FLOWGUARD™ CPVC

Under licence from Lubrizol

High Performance piping system	Heating and Cooling	Marine piping system	Buildings	Solar system	Industrial

FIRST PLASTICS

Table of Content

FlowGuard™ CPVC
Hot & cold water distribution.

Guide for engineers and plumbing professionals.

FlowGuard™ CPVC is produced under license of Lubrizol Advanced Materials in compliance with its high quality requirements, exceeding the standards.

The Right Product

FlowGuard™ CPVC pipe is the right choice for today's hot and cold water distribution systems. Stringent product quality testing in independent laboratories ensures that FlowGuard™ CPVC products are of the highest international standards, combining performance, durability, reliability, safety and cost savings. FlowGuard™ CPVC outperforms all other water plastic piping systems wether plastic, galvanized or copper.

FlowGuard™ CPVC pipes and fittings are produced to the EN ISO 15877 standard; in sizes ranging from 16mm to 160mm; and pressure ratings of PN 16, PN 20, and PN 25.

The Quality Choice

FlowGuard™CPVC products are strong and tough, needing less hangers and supports and with a higher pressure bearing capability than many alternative plastic systems. Oxygen permeation through the pipe wall and the subsequent corrosion of metal components is eliminated. Heat loss and thermal expansion are reduced. In addition FlowGuard™ CPVC products do not support combustion, enhancing the fire safety of the building.

The Result

FlowGuard™ CPVC hot and cold water system means a lower installed cost and a plumbing system that will perform for the entire life of the building. It is quieter than metal pipe systems and virtually eliminates the risk of water hammer and the possibility of condensation while providing superior heat retention.

A History of Proven Performance

The reputation of FlowGuard™ CPVC is built on over 50 years of trouble free performance. Based on the advanced polymer chemistry of Lubrizol, CPVC plumbing systems have a proven track record in millions of homes, apartments, hotels, hospitals and offices. Professional installation with FlowGuard™ approved solvent cement is your assurance of a worry free system.

The bonding of FlowGuard™ CPVC is simple, long lasting, safe and does not need expensive tools or the use of electricity.

FlowGuard™ CPVC FEATURES AND BENEFITS:

PHYSICAL PROPERTIES

FlowGuard piping is highly durable. It can be relied upon to deliver impact strength and a heat deflection temperature that surpasses many other piping options.

	CPVC	PVC	PPR	PEX	PB	CU
Tensile strength (MPa at 23°C)	55	50	30	25	27	>300
Coefficient of Thermal expansion (x10-4K-1)	0.7	0.7	1.5	1.5	1.3	0.2
Thermal conductivity (W/MK)	0.14	0.14	0.22	0.22	0.22	>400
LOI	60	45	18	17	18	
Oxygen permeation (cm3/m.day.atmosphere) (at 70°C)	<1 insignificant	(not available) similar to CPVC	(not available) similar to PB/PEX	13	16	insignificant

Temperature & Pressure

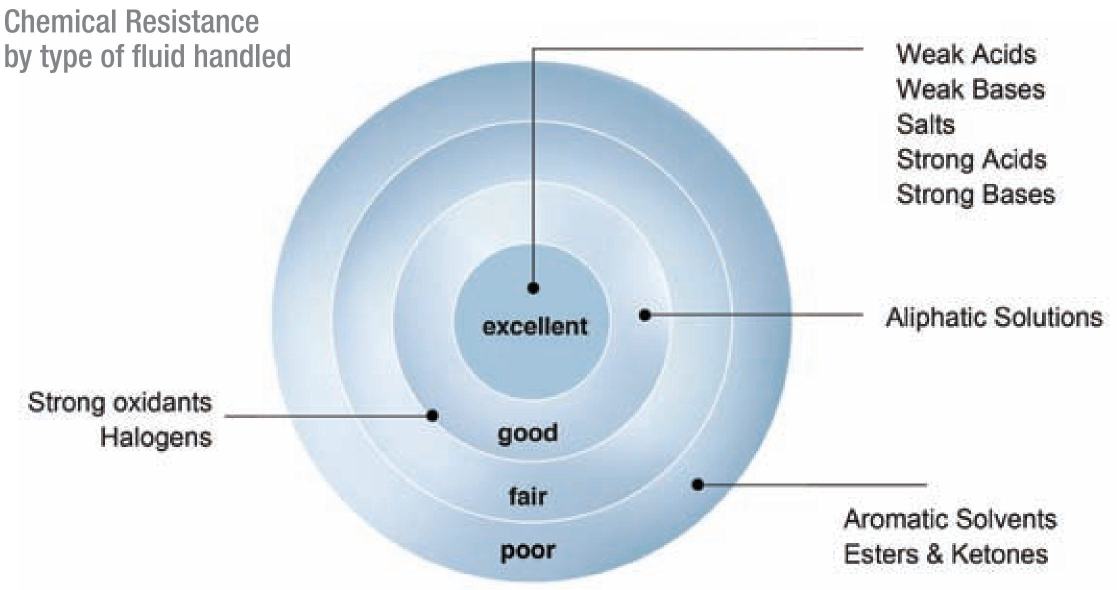
Temperature (°C)	Working Pressure PN 16 (bar)	Working Pressure PN 20 (bar)	Working Pressure PN 25 (bar)
20	16	20	25
40	11	14	17
60	6	8	10
80	4	4	6
95	2	3	4

Pipe Dimensions & Weights:

DIMENSIONS ISO15877						
Outside diameter (mm)	PN 16 (S=6,25) Wall thickness weight (mm)	Kg/m	PN 20 (S=5) Wall thickness weight (mm)	Kg/m	PN 25 (S=4) Wall thickness weight (mm)	Kg/m
16	1.2	0.100	1.5	0.118	1.8	0.136
20	1.5	0.151	1.9	0.183	2.3	0.217
25	1.9	0.234	2.3	0.279	2.8	0.326
32	2.4	0.379	3.0	0.455	3.6	0.534
40	3.0	0.582	3.7	0.701	4.5	0.830
50	3.7	0.896	4.6	1.090	5.6	1.290
63	4.7	1.430	5.8	1.720	7.0	2.020
75	5.6	2.020	6.9	2.420	8.4	2.880
90	6.7	2.880	8.2	3.460	10.0	4.100
110	8.2	4.310	10.0	5.130	12.3	6.160
125	9.2	5.460	11.4	6.620	14.0	7.900
140	10.3	6.850	12.7	8.210	15.7	9.920
160	11.8	9.070	14.6	10.800	17.9	12.910

CHEMICAL RESISTANCE

FlowGuard™ CPVC highly resistant to acids, alkalis, alcohols and many other corrosive materials. Both materials are ideal for process piping installation and most service piping applications.

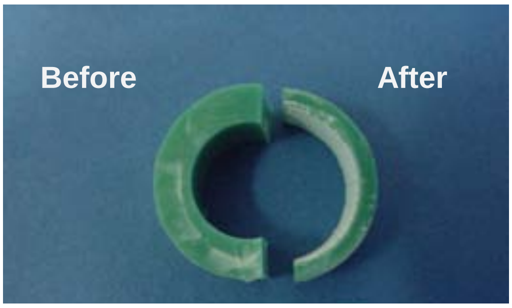


CHLORINE RESISTANCE

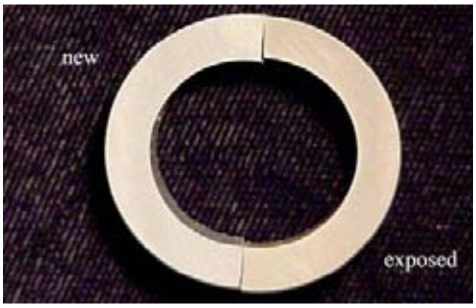
When chlorine is added to water for disinfection, it transforms to hypochlorous acid. Hypochlorous acid is a strong oxidizer capable of breaking the carbon-to-carbon bonds of the polymer chain.

The chlorine atoms surrounding the carbon chain of FlowGuard™ CPVC, however, are large atoms which protect the chain from attack by hypochlorous acid in the water.

The hydrogen atoms surrounding the carbon chain of polyolefins, such as PPR, PEX and PB (polybutylene), are small atoms which are incapable of protecting the chain from attack by hypochlorous acid in the water and causes erosion inside the piping system.



PPR Erosion
After 10 months (at 5ppm Chlorine)



CPVC: Real Life testing after 24 years

HEALTH BENEFITS

FlowGuard™ CPVC plumbing systems are approved for contact with potable water in a wide range of countries including the USA, Canada, the UK, Japan, the E.U, and the Middle-East. FlowGuard™ CPVC is certified to NSF 61 for potable water service for uncompromised water quality under all water conditions.

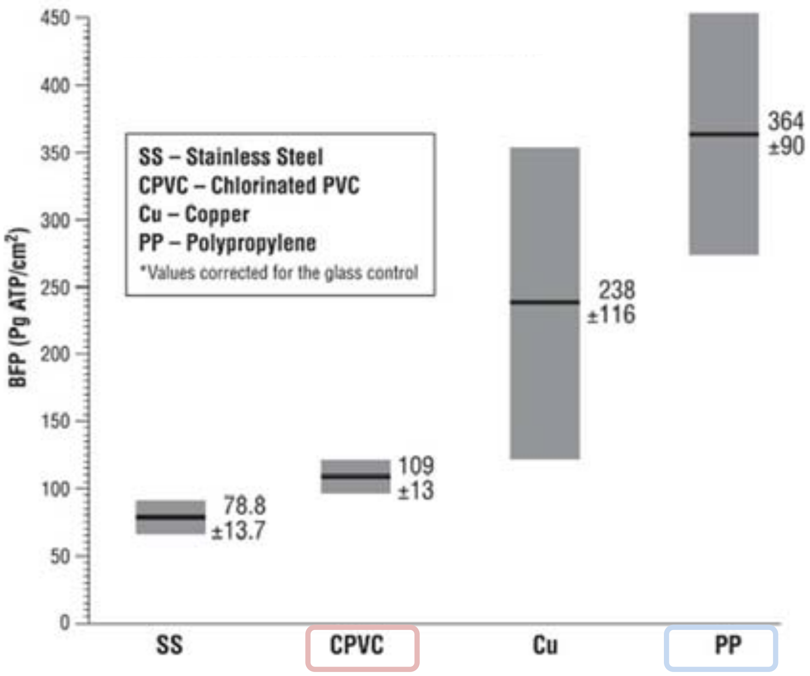
FlowGuard™ CPVC does not break down - even under the harshest of water conditions. It keeps water pure without any traces of corrosion or chemicals.

