●	●
ARSENIC ACID	40%	●	●	–
ARSENIC ACID	80%	●	●	◐
BARIUM HYDROXIDE	GL	●	●	●

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
BARIUM SALTS	GL	●	●	●
BATTERY ACID	H	●	●	–
BEER	H	●	●	●
BENZALDEHYDE	GL	●	●	–
BENZINE - BENZOL MIXTURE	8090/2090	◐	○	○
BENZOL	TR	◐	○	○
BENZIL CHLORIDE	TR	◐	–	–
BORAX	L	●	●	–
BORIC ACID	GL	●	●	●
BROMINE	TR	○	○	○
BROMINE VAPOURS	ALL	◐	○	○
BUTADIENE, GAS	TR	◐	○	○
BUTANE (2)DIOL(1,4)	TR	●	●	–
BUTANEDIOL	TR	●	●	–
BUTANETRIOL(1,2,4)	TR	●	●	–
BUTIN(2)DIOL(1,4)	TR	●	–	–
BUTYL ACETATE	TR	◐	○	○
BUTYL ALCOHOL	TR	●	◐	◐
BUTYL PHENOL	GL	●	–	–
BUTYL PHENON	TR	◐	–	–
BUTYLENE GLYCOL	10%	●	●	●
BUTYLENE GLYCOL	TR	●	●	●
BUTYLENE, LIQUID	TR	●	●	●
CALCIUM CABONATE	GL	●	–	–
CALCIUM CHLORIDE	GL	●	●	–
CALCIUM HYDROXIDE	GL	●	–	–
CALCIUM HYPOCHLORITE	L	●	●	–
CALCIUM NITRATE	GL	●	●	–
CARBOLINE	H	●	●	–
CARBON DIOXIDE, GAS	ALL	●	●	–
CARBONDIOXIDE, LIQUID	ALL	○	○	○
CARBONHYDRIDE	RARE	●	●	●
CARBONIMONOXIDE	ALL	●	●	–
CARBONSULPHIDE	TR	●	–	–
CAUSTIC SODA	60%	●	●	–
CHLORAL	TR	●	◐	○
CHLORAMINE	L	●	◐	○
CHLORETHANOL	TR	●	○	○
CHLORIC ACID	1%	◐	–	–
CHLORIC ACID	10%	○	○	○
CHLORIC ACID	20%	◐	○	○
CHLORINE	0.5%	○	○	○
CHLORINE	1%	○	○	○
CHLORINE	GL	◐	○	○

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
CHLORINE, GAS	TR	○	○	○
CHLORINE, WATER	TR	○	○	○
CHLOROACETIC ACID	L	●	●	–
CHLOROBENZOL	TR	◐	–	–
CHLOROFORM	TR	◐	○	○
CHLOR SULPHON ACID	TR	○	○	○
CHROMIC ACID	40%	◐	◐	○
CHROMIC ACID/SULPHURIC ACID/WATER	15/35/50%	○	○	○
CHROTONIC ALDEHYDE	TR	●	–	–
CITRIC ACID	VL	●	●	●
CITRIC ACID	VL	●	●	●
CITY GAS	H	●	–	–
COCONUT FAT ALCOHOL	TR	●	◐	–
COCONUT OIL	TR	●	–	–
COGNAC	H	●	●	–
COPPER(II)CHLORIDE	GL	●	●	–
COPPER(I)CYANIDE	GL	●	●	–
COPPER(III) NITRATE	30%	●	●	●
COPPER SULPHATE	GL	●	●	–
CORN OIL	TR	●	◐	–
COTTON OIL	TR	●	●	–
CRESOL	90%	●	●	–
CRESOL	>90%	●	–	–
CYCLOHEXANE	TR	●	–	–
CYCLOHEXANOL	TR	●	◐	–
CYCLOHEXANONE	TR	◐	○	○
DEXTRINE	L	●	●	–
DEXTRINE	L	●	●	–
DEXTROSE	20%	●	●	●
1,2 DIAMINOETHAN	TR	●	●	–
DICHLORO ACETIC ACID	TR	◐	–	–
DICHLORO ACETIC ACID	50%	●	●	–
DICHLORO BENZENE	TR	◐	–	–
DICHLORO ETHYLENE (1,1-1,2)	TR	◐	–	–
DIESEL OIL	H	●	◐	–
DIETHYL AMINE	TR	●	–	–
DIETHYL ETHER	TR	●	◐	–
DIGLYCOLIC ACID	GL	●	●	–
DIHEXYL PHATALATE	TR	●	◐	–
DI-ISO OCTYLPHATALATE	TR	●	◐	–
D-ISO PROPYLETHER	TR	◐	○	–
DIMETHYFORMAMIDE	TR	●	●	–
DYMETHYL AMINE	100%	●	–	–
DI-N BUTYL ETHER	TR	◐	–	–

