CPVC Pipes and Fittings

Jain Plumbing™

Install Peace of Mind !

JAIN®

Jain Irrigation Systems Ltd.

Small Ideas. Big Revolutions.®

IS : 15778 : 2007

ISI

CM/L-2905157
For Pipes

Cpvc compound tested as per IS 15225:2002

CPVC FITTINGS

ASTM D 2846

For SCH 80 Fittings

MCGM Approved

India's largest Polymer processors

Jain Irrigation Systems Ltd. (JISL) derives its name from the pioneering work it did for the Micro Irrigation Industry in India. However, there is more to Jain Irrigation than Irrigation. Jain Piping Division is the largest producer of Thermoplastic piping systems for all conceivable applications with pipes ranging from 3 mm to 1600 mm in diameter and in different pressure ratings. JISL has a production capacity of over 3,00,000 M.T. per annum. JISL is the only manufacturer to own DSIR approved R&D setup with state-of-the-art facilities. The pipes are manufactured confirming to IS, DIN, ISO, ASTM, TEC and other customized specifications. The Piping Division includes PE, PVC Pipes and Fittings catering to the urban and rural infrastructure needs of the country apart from irrigation needs of the farmers. Jain CPVC plumbing pipes & fittings for Hot water application is yet another product which will be a forward integration of the above group of infrastructure products. This will convey the hot water with efficiency combined with economy and have a long life.

Features & Advantages:

- Manufactured from high quality AISF Approved CPVC Coumpond.
- Compound is tested safe for potable water application.
- Wide range of working temperatures and pressures.
- Low thermal expansion.
- Smooth inner wall, no scale build-up or erosion.
- Long life – as CPVC does not build scale or corrode.
- Excellent impact strength.
- Light in weight, easy to Install.
- Energy efficient, low insulation cost.
- Ability to withstand water flow noise.
- Excellent fire resistant characteristics.
- Completely leak proof jointing.
- Durablity and long term reliability.
- Non-Toxic-Lead free.
- Wide range of pipes and fittings.
- Aesthetically pleasing when exposed in application.

Standard and Range:

Jain Plumbing CPVC pipes are manufactured to **IS 15778**, from specially formulated compound conforming to or exceeding the requirements of CPVC compound of cell classification " D.P.110-2-3-2 " as per **IS 15225.**

CPVC Pipe Properties:

Sr. No.	Property	Test Method	Value	Unit
1	CPVC Compound Cell Classification	IS 15225	D.P.110-2-3-2	
2	Chlorine Content(Base CPVC Resin)	IS 15778	≥ 66.5 %	
3	Specific Gravity IS 13360(Part 3/Sec 1)	Minimum 1.45		
4	VST IS 12235 (Part 2)	≥ 110°	C	
5	Thermal Conductivity (K)	ASTM C177	0.16	W/(m·K)
6	Malfunctioning Test Temperature at 10 bar for 1000 Hrs.	IS 15778	95± 2	°C
7	Tensile Strength Yield at 27 ± 2°C	IS 12235 (Part 13)	500	Kg/cm^2
8	Modulus of elasticity in tension	DIN 53455	2000 - 2500	Mpa
9	Impact Strength ISO 178	Maximum 10%	TIR	
10	Charpy Notched Impact Strength	ISO 179	> 4	KJ/M^2
11	transmission Of Visible Light	IS 12235 (Part 3)	< 0.2%	
12	Burning Rate ASTM D635	Self-Extinguishing		
13	Flammability Rating UL 94	94 V-0		
14	Coefficient of Thermal Expansion	ASTM D 696	3.4 x10-5	mm/mm°F

Jain Plumbing CPVC pipes are manufactured in different pipe diameters of copper tube size (CTS). The pipes are manufactured in size range from ½" to 2" in SDR 11 & SDR 13.5.