Even after years of use in the most aggressive conditions, FlowGuard™ CPVC piping won't corrode, standing up to low PH water, coastal salt air exposure and corrosive soils.

CPVC vs PPR: Antimicrobial Performance

Dr. Paul Sturman concludes*:
"CPVC consistently outperforms most other non-metallic piping materials with regard to its ability to resist the formation of biofilms".

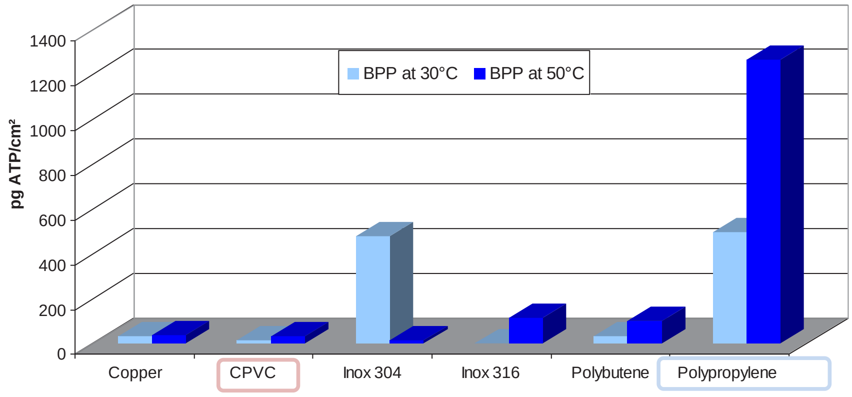
Biofilm Formation Potential



**Source: Dr. Paul Sturman, research professor and industrial coordinator for The Center for Biofilm Engineering at Montana State University based on his evaluation of Dutch Research and Knowledge Institute for Drinking Water (KIWA) 1999 study Biofilm Formation Potential of Pipe Materials in Plumbing Systems, 2006 study Standardizing the Biomass Production Potential Method for Determining the Enhancement of Microbial Growth by Construction Products in Contact With Drinking Water, and 2007 study Assessment of the Microbial Growth Potential of Materials in Contact with Treated Water Intended for Human Consumption.*

Study conducted by CRECEP in France, confirms the ability of CPVC to resist biofilm formation. Comparison of BPP (Biomass Production Potential) values observed at 30°C and 50°C. [1]

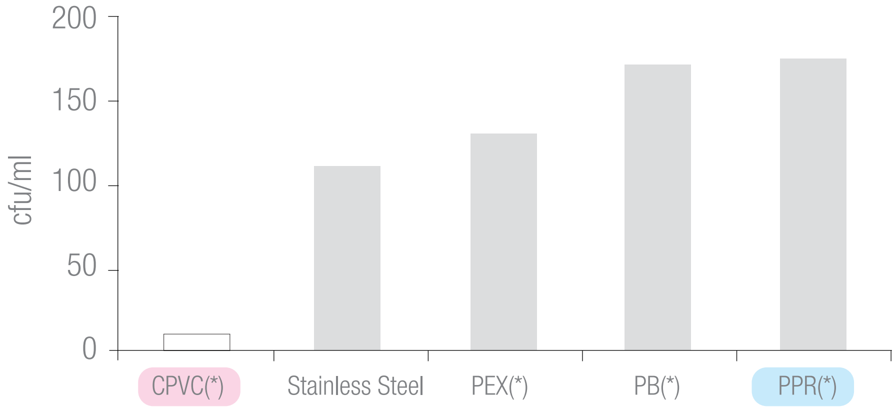
Biomass formation in different materials of pipe



(Inox 304/316 = Stainless Steel) * Values measured at 8, 12 and 16 weeks

For CPVC, the growth of Legionella bacteria in the water was low.

Legionella Bacteria count in different materials of pipe[2]



(*) Average of 2 samples

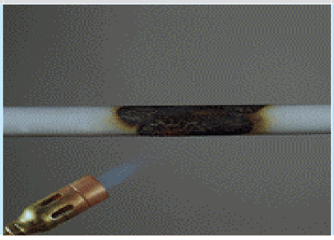
[1] *Source: Study of 6 different materials used for drinking water distribution and their capacity to support bacterial growth conducted by Crecep (Research and Control of drinking water Centre in Paris) according to a European standard project by means of the Biomass Production Potential test in 2005.*

[2] *Study: Biofilm Formation Potential of Pipe Materials in internal installations by H.R. Veenendaal / D. van de Kooiy – KIWA - 1999 (KIWA is the approvals agency for potable water piping systems in The Netherlands)*

FIRE RESISTANCE

FlowGuard™ CPVC has a limiting Oxygen Index (LOI) of 60. Thus in air CPVC does not support combustion. It is self extinguishing, it will not cause flaming drips. It has low flame spread and low smoke generation.

FlowGuard™ CPVC has the best possible product fire classification for products made from synthetic materials according to New European classification.

	CPVC	PPR
Limiting Oxygen Index (% of Oxygen needed in an atmosphere to support combustion)	60	17
Flash Ignition Temperature	480°C	340°C
Heat of combustion of PPR is about 3x more than CPVC generating more heat		

CPVC and Fire Resistance Testing

The best possible rating a non-metal material can receive

EN 13501-1:2002- Fire classification of construction products and building elements.

CPVC Rating = B s1 d0

Fire behavior	B —> Low flammability, no contribution to flashover
Smoke development	s1—> Low smoke development
Flaming droplets	d0 —> No flaming drips

UV RESISTANCE

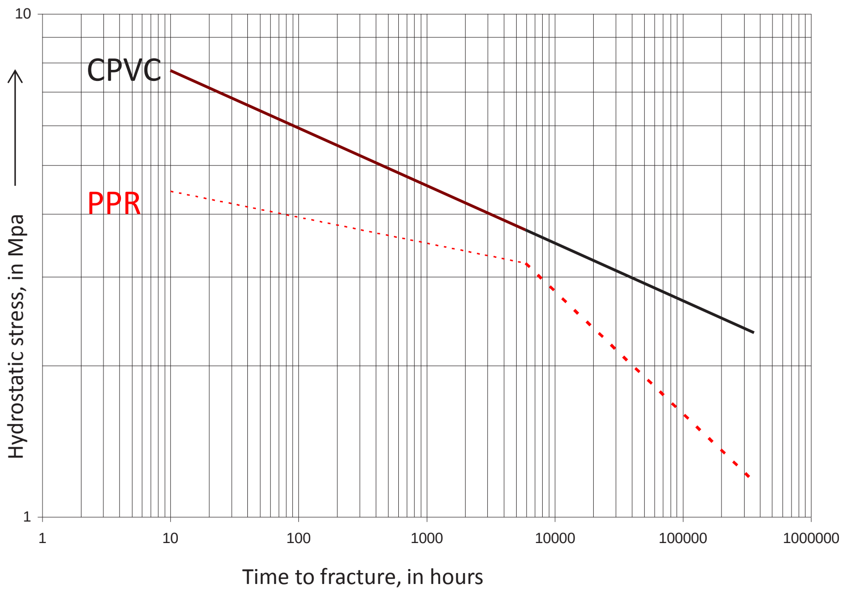
Unlike PPR, FlowGuard™ CPVC resists U.V. rays. The main degradation process caused by U.V. rays is dehydrochlorination, which breaks down the PPR polymer chain, leading to weakness in PPR pipe and the loss of its hydrostatic strength.

In FlowGuard™ CPVC this dehydrochlorination, whilst slightly accelerated by U.V., does not break down the polymer chains to any significant extent after outdoor exposure. The effect is limited to a surface discoloration. There is a loss of impact resistance due to impact modifiers losing efficiency. But, there is no effects on the tensile strength and modulus of elasticity of the material. The damage due to weathering is mainly a surface phenomenon.

LONG TERM PERFORMANCE

FlowGuard™ CPVC have a track record of more than 50 years of successful performance. Laboratory tests show that on the long run and at high temperatures FlowGuard™ CPVC outperforms PPR.

Reference curves for expected strength at 95°C.*



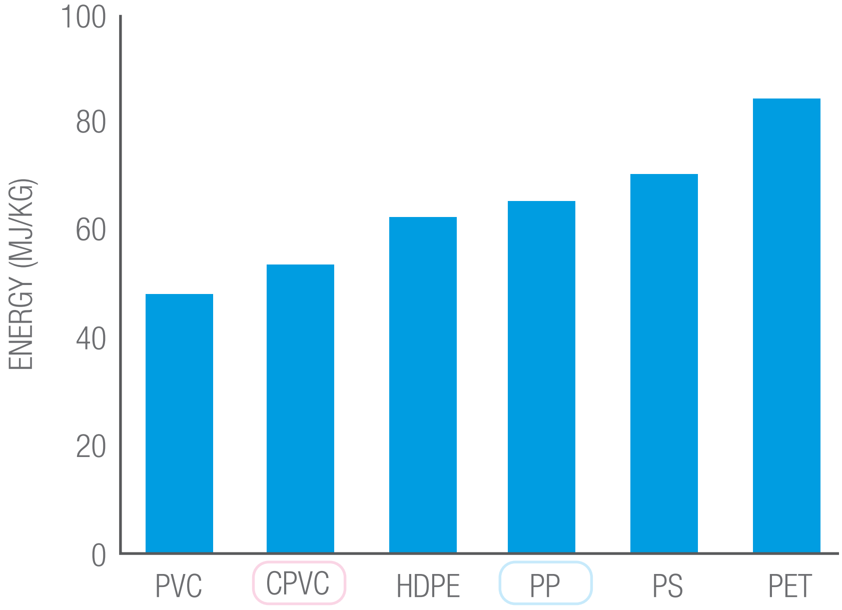
**Source: EN ISO 15874-2 / EN ISO 15877-2*

SUSTAINABILITY

Environmental Impact

Total energy requirements for CPVC production are lower than other plastic materials, due primarily to the low petroleum content.*

Plastic materials production energy requirements



Recycling

FlowGuard™ CPVC piping can easily be recycled.