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
DINONYL PHATALATE	TR	●	◐	–
DIOCTYL PHATALATE	TR	●	◐	–
DIOXANE	TR	◐	◐	–
DRINKING WATER	TR	●	●	●
ETHANOL	L	●	–	–
ETHANOL+2% TOLUENE	96%	●	–	–
ETHYL ACETATE	TR	●	◐	○
ETHYL ALCOHOL	TR	●	●	●
ETHYL BENZOL	TR	◐	○	○
ETHYL CHLORIDE	TR	○	○	○
ETHYLENE DIAMINE	TR	●	●	–
ETHYLENE GLYCOL	TR	●	●	●
ETHYLENE OXIDE	TR	○	–	–
FATTY ACID	20%	●	–	–
FATTY ACIDS>C4	TR	●	◐	–
FERMENTATION MALT	H	●	●	–
FERTILIZER SALTS	GL	●	●	–
FILM BATH	H	●	●	–
FLUORINE	TR	◐	–	–
FLUOSILICIC ACID	32%	●	●	–
FORMALDEHYDE	40%	●	●	–
FORMIC ACID	10%	●	●	◐
FORMIC ACID	85%	●	◐	○
FRUCTOSE	L	●	●	●
FRUIT WUICES	H	●	●	●
FURFURYL ALCOHOL	TR	●	◐	–
GELATINE	L	●	●	●
GLUCOSE	20%	●	●	●
GLYCERINE	TR	●	●	●
GLYCOLIC ACID	30%	●	◐	–
GREASE	H	◐	–	–
HCL/HNO3	75/25%	○	○	○
HEPTANE	TR	●	◐	○
HEXANE	TR	●	◐	–
HEXANETRIOL (1,2,6)	TR	●	●	–
HYDRAZINE HUDRATE	TR	●	–	–
HYDROBROMINE ACID	48%	●	◐	○
HYDROCHLORIC ACID	20%	●	●	–
HYDROCHLORIC ACID	20-36%	●	◐	◐
HYDROFLUORIC ACID	40%	●	●	–
HYDROFLUORIC ACID	70%	●	◐	–
HYDROGEN	TR	●	●	–
HYDROGEN CHLORIDE	TR	●	●	–
HYDRGEN PROXIDE	30%	●	◐	–