Pipe Dimension Chart

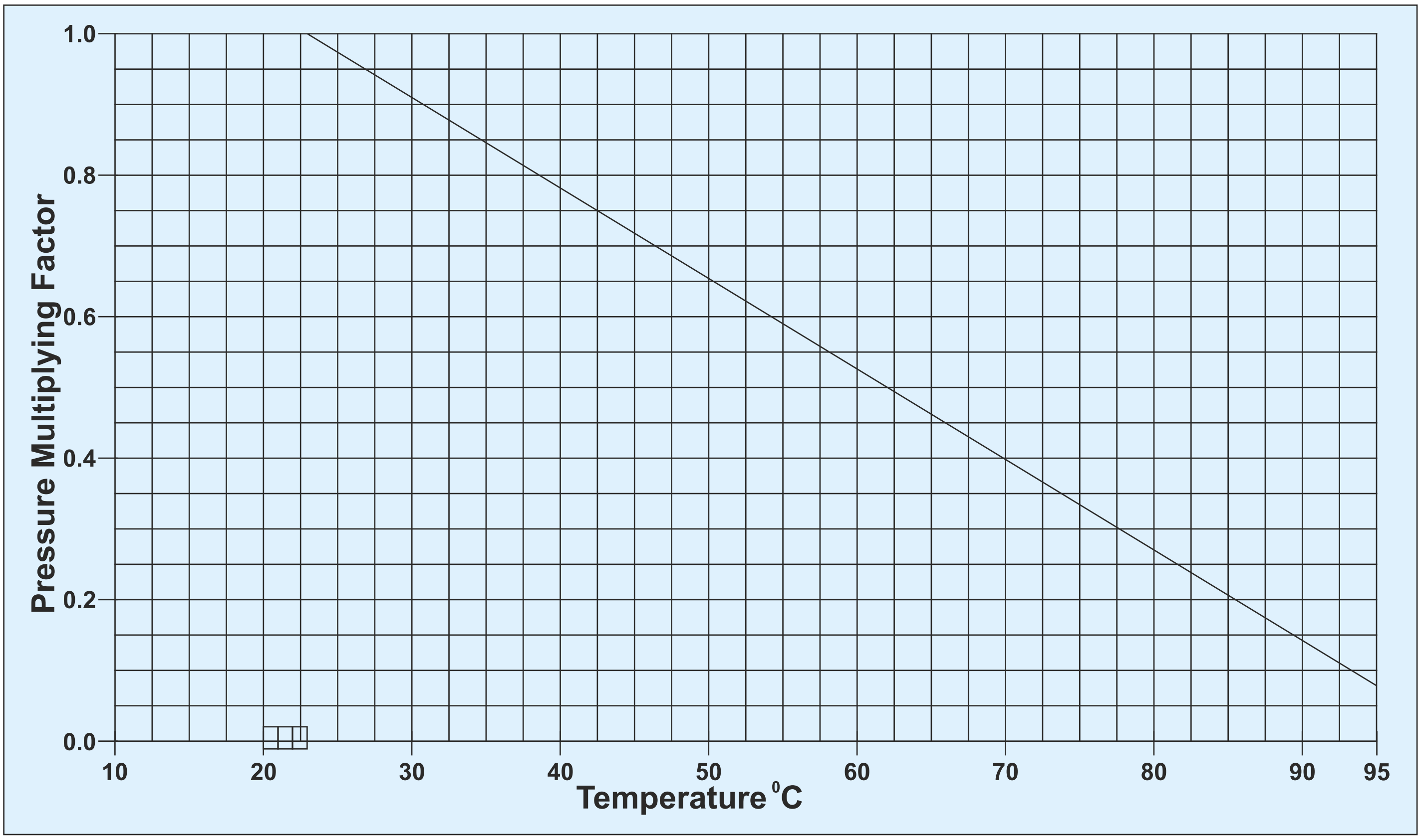
Sr. No.	Nominal Size	Pipe Nominal (OD)	Minimum wall Thickness SDR 11	Minimum wall Thickness SDR 13.5
	Inch	MM	MM	MM
1	½"	15.9	1.7	1.4
2	¾"	22.2	2	1.7
3	1"	28.6	2.6	2.1
4	1.25"	34.9	3.2	2.6
5	1.5"	41.3	3.8	3.1
6	2"	54	4.9	4.0

Temperature & Pressure Ratings

The selection of pipes is further based on the working pressure at different operating temperatures as per the details given below.

Sr. No.	Pipe SDR Series	Recommended Working Pressure(Kg/cm^2)	
		Operating Temperature 27°C(80.6°F)	Operating Temperature 82°C (179.6°F)
1	11.0	28.13	6.93
2	13.5	22.22	5.60

To find out the operating pressure at temperatures other than specified above, please refer the graph.



Fitting -

Jain Plumbing CPVC fittings are manufactured from CPVC compound meeting the mechanical strength, heat resistance, flammability and chemical resistance requirements for cell classification 23447 in accordance with ASTM D 2846 & ASTM D 1784 in SDR 11 series. The complete range of CPVC fittings required for the HOT water application system is available with us.