- Piping material can be collected from the jobsite by a specialized recycling firm (country specific).
- Regrind piping material into pellets and granules.
- Mix regrind into applications such as floor fillings, floor coatings, cable trays, speed bumps and car mats.

Lower Friction Loss

The smooth interior surface of the FlowGuard™ CPVC piping system assures low friction loss and higher flow rate, which results in lower pumping requirements and less energy usage. The FlowGuard™ CPVC piping system resists rusting pitting, scaling and corrosion, so the design flow rate can be maintained for the life of the system.

*Source: H. Sambele, Kapitel Nachchlorierte Polyvinylchloride Rohre, Technical University Berlin, 1993

EASY, COST EFFECTIVE INSTALLATION

FlowGuard™ CPVC uses a solvent cement jointing method. Tools required are simple and inexpensive (chamfering tool and pipe cutter only. Working with FlowGuard™ CPVC does not require an electrical source. Installation is easy in tight, confined or inaccessible places.

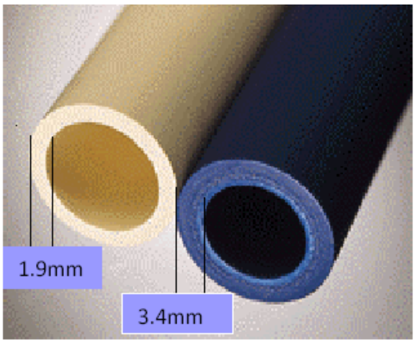
The installation procedure is the same as that for PVC familiar to all plumbers.

Pipe Size Selection Advantage

FlowGuard™ CPVC presents an advantage in pipe selectin as it offers a larger inside diameter compared to other plastic pipe materials e.g. FlowGuard™ CPVC Ø16mm handle the same flow rate as PPR Ø 20mm. FlowGuard™ CPVC Ø 20mm handle the same flow rate as PPR Ø 25mm.

Wall Thickness PN 20 Pipe*

Outside Diameter (mm)	Wall Thickness (mm)	
	FLOWGUARD™CPVC	PPR
20	1.9	3.4
25	2.3	4.2
32	3.0	5.4
40	3.7	6.7
50	4.6	8.4



Ref. DIN 8077, 8079
PN20, wall thickness
20mm diameter
CPVC: 1.9mm PPP: 3.4mm

FLOWGUARD™CPVC	PPR
OD = 16 mm t = 1.5 mm ID = 13.0 mm Weight = 0.118 kg/m	OD = 20 mm t = 3.4 mm ID = 13.2 mm Weight = 0.172 kg/m
OD = 20 mm t = 1.9 mm ID = 16.2 mm Weight = 0.183 kg/m	OD = 25 mm t = 4.2 mm ID = 16.6 mm Weight = 0.266 kg/m
OD = 25 mm t = 2.3 mm ID = 20.4 mm Weight = 0.279 kg/m	OD = 32 mm t = 5.4 mm ID = 21.2 mm Weight = 0.434 kg/m

Source: DIN 8077 / 8079 / 16969 / 16893

INSTALLATION BENEFITS

No beading

FlowGuardTM CPVC does not use PPR's Heat fusion, which leads to 'bead formation' internally and externally. This results in:

- Increased friction loss at every joint
- Increased depositions of non solubles
- Reduced flow rate
- Ample opportunity for bacterial growth

Professional Appearance:

FlowGuardTM CPVC is suitable for vertical risers (left installation) and tooks professional, and it requires less hangers than the other thermoplastic piping (PPR & PEX).

INSTALLATION GUIDE

Cutting

FlowGuard™ CPVC pipe can be easily cut with a wheel-type plastic tube cutter, a hack saw or other fine toothed hand or power saw. Use of ratchet cutters is permitted, provided blades are sharpened regularly. A miter box should be used to ensure a square cut when using a saw. Cutting pipe as squarely as possible provides an optimal bonding area within the joint. If any indication of damage or cracking is evident at the pipe end, cut off at least 5 cm beyond any visible crack.

Deburring / Beveling

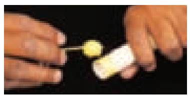
Burrs and filings can prevent proper contact between pipe and fitting during assembly, and should be removed from the outside and inside of the pipe. A chamfering tool is preferred but a pocketknife or file are suitable for this purpose. A slight bevel on the end of the pipe will ease entry of the pipe into the fitting socket and minimize the chances of pushing solvent cement to the bottom of the joint.

Fitting Preparation

Wipe any dirt or moisture from the fitting socket and pipe end. Check the dry fit of the pipe and fitting. The pipe should make contact with the socket wall 1/3 to 2/3 of the way into the fitting socket. At this stage, pipe should not bottom out in the socket.

Solvent Cement Application

Use only FlowGuard™ CPVC approved cement. Make sure the pipe and fitting surfaces are dry. Apply a sufficient, even coat of cement on the pipe end. And apply a thin coat inside the fitting socket (make sure not to use an excessive amount of cement especially on the fitting).



Assembly

Immediately insert the pipe into the fitting socket, rotating the pipe 1/4 to 1/2 turn while inserting. This motion ensures an even distribution of cement within the joint. Properly align the fitting.

Hold the assembly for approximately 10 seconds, allowing the joint to set-up. An even bead of cement should be evident around the joint. If this bead is not continuous around the socket edge, it may indicate that insufficient cement was applied. In this case remake the joint to avoid potential leaks. Wipe excess cement from the tubing and fittings surfaces for an attractive, professional appearance.

Set and Cure Times

Solvent cement set and cure times are a function of pipe size, temperature and relative humidity. Curing time is shorter for drier environments, smaller sizes and higher temperatures. Refer to the table below for minimum cure times after the last joint has been made before pressure testing can be done.

In certain areas, quick drying one-step cements are available. Theses cements avoid the need for a primer.

Special care should be exercised when assembling CPVC systems in extremely low temperatures (below 4°C) or extremely high temperatures (above 38°C). Dried cement can not be recovered and should be discarded. In extremely hot temperatures, make sure both surfaces to be joined are still wet with cement when putting them together.

MINIMUM CURE PRIOR TO PRESSURE TESTING AT 10BAR		
Ambient temperature during current period	Pipe Sizes	
	Up to 25mm	40mm and above
Above 15˚C	1Hour	2Hours
At 15˚C	2Hours	4Hours
Below 4˚C	4Hours	8Hours

All you need is:


Ratchet


Pipe Cutter


Saw


Chamfering Tool

Sand Paper

Solvent Cement

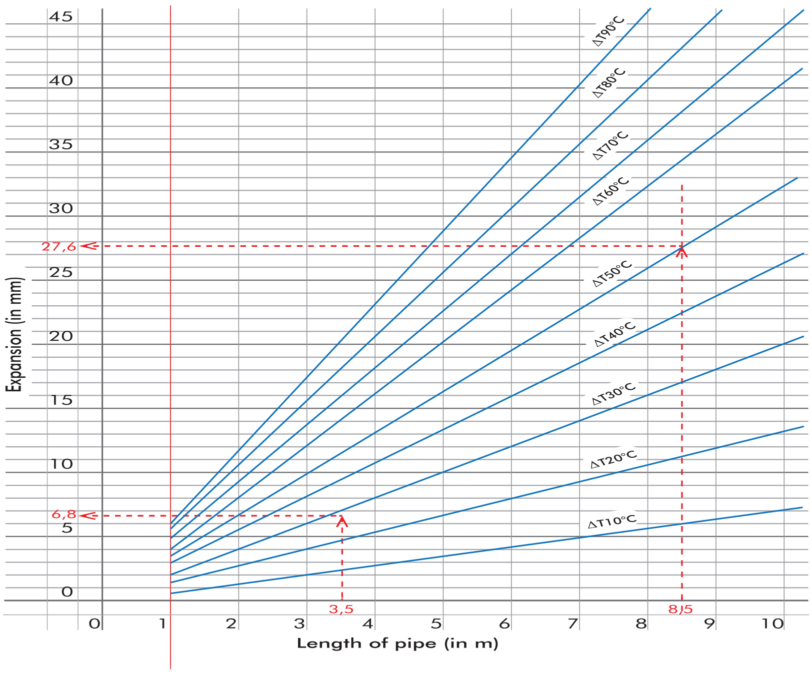
THERMAL EXPANSION

The stresses developed in FlowGuard™ CPVC are generally much smaller than those developed in metal systems for equal temperature changes because of significant differences in elastic modulus.Therefore, expansion loop requirements are not significantly different than those recommended for copper tubing.

Thermal expansion can generally be accommodated at changes in direction. On a long straight run, an offset or loop based on the following chart is required.

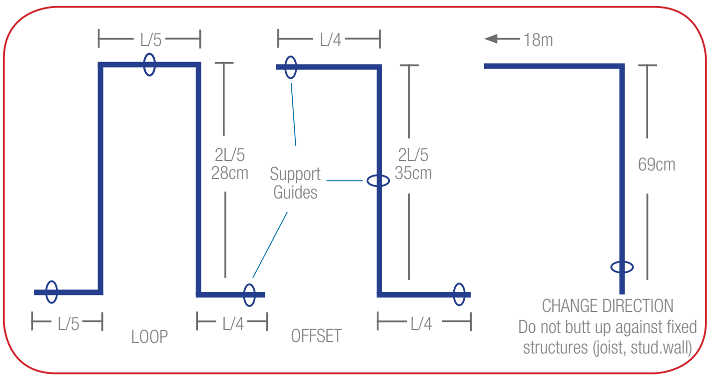
EXPANSION LOOP LENGTH (cm) FOR (44°C) TEMPERATURE CHANGE					
Normal pipe size	Length of run in meters				
	6	12	18	24	30
20mm	43	56	69	79	86
25mm	48	66	81	91	104
32mm	53	74	91	104	117
40mm	58	81	102	117	130
50mm	63	89	109	127	142
63mm	71	102	124	145	163

CPVC pipe expansion table



CPVC pipe expansion loop calculation

Example:
Pipe size=25mm
Length of run=18m
L= 69 cm from table



HANGERS AND SUPPORTS:

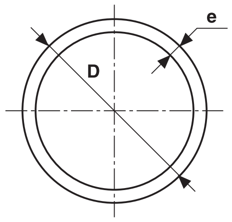
Because FlowGuard™ CPVC tubing is rigid, it requires fewer supports than flexible plastic systems. The table below shows the required vertical and horizontal spacing of the hangers.