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
HYDROSYANIC ACID	TR	●	●	–
HYDROXYLAMMONIUM SULFATE	12%	●	●	–
IODINE SOLUTION	H	●	◐	–
ISOOCTANE	TR	●	◐	○
ISOPROPYL	TR	●	●	●
KEROSEN	H	●	◐	○
LASTIC ACID	90%	●	●	–
LANOLIN	H	●	●	–
LEAD ACETATE	GL	●	◐	○
LINSEED OIL	H	●	●	●
LUBRICATING OILS	TR	●	◐	○
MAGNESIUM CHLORIDE	GL	●	●	●
MAGNESIUM HYDROCARBONATE	GL	●	○	○
MAGNESIUM SALTS	GL	●	●	–
MAGNESIUM SULPHATE	GL	●	●	●
MENTHOL	TR	●	◐	–
METHANOL	TR	●	●	–
METHANOL	5%	●	●	◐
METHYL ACETATE	TR	●	●	–
METHYL AMINE	32%	●	–	–
METHYL BROMIDE	TR	○	○	○
METHYL CHLORIDE	TR	○	○	○
METHYL ETHYL KETONE	TR	●	◐	–
MERCURY	TR	●	●	–
MERCURY SALTS	GL	●	●	–
MILK	H	●	●	●
MINERAL WATER	H	●	●	●
MOLASSES	H	●	●	●
MOTOR OIL	TR	●	◐	–
NATURAL GAS	TR	●	–	–
NICKEL SALTS	GL	●	●	–
NITRIC ACID	10%	●	◐	○
NITRIC ACID	10-50%	◐	○	○
NITRIC ACID	>50%	○	○	○
2-NITROTOLUEN	TR	●	◐	–
NITROYUS GASES	ALL	●	●	–
OLEUM(H2SO4+SO3)	TR	○	○	○
OLIVE OIL	TR	●	●	◐
OXALIC ACID	GL	●	●	○
OXYGEN	TR	●	–	–
OZONE	0,5PPM	●	◐	–
PARAFFIN EMULSIONS	H	●	●	–
PARAFFIN OIL	TR	●	●	○
PERCHLORIC ACID	20%	●	●	–

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
PERCHLOROETHYLENE	TR	◐	◐	–
PETROLEUM	TR	●	◐	–
PETROLEUM ETHER	TR	●	◐	–
PHENOL	5%	●	●	–
PHENOL	90%	●	–	–
PHENYL HYDRAZINE	TR	◐	◐	–
PHENYL HYDRAZINE HYDROCHLORIDE	TR	●	◐	–
PHOSGENE	TR	◐	◐	–
PHOSPHATES	GL	●	●	–
PHOSPHORIC ACID	85%	●	●	●
PHOSPHORUS OXYCHLORIDE	TR	◐	–	–
PHTHALIC ACID	GL	●	●	–
PHOTO EMULSIONS	H	●	●	–
PHOTO FIXING BATHS	H	●	●	–
PICRIC ACID	GL	●	–	–
PATASSIUM BICHROMATE	GL	●	●	–
POTASSIUM BROMATE	10%	●	●	–
POTASSIUM BROMIDE	GL	●	●	–
POTASSIUM CARBONATE	GL	●	●	–
POTASSIUM CHLORATE	GL	●	●	–
POTASSIUM CHLORIDE	GL	●	●	–
POTASSIUM CHROMATE	GL	●	●	–
POTASSIUM CYANIDE	L	●	●	–
POTASSIUM FLUORIDE	GL	●	●	–
POTASSIUM HYDROGEN CARBONATE	GL	●	●	–
POTASSIUM HYDROXIDE	50%	●	●	●
POTASSIUM IODIDE	GL	●	●	–
POTASSIUM NITRATE	GL	●	●	–
POTASSIUM PERCHLORATE	10%	●	●	–
POTASSIUM PERMANGANATE	GL	●	○	–
POTASSIUM PERSULFATE	GL	●	●	–
POTASSIUM SULFATE	GL	●	●	–
PROPANE, GAS	TR	●	–	–
PROPANOL (I)	TR	●	●	–
PROPARGYL ALCOHOL	7%	●	●	–
PROPIONIC ACID	>50%	●	–	–
PROPYLENE GLYCOL	TR	●	●	–
PYRIDIN	TR	◐	◐	–
SEAWATER, BRINE	H	●	●	●
SILICIC ACID	All	●	●	–
SILICO FLUORIC ACID	32%	●	●	–
SILICONE EMULSION	H	●	●	–
SILICONE OIL	TR	●	●	●