Elbow 90^{0} Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCE90012SJ	CPVC ELBOW 1/2"X 900
3/4"	CPVCE90034SJ	CPVC ELBOW 3/4"X 900
1"	CPVCE90100SJ	CPVC ELBOW 1"X 900
11/4"	CPVCE90114SJ	CPVC ELBOW 1.1/4"X 900
11/2"	CPVCE90112SJ	CPVC ELBOW 1.1/2"X 900
2"	CPVCE90200SJ	CPVC ELBOW 2"X 900

Elbow 45^{0} Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCE45012SJ	CPVC ELBOW 1/2"X 450
3/4"	CPVCE45034SJ	CPVC ELBOW 3/4"X 450
1"	CPVCE45100SJ	CPVC ELBOW 1"X 450
11/4"	CPVCE45114SJ	CPVC ELBOW 1.1/4"X 450
11/2"	CPVCE45112SJ	CPVC ELBOW 1.1/2"X 450
2"	CPVCE45200SJ	CPVC ELBOW 2"X 450

Reducing Elbow 90^{0} Solvent Type		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRE034012SJ	CPVC REDUCING ELBOW 3/4X 1/2

Equal Tee Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCET012SJ	CPVC TEE (EQUAL) 1/2"
3/4"	CPVCET034SJ	CPVC TEE (EQUAL) 3/4"
1"	CPVCET100SJ	CPVC TEE (EQUAL) 1"
11/4"	CPVCET114SJ	CPVC TEE (EQUAL) 1.1/4"
11/2"	CPVCET112SJ	CPVC TEE (EQUAL) 1.1/2"
2"	CPVCET200SJ	CPVC TEE (EQUAL) 2"

Reducing Tee Solvent Type		
Size	Material	CodeMaterial Description
3/4" x 1/2"	CPVCRT034012SJ	CPVC REDUCING TEE 3/4"X1/2"
1" x 1/2"	CPVCRT100012SJ	CPVC REDUCING TEE 1"X1/2"
1" x 3/4"	CPVCRT100034SJ	CPVC REDUCING TEE 1"X3/4"
11/4" x 1/2"	CPVCRT114012SJ	CPVC REDUCING TEE 1.1/4"X1/2"
11/4" x 3/4"	CPVCRT114034SJ	CPVC REDUCING TEE 1.1/4"X3/4"
11/4" x 1"	CPVCRT114100SJ	CPVC REDUCING TEE 1.1/4"X1"
11/2" x 1/2"	CPVCRT112012SJ	CPVC REDUCING TEE 1.1/2"X1/2"
11/2" x 3/4"	CPVCRT112034SJ	CPVC REDUCING TEE 1.1/2"X3/4"
11/2" x 1"	CPVCRT112100SJ	CPVC REDUCING TEE 1.1/2"X1"

Reducing Tee Solvent Type		
11/2" x 11/4"	CPVCRT112114SJ	CPVC REDUCING TEE 1.1/2"X1.1/4"
2" x 3/4"	CPVCRT200034SJ	CPVC REDUCING TEE 2"X3/4"
2" x 1"	CPVCRT200100SJ	CPVC REDUCING TEE 2"X1"
2" x 11/4"	CPVCRT200114SJ	CPVC REDUCING TEE 2"X1.1/4"
2" x 11/2"	CPVCRT200112SJ	CPVC REDUCING TEE 2"X1.1/2"

Coupler Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCC012SJ	CPVC COUPLER (SOCKET) 1/2"
3/4"	CPVCC034SJ	CPVC COUPLER (SOCKET) 3/4"
1"	CPVCC100SJ	CPVC COUPLER (SOCKET) 1"
11/4"	CPVCC114SJ	CPVC COUPLER (SOCKET) 1.1/4"
11/2"	CPVCC112SJ	CPVC COUPLER (SOCKET) 1.1/2"
2"	CPVCC200SJ	CPVC COUPLER (SOCKET) 2"