Piping should not be anchored tightly to supports, but rather secured with smooth straps or hangers that allow for movement caused by expansion and contraction. Most hangers designed for metal pipes are suitable for FlowGuard™ CPVC Hangers should not have rough or sharp edges which come in contact with the tubing.

Diameter of pipe (mm)	Hangers spacing (mm)			
	Horizontal			Vertical
	20°C	60°C	80°C	
16	850	700	600	1000
20	950	850	750	1200
25	1050	950	850	1300
32	1200	1100	1000	1400
40	1350	1300	1150	1500
50	1500	1450	1350	1700
63	1700	1650	1550	2000

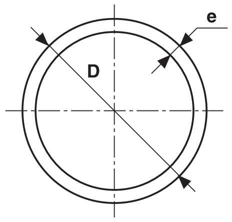
PRODUCT DATA

PN 16



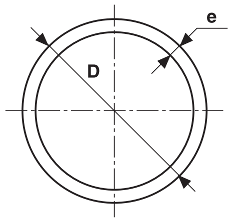
Diameter D	e/mm	PN	Description	Unit	Weight per meter (Kg)	Internal Diameter (mm)
16	1,4	16	TUBE CPVC	ML	0,111	13,20
20	1,5	16	TUBE CPVC	ML	0,151	17,00
25	1,9	16	TUBE CPVC	ML	0,234	21,20
32	2,4	16	TUBE CPVC	ML	0,379	27,20
40	3	16	TUBE CPVC	ML	0,590	34,00
50	3,7	16	TUBE CPVC	ML	0,910	42,60
63	4,7	16	TUBE CPVC	ML	1,460	53,60
75	5,6	16	TUBE CPVC	ML	2,100	63,80
90	6,7	16	TUBE CPVC	ML	2,900	76,60
110	8,1	16	TUBE CPVC	ML	4,310	93,80
125	9,2	16	TUBE CPVC	ML	5,460	106,60
140	10,3	16	TUBE CPVC	ML	6,850	119,40
160	11,8	16	TUBE CPVC	ML	9,070	136,40

PN 20



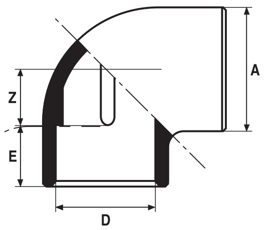
Diameter D	e/mm	PN	Description	Unit	Weight per meter (Kg)	Internal Diameter (mm)
16	1,5	20	TUBE CPVC	ML	0,115	13,00
20	1,9	20	TUBE CPVC	ML	0,187	16,20
25	2,3	20	TUBE CPVC	ML	0,270	20,40
32	2,9	20	TUBE CPVC	ML	0,470	26,20
40	3,7	20	TUBE CPVC	ML	0,701	32,60
50	4,6	20	TUBE CPVC	ML	1,090	40,80
63	5,8	20	TUBE CPVC	ML	1,720	51,40
75	6,8	20	TUBE CPVC	ML	2,420	61,40
90	8,2	20	TUBE CPVC	ML	3,750	73,60
110	10	20	TUBE CPVC	ML	5,130	90,00
125	11,4	20	TUBE CPVC	ML	6,620	102,20
140	12,7	20	TUBE CPVC	ML	8,200	114,60
160	14,6	20	TUBE CPVC	ML	10,800	130,80

PN 25



Diameter D	e/mm	PN	Description	Unit	Weight per meter (Kg)	Internal Diameter (mm)
16	1,8	25	TUBE CPVC	ML	0,140	12,40
20	2,3	25	TUBE CPVC	ML	0,220	15,40
25	2,8	25	TUBE CPVC	ML	0,330	19,40
32	3,6	25	TUBE CPVC	ML	0,490	24,80
40	4,5	25	TUBE CPVC	ML	0,830	31,00
50	5,6	25	TUBE CPVC	ML	1,290	38,80
63	7,1	25	TUBE CPVC	ML	2,020	48,80
75	8,4	25	TUBE CPVC	ML	2,880	58,20
90	10,1	25	TUBE CPVC	ML	4,250	69,80
110	12,3	25	TUBE CPVC	ML	6,160	85,40
125	14	25	TUBE CPVC	ML	7,90	97,00
140	15,7	25	TUBE CPVC	ML	9,920	108,60
160	17,9	25	TUBE CPVC	ML	12,910	124,20

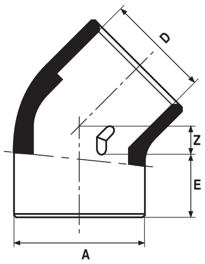
Elbow 90°



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)
16	GIC 16	21,2	16,2	9,0	14,0
20	GIC 20	26,6	20,2	11,0	16,0
25	GIC 25	32,95	25,35	13,5	25,0
32	GIC 32	40,35	32,35	17,0	30,0
40	GIC 40	50,35	40,35	21,0	35,0
50	GIC 50	62,95	50,35	26,0	41,0
63	GIC 63	76,15	63,35	32,5	50,0
75	GIC 75	90,65	75,45	38,5	60,0
90	GIC 90	108,65	90,45	46,0	72,0
110	GIC 110	132,45	110,45	56,0	88,0

Notes: All dimensions are in mm

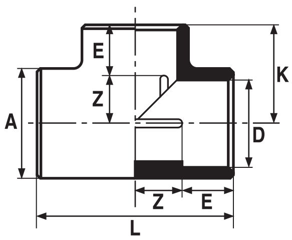
Elbow 45°



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)
16	HIC 16	21,2	16,2	4,5	14,0
20	HIC 20	26,6	20,2	5,0	16,0
25	HIC 25	32,8	25,2	6,0	18,5
32	HIC 32	40,35	32,35	7,5	30,0
40	HIC 40	50,35	40,35	9,5	35,0
50	HIC 50	60,35	50,35	11,5	41,0
63	HIC 63	76,15	63,35	14,0	50,0
75	HIC 75	90,65	75,45	16,5	60,0
90	HIC 90	108,65	90,45	19,5	72,0
110	HIC 110	132,45	110,45	24,0	88,0

Notes: All dimensions are in mm

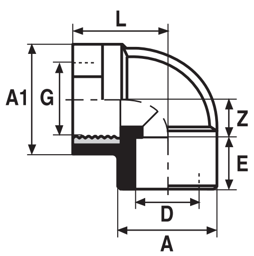
Tee 90°



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)	K	L
16	TIC 16	21,2	16,2	9,0	14,0	23,0	46,0
20	TIC 20	26,6	20,2	11,0	16,0	27,0	54,0
25	TIC 25	32,95	25,35	13,5	25,0	38,5	77,0
32	TIC 32	40,35	32,35	17,0	30,0	47,0	94,0
40	TIC 40	50,35	40,35	21,0	35,0	56,0	112,0
50	TIC 50	62,95	50,35	26,0	41,0	67,0	134,0
63	TIC 63	76,15	63,35	32,5	50,0	82,5	165,0
75	TIC 75	90,65	75,45	38,5	60,0	98,5	197,0
90	TIC 90	108,65	90,45	46,0	72,0	118,0	236,0
110	TIC 110	132,45	110,45	56,0	88,0	144,0	288,0

Notes: All dimensions are in mm

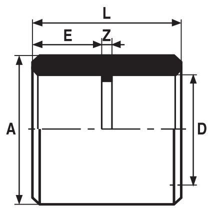
Elbow Metal Reduced and Threaded



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)	G	A1	L
16x½"	GIRC 16x½"	21,2	16,2	9,0	14,0	½"	39,8	28,5
20x½"	GIRC 20x½"	26,75	20,35	11,0	20,0	½"	42,0	27,5
25x¾"	GIRC 25x¾"	32,95	25,35	13,5	25,0	¾"	43,0	33,8
32x1"	GIRC 32x1"	40,35	32,35	17,0	30,0	1"	49,3	39,7

Notes: All dimensions are in mm

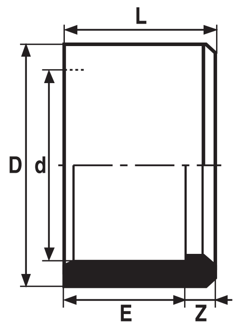
Sleeves



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)	L
16	MIC 16	21,2	16,2	3,0	14,0	31,0
20	MIC 20	26,6	20,2	3,0	16,0	35,0
25	MIC 25	32,95	25,35	3,0	25,0	53,0
32	MIC 32	40,35	32,35	3,0	30,0	63,0
40	MIC 40	50,35	40,35	3,0	35,0	73,0
50	MIC 50	62,95	50,35	3,0	41,0	85,0
63	MIC 63	76,15	63,35	3,0	50,0	103,0
75	MIC 75	90,65	75,45	4,0	60,0	124,0
90	MIC 90	108,65	90,45	5,0	72,0	149,0
110	MIC 110	132,45	110,45	6,0	88,0	182,0