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
SILVER NITRATE	GL	●	●	◐
SILVER SALTS	GL	●	●	–
SODIUM ACETATE	GL	●	●	●
SODIUM BENZOATE	35%	●	●	–
SODIUM BICARBONATE	GL	●	●	●
SODIUM BISULPHATE	GL	●	●	–
SODIUM BISULPHITE	L	●	–	–
SODIUM CARBONATE	50%	●	●	◐
SODIUM CHLORATE	GL	●	●	–
SODIUM CHLORIDE	VL	●	●	●
SODIUM CHLORITE	VL	●	●	●
SODIUM CHLORITE	2-20%	●	◐	○
SODIUM CHROMATE	GL	●	●	●
SODIUM HYDROX	60%	●	●	●
SODIUM HYPOCHLORIDE	20%	○	○	○
SODIUM HYPOCHLORITE	10%	●	–	–
SODIUM HYPOCHLORITE	20%	◐	◐	○
SODIUM NITRATE	GL	●	●	–
SODIUM SILICATE	L	●	●	–
SODIUM SULPHATE	GL	●	●	–
SODIUM SULPHIDE	GL	●	●	–
SODIUM SULPHIDE	40%	●	●	●
SODIUM THIOSULPHATE	GL	●	●	–
SODIUM TRIPHOSPHATE	GL	●	●	●
SAYABEAN OIL	TR	●	◐	–
STRACH SOLUTION	All	●	●	–
STRACH SYRUP	All	●	●	–
SULPHURDIOXIDE	All	●	●	–
SULPHURDIOXIDE, GAS	TR	●	●	–
SULPHURDIOXIDE, LIQUID	All	●	●	–
SULPHURIC ACID	10%	●	●	●
SULPHURIC ACID	10-80%	●	●	–
SULPHURIC ACID	80%-TR	◐	○	–
SULPHURIC ACID		○	○	○
SULPHURIC ACID	All	●	●	–
SULPHUR TRIOXIDE	All	●	●	–
TAR OIL	H	●	○	○
TETRACHLOROETHANONE	TR	◐	○	○
TETRACHLOROETHYLENE	TR	◐	◐	–
TETRACHLOROMETHANE	TR	○	○	○
TETRAETHYL LEAD	TR	●	–	–
TETRAHYDROFURANE	TR	◐	○	○
TETRAHYDRONAPHATALENE	TR	○	○	○
THIONYL CHLORIDE	TR	◐	○	○

AGRESIVE MEDIA	CON-CEN-TRA-TION	CHEMICAL RESISTANCE		
		20°C	60°C	100°C
TIN (II) CHLORIDE	GL	●	●	–
TIN (IV) CHLORIDE	GL	●	●	–
TOULENE	TR	◐	○	○
TRICHLOROETHYLENE	TR	○	○	○
TRICHLORO ASETIC ACID	50%	●	●	–
TRICRESYL PHOSPHATE	TR	●	◐	–
TRIETHANOLAMIN	L	●	–	–
WINE VINEGAR	H	●	●	●
XYLENE	TR	◐	○	○
YEAST	ALL	●	–	–
ZINK	GL	●	●	–
TRIOCTYL PHOSPHATE	TR	●	–	–
UREA	GL	●	●	–
VASELINE OIL	TR	●	◐	–
VINEGAR	H	●	●	●
VINYL ACETATE	TR	●	◐	–
WASHING POWDER	VL	●	●	–
WASTE GASES CONTAINING HYDROGEN FLUORIDE	RARE	●	●	–
WATER, PURE	H	●	●	●
WAX	H	●	◐	–
WINE ACID	10%	●	●	–
WINES	H	●	●	–

CERTIFICATES

LABORATORY TESTING

MELT MASS-FLOW RATE

DENSITY

CARBON BLACK OR PIGMENTED DISPERSION

ELONGATION AT BREAK

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HYDROSTATIC STRENGTH AT 80° AND 20° C

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