Notes: All dimensions are in mm

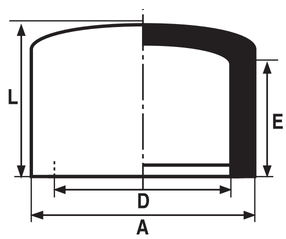
Reduction



Dn	Reference	D(min)	d(avg)	Z(avg)	E(min)	L(min)
20/16	DIC 20/16	20,0	16,35	4,0	16,0	20,0
25/20	DIC 25/20	25,0	20,35	5,0	20,0	25,0
32/20	DIC 32/20	32,0	20,35	10,0	20,0	30,0
32/25	DIC 32/25	32,0	25,35	5,0	25,0	30,0
40/20	DIC 40/20	40,0	20,35	15,0	20,0	35,0
40/25	DIC 40/25	40,0	25,35	10,0	25,0	35,0
40/32	DIC 40/32	40,0	32,35	5,0	30,0	35,0
50/20	DIC 50/20	50,0	20,35	15,0	20,0	35,0
50/25	DIC 50/25	50,0	25,35	16,0	25,0	41,0
50/32	DIC 50/32	50,0	32,35	11,0	30,0	41,0
50/40	DIC 50/40	50,0	40,35	6,0	35,0	41,0
63/32	DIC 63/32	63,0	32,35	20,0	30,0	50,0
63/40	DIC 63/40	63,0	40,35	15,0	35,0	50,0
63/50	DIC 63/50	63,0	50,35	9,0	41,0	50,0
75/50	DIC 75/50	75,0	50,35	19,0	41,0	60,0
75/63	DIC 75/63	75,0	63,35	10,0	50,0	60,0
90/75	DIC 90/75	90,0	75,45	12,0	60,0	72,0
110/90	DIC 110/90	110,0	90,45	16,0	72,0	88,0

Notes: All dimensions are in mm

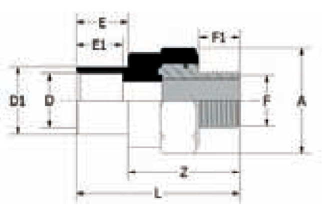
End Cap



Dn	Reference	A(min)	D(Avg)	E(min)	L(min)
16	CIC 16	21,2	16,2	14,0	19,5
20	CIC 20	26,6	20,2	16,0	22,2
25	CIC 25	32,8	25,2	18,5	25,3
32	CIC 32	40,35	32,35	30,0	37,0
40	CIC 40	50,35	40,35	35,0	43,0
50	CIC 50	62,95	50,35	41,0	50,3
63	CIC 63	79,15	63,35	50,0	60,9
75	CIC 75	93,85	75,45	60,0	73,2
90	CIC 90	112,65	90,45	72,0	88,1
110	CIC 110	137,45	110,45	88,0	107,5

Notes: All dimensions are in mm

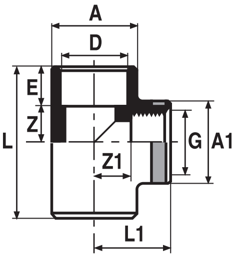
Reduced Metal Sleeve



Dn	Reference	D1(min)	D(avg)	A	E1	E	F	F1	L	Z
25x½"	KRGC 25x½"	32,95	25,35	40,8	25,0	28,0	½"	13,7	59,5	43,0
32x¾"	KRGC 32x¾"	40,35	32,35	47,5	30,0	33,0	¾"	16,6	65,0	47,5

Notes: All dimensions are in mm

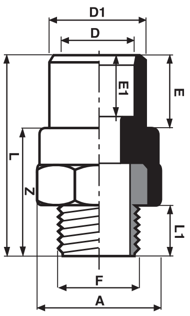
Tee Metal Threaded



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)	L	G	A1	Z1	L1
16x½"	TIRC 16x½"	21,2	16,2	9,0	14,0	46,0	½"	39,5	15,0	30,0
20x½"	TIRC 20x½"	26,75	20,35	11,0	20,0	62,0	½"	42,5	13,5	30,0
25x¾"	TIRC 25x¾"	32,95	25,35	13,5	25,0	77,0	¾"	43,0	16,5	34,5
32x1"	TIRC 32x1"	40,35	32,35	17,0	30,0	94,0	1"	49,2	20,0	40,5

Notes: All dimensions are in mm

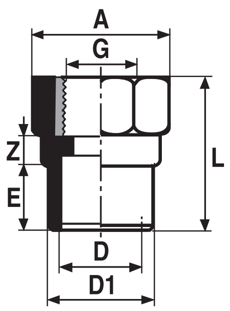
Metal Sleeves Male



Dn	Reference	D1(min)	D(avg)	A	E1	E	F	L1	L	Z
16x½"	KIGC 16x½"	21,2	16,2	39,5	14,0	16,0	½"	12,0	46,7	30,5
20x½"	KIGC 20x½"	26,75	20,35	34,9	20,0	19,0	½"	12,0	48,0	29,5
25x¾"	KIGC 25x¾"	31,75	25,35	40,8	25,0	15,6	¾"	13,7	59,5	43,0
32x1"	KIGC 32x1"	40,35	32,35	47,5	30,0	17,0	1"	16,6	65,0	47,5
40x1¼"	KIGC40x1¼"	48,55	40,35	59,5	35,0	19,5	1¼"	22,0	75,5	56,0
50x1½"	KIGC50x1½"	60,35	50,35	69,0	41,0	26,5	1½"	20,0	81,0	54,5
63x2"	KIGC 63x2"	76,15	63,35	81,0	50,0	33,7	2"	26,5	98,5	64,0

Notes: All dimensions are in mm

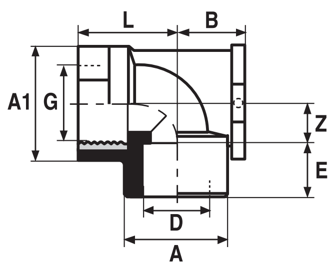
Sleeve Female Metal Reduced and Threaded



Dn	Reference	D1(min)	D(avg)	A	E(min)	G	Z	L
25x½"	MRGC 25x½"	32,95	25,35	45,5	25,0	½"	3,0	48,0
32x¾"	MRGC 32x¾"	40,35	32,35	50,5	30,0	¾"	3,0	48,5

Notes: All dimensions are in mm

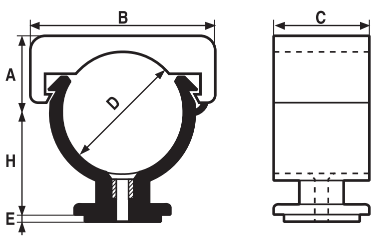
Wall Mount Elbow



Dn	Reference	A(min)	D(avg)	Z(avg)	E(min)	G	A1	L	B
20x½"	20x½"	26,75	20,35	11,0	20,0	½"	42,0	27,0	12,5
25x¾"	25x¾"	32,95	25,35	13,5	25,0	¾"	46,5	34,0	17,5

Notes: All dimensions are in mm

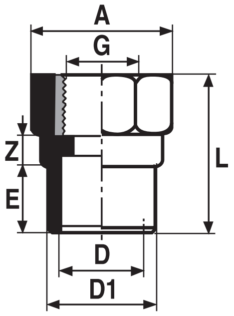
Bracket for Pipe



Dn	Reference	D	A	B	C	E	H
20	MDC 20	20,5	10,0	31,5	16,0	1,9	18,0
25	MDC 25	25,5	11,0	38,0	16,0	1,9	21,0
32	MDC 32	32,8	15,0	48,0	18,0	2,7	25,5

Notes: All dimensions are in mm

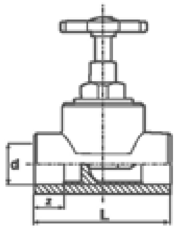
Sleeve Female Metal Threaded



Dn	Reference	D1(min)	D(avg)	A	E(min)	G	Z	L
16x½"	MIRC 16x½"	21,2	16,2	39,5	14,0	½"	3,0	34,5
20x½"	MIRC 20x½"	26,75	20,35	39,5	20,0	½"	3,0	35,2
25x¾"	MIRC 25x¾"	32,95	25,35	45,5	25,0	¾"	3,0	48,0
32x1"	MIRC 32x1"	40,35	32,35	50,5	30,0	1"	3,0	48,5
40x1¼"	MIGC 40x1¼"	48,55	40,35	60,0	35,0	1¼"	3,0	54,5
50x1½"	MIGC 50x1½"	60,35	50,35	69,0	41,0	1½"	3,0	61,0
63x2"	MIGC 63x2"	76,15	63,35	81,0	50,0	2"	3,0	72,0

Notes: All dimensions are in mm

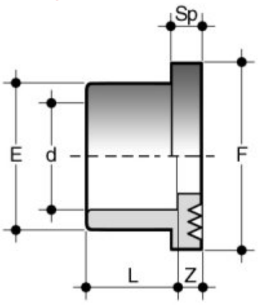
Stop Valve



Dn	Reference	d(avg)	Z(min)	L
20x½"	VKIK 20x½"	20.35	20.0	62.0
25x¾"	VKIK 25x¾"	25.35	25.0	77.0
32x1"	VKIK 32x1"	32,35	30.0	94.0

Notes: All dimensions are in mm

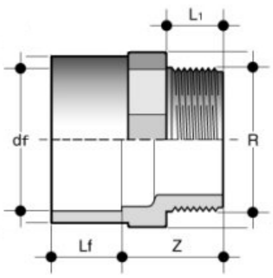
Flange Hub



Dn	Reference	d(avg)	E(min)	L	Z	SP	F
63	Colet 63	63.35	82.0	41.0	3.0	9.0	90.0
75	Colet 75	75.45	89.5	43.5	3.0	10.0	105.0
90	Colet 90	90.45	107.5	49.0	5.0	11.0	125.0
110	Colet 110	110.45	131.0	63.0	5.0	14.0	158.0

Notes: All dimensions are in mm

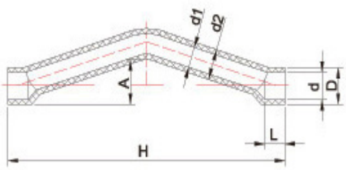
Sleeve Male Threaded



Dn	Reference	df(avg)	Lf(min)	L1(min)	Z	R
25x¾"	KIFC 25x¾"	25.35	25.0	16.3	27.0	¾"
32x1"	KIFC 32x1"	32.35	30.0	19.1	30.5	1"
40x1¼"	KIFC 40x1¼"	40.35	35.0	21.4	35.0	1¼"
50x1½"	KIFC 50x1½"	50.35	41.0	21.4	35.0	1½"
63x2"	KIFC 63x2"	63.35	50.0	25.7	41.0	2"
75x3"	KIFC 75x3"	75.45	60.0	34.5	46.5	3"
90x4"	KIFC 90x4"	90.45	72.0	41.0	52,0	4"

Notes: All dimensions are in mm

Step over bend



Dn	Reference	d(avg)	D(min)	L(min)	H(min)	A	d1	d2
20	SOBC 20	20.2	28.0	16.0	160.0	26,5	14,0	21,8
25	SOBC 25	25.2	34.8	18.5	180.0	29,5	17,7	26,7
32	SOBC 32	32.2	42.0	22.0	220.0	32,5	22,2	32,0

Notes: All dimensions are in mm

COMPARISONS

CPVC COMPARED TO PEX

Add up all the advantages and discover why FlowGuard™ CPVC is the smart choice.

CPVC	PEX
Proven Reliability	
• Used for potable water distribution in the U.S. for more than 50 years.	• Introduced into the U.S. in the mid-1990s. • Polyolefin family widely known for its poor reliability.
Superior Performance	
• Specified widely for highly corrosive and aggressive industrial chemicals. • Superior tensile strength (three times greater than PEX). • The only rigid thermoplastic rated for hot and cold water service. • Excellent thermal expansion properties (three times less expansion than PEX). • Inherently kink-resistant, rigid material.	• Inconsistent properties between small and large sizes. • Reduced water flow in all sizes. • Difficult to pull through framing. • Difficult to uncoil and join with crimping tools at 1 and above. • Flexible and prone to kinking.
Ease of Installation	
• Fast, easy installation with solvent welding method. • Inexpensive tools. • Fewer hangers and supports. • Clean, professional, rigid appearance.	• Unprofessional and spaghetti-like appearance. • Expensive crimping tools, fittings and crimp rings. • Calibration of tool required prior to each installation. • Despite misleading claims, kinks in PEX pipe cannot be repaired through a reheating process.
Greater Material Safety – Human Health	
• Superior performance over plastics in the polyolefin family, as well as metals. • Very limited types of bacteria that have the potential to make biofilm on the surface.	• Twice the biofilm formation potential than CPVC, according to international studies. • Wide variety of bacteria can grow and make biofilm that can harbor Legionella and E. coli bacteria.
Greater Material Safety – Fire	
• Will not propagate a flame. • Requires nearly three times more oxygen than what is in the air to burn. • Will not burn on its own. Will char and stop burning when flame is removed. • Smoke from CPVC is no more toxic than traditional building materials, such as wood.	• Will propagate a fire. • Will burn just like a candle. • Will continue to burn on its own. • Will drip flaming plastic onto structures below. • Likely to worsen the overall property damage.

CPVC	PEX

UV and Chlorine Resistance

CPVC	PEX
• Resistant to even the most highly concentrated chlorine levels (in excess of 3,000 ppm). • Widely specified to transport aggressive chlorine disinfection chemicals, such as sodium hypochlorite (bleach), chlorine dioxide, etc. • Pressure-bearing capability does not diminish with UV exposure or age. • Proven reliable in U.S. chlorinated water service for more than 50 years.	• No PEX is recommended for use in chlorine levels greater than 5 ppm. • Different PEX production methods (A, B, C) vary widely in chlorine resistance. • UV light will consume PEX additives until they no longer protect tubing from chlorine degradation. • Industry groups do not recommend it for outdoor, above-ground use. • Difficult to figure out which, if any, PEX product is reliable.

Fitting and Joint Strength

CPVC	PEX
• Joint is strongest part of system, stronger than pipe or fitting alone. • No reduction in water flow through fitting (no insert).	• Joint is the weakest point most vulnerable to failure. • Freeze-thaw performance of tubing does not match fittings. • Lower water flow due to insert fittings. • Quality of assembled joint is questionable (insufficient rib coverage, dented tubing, ring distortion, non-uniform crimp...)

Sustainability

CPVC	PEX
• Environmentally friendly, 65% sea salt, 35% petrolium product.	• 100% petrolium product.

CPVC COMPARED TO PPR

Don't be confused by the many different types of materials when you can choose the safe and durable FlowGuard™ CPVC technology.

CPVC	PPR
Durability	
• 60 percent greater tensile strength. • Nearly twice the flexural strength of polypropylene.	• Used for drainage applications when the pipe exceeds 75˚C. • Can only meet ASTM F2389 pressure rating of 6.8bar at 82˚C and only recommended for hot water applications when using fiberglass reinforcement and a thicker pipe wall, reducing the flow area.
Proven Performance	
• Proven track record of more than 50 years of successful performance in the U.S. • All FlowGuard piping systems are certified by NSF International for potable water.	• Does not have a certification from the Plastic Pipe Institute® (PPI) validating a 50-year life expectancy using Hydrostatic Design Basis (HDB) data in a chlorinated water system. • Not included in the Uniform Plumbing Code™. • Some forms of polypropylene piping have not achieved NSF 61 certification for potable water systems.
Chlorine Resistance	
• Ideal for chlorinated hot and cold water systems. • Recommended by the American Water Works Association and the Environmental Protection Agency for concentrated chlorine piping in drinking water treatment systems.	• Erodes in hot chlorinated water systems causing pieces of material to flake off, which can clog fixtures and appliances. • Eroded polypropylene pipe continually loses its ability to hold pressure over time. • When tested in accordance with the NSF P171 Protocol for Chlorine Resistance of Plastic Piping Materials, hot, chlorinated water at 5 ppm can degrade polypropylene by up to 50 percent after only 10 months of exposure at a low flow rate.
Superior Installation	
• More than twice the impact strength of unreinforced polypropylene, resulting in far fewer problems when cutting pipe on the job. • Solvent cement welding process means fast and easy assembly. • Chemically welded joints are the strongest part of the system. • Since no heat is required during installation, there is no fire risk.	• Fusion welding tool heats up to 260°C, which creates a burn hazard and adds time to the installation process. • Labor intensive and difficult to install in tight spaces. • Heat fusion leads to bead formation internally and externally. - Prone to bacteria growth. - Increases frictional loss. - Reduces flow rate. - Increases mineral deposits that further reduce flow.

CPVC	PPR
Environmental Impact	
• More recyclable than polypropylene containing fiberglass / Aluminum. • Widely used in designs qualifying for points in common sustainability rating systems. • Listed by U.S. National Institute of Standards and Technology in BEES 4.0 database.	• Cannot meet the strength and performance requirements of many applications without fiberglass reinforcement. • More expensive and not recyclable due to its fiberglass layer. • Environmental claims are not independently supported by the National Institute of Standards and Technology.
Greater Material Safety – Human Health	
• Multiple international studies have confirmed the superior antimicrobial performance of CPVC over other piping materials, especially polypropylene.	• Biofilm forms when biomass such as bacteria, fungi, algae and mold adhere to surfaces in wet environments. • A study conducted by a leading water research institute in 2007 showed that polypropylene had the greatest potential to form biofilms of all the piping materials studied.
Greater Material Safety – Fire	
• In the event of a fire, will not sustain a flame and is not combustible. • Testing confirms that smoke from burning CPVC is considered no more toxic than traditional building materials, such as wood.	• Combustible, increase fire damage. • Requires the use of an expensive insulating wrap before the pipe can be installed in a plenum. - Interferes with the ability to perform a heat-fusion weld. - Must be partially removed at every joint. - Creates a condition whereby portions of the piping system can be left exposed and susceptible to fire.

CPVC COMPARED TO COPPER

Today's builders and contractors use The Lubrizol Corporation's plumbing solutions, FlowGuard™ CPVC systems, that offer significant advantages over copper.

CPVC	COPPER
Corrosion Resistance	
• Immune to Corrosion regardless of water quality.	• Corrodes and develops pin holes and pitting. • Needs water quality control to perform well.
Ease of Installation + Economy	
• Proven highly reliable solvent cement welding. • No heat , no flame. • Simple tools. • Fast easy installation, less labor. • Lower cost material. • Stable prices. • Reduces installation cost by 50 % and more.	• Requires highly skilled workers. • Time consuming, labor intensive installation • Use of torches, fire hazard. • Skyrocketing cost in the past years + fluctuating prices. • Labor intensive installation. • Installed cost can be double that of FlowGuard™ CPVC.
Quiet Operation	
• Independent lab tests show that FlowGuard™ CPVC can be 4 times quieter than copper. Virtually noise free. No banging pipes.	• Copper pipes can be noisy and prone to water hammer.
Superior Hydraulics	
• FlowGuard™ CPVC never scales, provides full unimpeded flow over the life of the building.	• Copper scales over time, restricts water flow. It will eventually need to be replaced.
Insulating Properties	
• Superior insulation properties reduce condensation and minimize need for insulation. • More energy efficient system.	• Needs extensive insulation to prevent heat loss in heating pipes. • May requires insulation for cold water pipe to prevent condensation.
Greater Material Safety - Human Health	
• No copper contimation. FlowGuard™ CPVC will never leach any harmful metals or chemicals. It meets NSF Std 61 for use with drinking water. • Superior antibacterial performance.	• Copper corrosion contaminates drinking water and causes health problems. • Biofilm formation potentiel is much higher than FlowGuard™ CPVC.
Sustainability	
• FlowGuard™ CPVC uses significantly less energy to manufacture. It contributes much less than other piping materials to global warming. • FlowGuard™ CPVC have a smoother internal surface, which requires less pumping power and thus less energy to operate.	• Copper requires more energy to manufacture, install, operate, and recycle and contributes more to the global warming.
Unmatched reliability	
• FlowGuard™ CPVC piping systems have a track record of more than 50 years of reliable performance.	• Copper piping system have an average life span of 20 years, and many copper systems start to fail in less than 2 years due to pitting, scaling or corrosion.

FLOWGUARD GLOBAL STANDARDS, CODES AND APPROVALS

STANDARDS

- ASTM D1784, Specification for Rigid Poly(Vinyl Chloride) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- ASTM F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
- ASTM F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
- ASTM F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 & 80
- ASTM F2855, Standard for CPVC/Al/CPVC
- EN ISO 15877, Plastics piping systems for hot and cold water installations - Chlorinated poly(vinyl chloride) (PVC-C)
- AFNOR PVC-C Piping systems for hot and cold water installations
- BS 7291 / 4 Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings
- DIN-8079 Chlorinated polyvinyl chloride (PVC-C) pipes - Dimensions
- DIN-8080 Chlorinated polyvinyl chloride (PVC-C) pipes - General quality requirements, testing.

PERFORMANCE STANDARDS & APPROVALS

- ASTM F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
- ASTM F656, Standard Specification for Primers for Use in Solvent Cement Joints in Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- NSF SE 8459 CPVC Schedule 40 & 80 Pipe and Fitting with High HDB at 180º F
- NSF Standard 14, Plastic Piping Components and Related Materials.
- NSF Standard 61, Drinking Water System Components – Health Effects

INSTALLATION STANDARDS

- ASTM D2855, Standard Practice for Making Solvent Cemented Joints and Poly(Vinyl Chloride) (PVC) Pipe and Fittings
- ASTM F402, Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

APPLICABLE CODES

- UPC, Uniform Plumbing Code
- UMC, Uniform Mechanical Code
- IBC, International Building Code
- IMC, International Mechanical Code
- IPC, International Plumbing Code
- NBCC, National Building Code of Canada
- CPC, Canadian Plumbing Code
- NSPC, National Standard Plumbing Code
- AFNOR, Association Française de Normalisation

CHEMICAL RESISTANCE TABLES

Chemical Name	Temperature 73°F 23°C	Max Temp°C	Chemical Name	Temperature 73°F 23°C	Max Temp°C
Acetaldehyde	N	N	Ammonium Carbonate	R	93
Acetic Acid,up to 10%	R	82	Ammonium Chloride	R	93
Acetic Acid,greatre than 10%	C	C	Ammonium Citrate	R	93
Acetic Acid Glacial	N	N	Ammonium Dichromate	R	93
Acetic Anhydride	N	N	Ammonium Fluoride	R	93
Acetone, up to 5%	R	82	Ammonium Hydroxide, 28%	N	N
Acetone, greater than 5%	C	C	Ammonium Hydroxide, 10%	N	N
Acetone, pure	N	N	Ammonium Hydr-oxide, 3%	C	N
Acetyl Nitrile	N	N	Ammonium Nitrate	R	93
Acrylic Acid	N	N	Ammonium Persulfate	R	-
Acrvlonitrile	N	N	Ammonium Phosphate	R	C
Adipic Acid.sat'd in water	R	93	Ammonium Sutfamate	R	93
Alcohols	C	C	Ammonium Sulfate	R	93
Allyl Alcohol	C	C	Ammonium Sulfide	R	93
Allyl Chloride	N	N	Ammonium Thiocyanate	R	93
Alum, All varieties	R	93	Ammonium Tanrate	R	93
Aluminum Acetate	R	93	Amyl Acetate	N	N
Aluminum Chloride	R	93	Amyl Alcohol	C	C
Aluminum Fluoride	R	93	Ami Chlorid	N	N
Aluminum Hydroxide	R	93	Aniline	N	N
Aluminum Nitrate	R	93	Antimonv Trichloride	R	93
Aluminum Sulfate	R	93	Aqua Regia	R	N
Amines	N	N	Aromatic Hydrocarbons	N	N
Ammonia	N	N	Arsenic Add	R	-
Ammonium Acetate	R	93	Barium Carbonate	R	93
Ammonium Benzoate	R	93	Barium CloridE	R	93
Ammonium Bifluoride	R	93	Barium Hvdroxide	R	93

Chemical Name	Temperature 73°F 23°C	Max Temp°C	Chemical Name	Temperature 73°F 23°C	Max Temp°C
Barlum Nitrate	R	93	Butyric Acid pure	N	N
Barlum Sulfate	R	93	Cadmium Acetate	R	93
Barium Sulfide	R	93	Cadmium Chloride	R	93
Beer	R	93	Cadmium Sulfate	R	93
Beet sugar liquors	R	93	Calcium Acetate	R	93
Senzaldehyde	N	N	Calcium Bisulfide	R	93
Benzene	N	N	Calcium Bisulfite	R	93
Benzoic acid Sat'd in water	R	N	Calcium Carbonate	R	93
Benzyl Alcohol	N	N	Calcium Chlorate	R	93
Benzyl Chloride	N	N	Calcium Chloride	R	93
Bismuth carbonate	R	93	Calcium Hydroxide	R	93
Black Liquor	R	93	Calcium Hypochlorite	R	93
Bleach,household (5%CL)	R	93	Calcium Nitrate	R	93
Bleach,household (15% CL)	R	93	Calcium Oxide	R	93
Borax	R	93	Calcium Sulfate	R	93
Boric Acid	R	93	Cane Sugar liquors	R	93
Brine Acid	R	93	Caprolactam	N	N
Bromine	N	N	Caprolactone	N	N
Bromine, acqueous, sat'd	R	93	Carbilol	N	N
Bromobenzene	N	N	Carbon Dioxide	R	93
Bromotoluene	N	N	Carbon Disulfide	N	N
Butanol	C	C	Carbon Monoxide	R	93
Butyl Acetate	N	N	Carbon Tetrachloride	N	N
Butyl Carbitol	N	N	Carbonic Acid	R	93
Butyl Cellosolve	N	N	Castor Oil	N	N
Butyric Acid, up to 1%	R	R	Caustic Potash	A	A
Butyric Acid greater than 1%	C	C	Caustic Soda	A	A

Chemical Name	Temperature 73°F 23°C	Max Temp°C	Chemical Name	Temperature 73°F 23°C	Max Temp°C
Cellosolve all types	N	N	Corn Syrup	R	93
Chloric Acid	R	82	Cottonseed Oil	N	N
Chlorinated Solvents	N	N	Creosote	N	N
Chlorinated water,	-	-	Cresol	N	N
(Hypochlorite)	R	93	Crotonaldehyde	N	N
Chlorine, Dry gas	A	A	Cumene	N	N
Chlorine liquid	N	N	Gupric Fluoride	R	93
Chlorine, trace in air	R	93	Gupric Sulfate	R	93
Chlorine, wet gas	A	A	Cuprous Chloride	R	93
Chlorine dioxide,	-	-	Cyclohexane	N	N
aqueous, sat'd	R	93	Cyclohexnol	N	N
Chlorine water Sat'd	R	93	Cyclohexanone	N	N
Chlorobenzene	N	N	Detergents	C	C
Chlorofonn	N	N	Dextrin	R	93
Chromic Acid 40%	R	82	Dextrose	R	93
Chromic nitrate	R	93	Dibutyl Phthalate	N	N
Citric Acid	R	93	Dibutyl Ethyl Phthalate	N	N
Citrus oils	N	N	Dichlorobenzene	N	N
Coconut Oil	N	N	Dichloroethylene	N	N
Copper Acetate	R	93	Diethylamine	N	N
Copper Carbonate	R	93	Diethyl Ether	N	N
Copper Chloride	R	93	Dill Oil	N	N
Copper Cyanide	R	93	Dimethylformamide	N	N
Copper fluoride	R	93	Disodium Phosphate	R	93
Copper Nitrate	R	93	Distilled water	R	93
Copper Sulfate	R	93	EDTA,Tetrasodium	R	93
Corn Oil	N	N	Esters	N	N

Chemical Name	Temperature 73°F 23°C	Max Temp°C	Chemical Name	Temperature 73°F 23°C	Max Temp°C
Ethanol , up to 5%	R	82	Glycol Ethers	N	N
Ethanol, greater than S%	C	C	Green Liquor	R	93
Ethers	N	N	Halocarbon Oils	N	N
Ethyl Acetate	N	N	Heptane	C	-
Ethyl Acrylate	N	N	Hydrazine	N	N
Ethyl Benzene	N	N	Hydrocholric Acid	R	82
Ethyl Chloride	N	N	Hydrochloric Acid,36%	R	82
Ethylene Bromide	N	N	Hydrofluoric Acid, 3%	R	-
Ethylene Chloride	N	N	Hydrofluoric Acid, 48%	C	C
Ethylene Dia ine	N	N	Hydrofluosilicic Acid, 30%	R	82
Ethlene Glycol,up to 50%	N	N	Hydrogen Peroxid, 50%	R	-
Ethylene Glycol greater 50%	R	82	Hydrogen Sutfide, Acqueous	R	82
Ethylene Oxide	C	C	Hypochlorous Acid	C	C
Ferric Chloride	N	N	Isopropanol	C	C
Ferric Hydroxide	R	93	Ketones	N	N
Ferric	R	93	Kraft Liquors	R	93
Ferric sulfate	R	93	Lactic Acid, 25%	R	93
Fluorine Gas	R	93	Lactic Acid, 85% (Full strength)	R	C
Fluosilicic Acid, 30%	N	N	Lead Acetate	R	93
Formaldehyde	N	82	Lead Chloride	R	93
Formic Acid up to 25%	R	N	Lead Nitrate	R	93
Formic Acid greater than 25%	C	82	Lead Sulfate	R	93
Freons	C	N	LemonOil	N	N
Fructose	R	C	Limonene	N	N
Gasoline	N	93	Linseed Oil	N	N
Glucose	R	N	Lithium Chloride	R	93
Glycerine	R	93	Lithium Sulfate	R	93

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Lubricating Oil,ASTM1,2,3	R	-
Magnesium Carbonate	R	93
Magnesium Chloride	R	93
Magnesium Citrate	R	93
Magnesium Fluoride	R	93
Magnesium Hydroxide	R	93
Magnesium Salts, inorganic	R	93
Magnesium	R	93
Nitrate	R	93
Magnesium Oxide	R	93
Magnesium Sulfate	R	93
Maleic Acid, 50%	R	82
Manganese Sulfate	R	93
Mercuric Chloride	R	93
Mercuric Cyanide	R	93
Mercuric Sulfate	R	93
Mercurous Nitrate	R	93
Mercury	R	82
Methane Sufonic Acid	R	82
Methanol, up to10%	R	C
Methanol, greater than10%	C	N
Methanol, pure	N	N
Methyl Cellosolve	N	N
Methyl Chloride	N	N
Methyl Ethyl Ketone	N	N
Methyl Formate	N	N
Methyl Isobutyl Ketone	N	N

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Methyl Methacrylate	N	N
Methylamine	N	N
Methylene chloride	N	-
Mineral Oil	R	N
Monoethanolamine	N	N
Motor Oil	N	82
Muriatic Acid	R	N
Naphthatene	N	93
Nickel Acetate	R	93
Nickel Chtoride	R	93
Nickel Nitrate	R	93
Nickel Sulfate	R	66
Nitric Acid, up to 25%	R	54
Nitric Acid,25%-35%	R	41
Nitric Acid,70%	R	N
Nitrobenzene	N	N
1-0ctanol	C	N
Oils, edible	N	N
Oils,Sour Crude	N	N
Oleum	N	N
Olive Oil	N	N
Oxalic Acid sat'd	R	77
Oxygen	R	82
Ozonized water	R	93
Palm Oil	N	N
Paraffin	R	82
Peanul Oil	N	N

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Silver Nitrate	R	93
Silver Sulfate	R	93
Soaps	R	93
Sodium Acetate	R	93
Sodium Aluminate	R	93
Sodium Arsenate	R	93
Sodium Benzoate	R	93
Sodium Bicarbonate	R	93
Sodium Bichromate	R	93
Sodium Bisulfate	R	93
Sodium Bisulfite	R	93
Sodium Borate	R	93
Sodium Bromide	R	93
Sodium Carbonate	R	93
Sodium Chl·orate	R	93
Sodium Chloride	R	93
Sodium Chlorite	R	93
Sodium Chromate	R	93
Sodium Cyanide	R	93
Sodium Dichromate	R	93
Sodium Ferricyanide	R	93
Sodium Ferrocyanide	R	93
Sodium Fluoride	R	93
Sodium Formate	R	93
Sodium Hydroxide	A	A
Sodium Hypobromite	R	93
Sodium Hypochlorite	R	93

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Sodium Lodide	R	93
Sodium Metaphosphate	R	93
Sodiurn itrate	R	93
Sodium Nitrite	R	93
Sodium Perborate	R	82
Sodium Perchlorate	R	82
Sodium Phosphate	R	93
Sodiurn Sificate	R	93
Sodium Sulfate	R	93
Sodium Sulfide	R	93
Sodium Sulfite	R	93
Sodium Thiosulfate	R	93
Sodium Tripolyphosphate	R	93
Soybean Oil	N	N
Stannic Chloride	R	93
Stannous Chloride	R	93
Stannous Sulfate	R	93
Starch	R	93
Stearic Acid	R	-
Strontium Chloride	R	93
Styrene	N	N
Sugar	R	93
Sulfamic Acid	R	82
Sulfur	R	-
Sulfuric Acid, Fuming	N	N
Sulfuric Acid,98%	R	52
Sulfuric Acid,85%	R	77

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Perchloric Acid,1006	R	-
Phenylhydrazine	N	N
Phosphoric Acid	R	82
Phosphorous tridlloride	N	N
Picric Acid	N	N
Pine Oil	N	N
Plating solutions	N	82
Polyethylene Glycol	R	N
Potash	N	93
Potassium Acetate	R	93
Potassium Bicarbonate	R	93
Potassium Bichromate	R	93
Potassium Bisulfate	R	93
Potassium Borate	R	93
Potassium Bromate	R	93
Potassium Bromide	R	93
Potassium Carbonate	R	93
Potassium Chlorate	R	93
Potassium Chlorrde	R	93
Potassium Chromate	R	93
Potassium Cyanate	R	93
Potassium Cyanide	R	93
Potassium Dichromate	R	93
Potassium ferricyanide	R	93
Potassium Ferrocyan ide	R	93
Potassium Fluoride	R	93
Potassium Hydroxide	A	A

Reagent	Temperature 73°F 23°C	Max Temp°C
Potassium Hypochlorite	R	93
Potassium lodide	R	93
Potassium Nitrate	R	93
Potassium Perborate	R	82
Potassium Perdllorate, sat'd	R	82
Potassium Permanganate, sat'd	R	82
Potassium persultate, sat'd	R	-
Potassium phosphate	R	93
Potassium Sulfate	R	93
Potassium Sulfide	R	93
Potassium Sulfite	R	93
Potassium tripolyphosphate	R	93
Propanol, up to O,5%	R	82
Propanol,greater than O,5%	C	C
Propionic Acid, uto 2%	R	82
Propionic Acid, greater than2%	C	C
Propionic Acid pure	N	N
Propylene Dichloride	N	N
Propytene Glycol, up to 25%	R	82
Propylene Glycol,greater 25%	C	C
Propylene Oxide	N	N
Pyridine	N	N
Sea water	R	93
Silicic Acid	R	-
Silkone Oil	R	-
Silver Chloride	R	93
Silver Cyanide	R	93

Chemical Name	Temperature 73°F 23°C	Max Temp°C
Sulfuric Acid,80%	R	82
Sulfuric Acid,50%	R	82
Tall Oil	C	C
Tannk Acid,30%	R	-
Tartaric Acid	R	-
Terpenes	N	N
Tetrahydrofuran	N	N
Tetrasodium pyrophosphate	R	93
Texanol	N	N
Thionyl chloride	N	N
Toluene	N	N
Tributyt Phosphate	N	N
Trichloroethylene	N	N
Trisodium Phosphate	R	93
Turpentine	N	N
Urea	R	82
Urine	R	93
Vegetable Oils	N	N
Vinegar	R	93
Vinyl Acetate	N	N
Water, Deionized	R	93
Water, Demineralized	R	93
Water Distilled	R	93
Water, Salt	R	93
Water, swimming Pool	R	93
WD-40	C	C
White Liquor	R	93

Reagent	Temperature 73°F 23°C	Max Temp°C
Xylene	N	N
Zinc Acetate	R	93
Zinc Carbonate	R	93
Zinc Ch loride	R	93
Zinc Nitrate	R	93
Zinc Sulfate	R	93

REFERENCES

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Cheikh Khalifa Casablanca Hospital, Morocco

Hotel Tour Hassan Rabat, Morocco

Chu Marrakech, Morocco

Golf Al Maaden Marrakech, Morocco

Dakhla Airport, Morocco

Charles De Gaule Airport, France.

Golden Temple, Amristar, India.

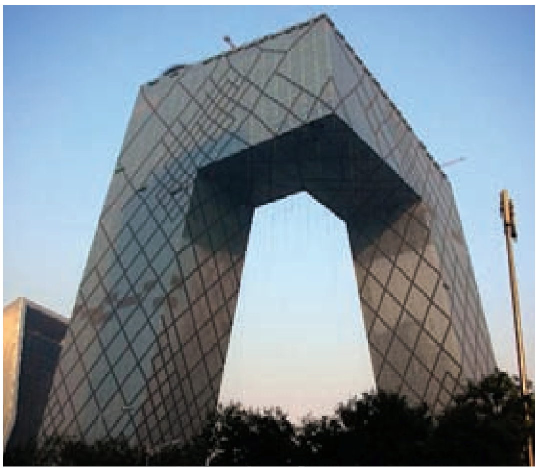
Beijing Olympics 2008, China.

Bourj Khalifa, Dubai

Sama Beirut, Lebanon.

Hotel Intercontinental De Paris, France.

Skygate, Lebanon.



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THE LUBRIZOL ADVANTAGE

Through product innovation, technical expertise and the many value-added services it offers customers, Lubrizol continues to advance CPVC solutions for the building and construction market. From design of the base materials, to the production of resins and compounds, Lubrizol has established world-class research and development capabilities, differentiating it from its competitors and setting a higher standard for product quality.

FlowGuard™ CPVC

FlowGuard™ PIPE & FITTINGS

Lubrizol is a leading provider of base materials for residential and commercial piping with the most widely used CPVC plumbing system in the world. FlowGuard® piping systems offer a unique combination of benefits, including corrosion resistance, a fast and easy installation process, quiet operation and superior energy efficiency. Beyond residential settings, FlowGuard piping can work seamlessly with larger Corzan® Piping Systems in certain commercial projects requiring larger diameter pipes, such as high-rise hotels, universities, hospitals and retail applications.

BlazeMaster® FIRE SPRINKLER SYSTEMS

BLAZEMASTER® FIRE SPRINKLER SYSTEMS

Specially engineered BlazeMaster® CPVC pipe and fittings meet and exceed global performance and manufacturing standards for residential and commercial fire sprinkler systems, making it the most specified non-metallic option for fire suppression systems in the world. In addition to the corrosion-resistant properties inherent in all Lubrizol CPVC piping, BlazeMaster systems are specially engineered for exceptional flame and smoke resistance, high impact and temperature resistance, and larger internal diameter to allow for increased flow rates and hydraulic capabilities.

CORZAN® INDUSTRIAL SYSTEMS

CORZAN® INDUSTRIAL SYSTEMS

Corzan® and Corzan® HP Industrial Systems meet the critical demands of industrial environments, using specially engineered CPVC polymer technology from Lubrizol. Corzan Industrial Systems are designed for use in demanding applications such as chemical processing, industrial manufacturing, marine usage, water treatment and more. All Corzan systems are highly corrosion resistant, have decreased installation costs and handle the effects of extreme outdoor ambient conditions. Corzan HP piping also has three times the drop-impact strength of standard CPVC, a 25 percent higher pressure rating than standard CPVC and the highest heat deflection temperature (HDT) of any CPVC piping compound. With a dedication to meeting and exceeding industry standards, Lubrizol's Corzan HP compounds are the first and only Schedule 40/80 piping system made from fully pressure-rated materials.

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