Reducer Solvent Type		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRC034012SJ	CPVC REDUCING SOCKET 3/4"X1/2"
1" x 1/2"	CPVCRC100012SJ	CPVC REDUCING SOCKET 1"X1/2"
1" x 3/4"	CPVCRC100034SJ	CPVC REDUCING SOCKET 1"X3/4"
11/4" x 1/2"	CPVCRC114012SJ	CPVC REDUCING SOCKET 1.1/4"X1/2"
11/4" x 3/4"	CPVCRC114034SJ	CPVC REDUCING SOCKET 1.1/4"X3/4"
11/4" x 1"	CPVCRC114100SJ	CPVC REDUCING SOCKET 1.1/4"X1"
11/2" x 1/2"	CPVCRC112012SJ	CPVC REDUCING SOCKET 1.1/2"X1/2"
11/2" x 3/4"	CPVCRC112034SJ	CPVC REDUCING SOCKET 1.1/2"X3/4"
11/2" x 1"	CPVCRC112100SJ	CPVC REDUCING SOCKET 1.1/2"X1"
11/2" x 11/4"	CPVCRC112114SJ	CPVC REDUCING SOCKET 1.1/2"X1.1/4"
2" x 3/4"	CPVCRC200034SJ	CPVC REDUCING SOCKET 2"X3/4"
2" x 1"	CPVCRC200100SJ	CPVC REDUCING SOCKET 2"X1"
2" x 11/4"	CPVCRC200114SJ	CPVC REDUCING SOCKET 2"X1.1/4"
2" x 11/2"	CPVCRC200112SJ	CPVC REDUCING SOCKET 2"X1.1/2"

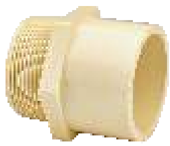
Union Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCU012	CPVC UNION 1/2"
3/4"	CPVCU034	CPVC UNION 3/4"
1"	CPVCU100	CPVC UNION 1"
11/4"	CPVCU114	CPVC UNION 1.1/4"
11/2"	CPVCU112	CPVC UNION 1.1/2"
2"	CPVCU200	CPVC UNION 2"

Elbow Brass Insert Type		
Size	Material Code	Material Description
1/2"	CPVCE90D012B	CPVC ELBOW 1/2"
3/4"	CPVCE90D034B	CPVC ELBOW 3/4"

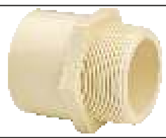
Reducing Elbow Brass Insert Type		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRE034012B	CPVC REDUCING ELBOW 3/4"X1/2"
1" x 1/2"	CPVCRE100012B	CPVC REDUCING ELBOW 1"X1/2"

Equal Tee Brass Insert Type		
Size	Material Code	Material Description
1/2"	CPVCET012B	CPVC TEE (EQUAL) 1/2"

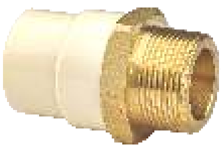
Reducing Tee Brass Insert Type		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRT034012B	CPVC REDUCING TEE 3/4"X1/2"
1" x 1/2"	CPVCRT100012B	CPVC REDUCING TEE 1"X1/2"



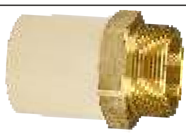
Male Threded Adoptor Solvent Type (MTA)		
Size	Material Code	Material Description
1/2"	CPVCMTA012SJ	CPVC MTA 1/2"
3/4"	CPVCMTA034SJ	CPVC MTA 3/4"
1"	CPVCMTA100SJ	CPVC MTA 1"
11/4"	CPVCMTA114SJ	CPVC MTA 1.1/4"
11/2"	CPVCMTA112SJ	CPVC MTA 1.1/2"
2"	CPVCMTA200SJ	CPVC MTA 2"



Reducing Male Threded Adoptor Solvent Type (MTA)		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRMTA034012SJ	CPVC REDUCING MTA 3/4"X1/2"

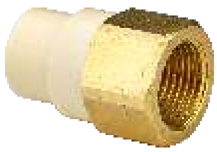


Male Threded Adoptor (MTA) Brass Insert Heavy Duty		
Size	Material Code	Material Description
1/2"	CPVCMTA012BHD	CPVC MTA 1/2"
3/4"	CPVCMTA034BHD	CPVC MTA 3/4"
1"	CPVCMTA100BHD	CPVC MTA 1"
11/4"	CPVCMTA114BHD	CPVC MTA 1.1/4"
11/2"	CPVCMTA112BHD	CPVC MTA 1.1/2"
2"	CPVCMTA200BHD	CPVC MTA 2"



Reducing Male Threded Adoptor (MTA) Brass Insert		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRMTA034012B	CPVC REDUCING MTA 3/4"X1/2"

Female Threded Adoptor (FTA)		
Size	Material Code	Material Description
1/2"	CPVCFTA012SJ	CPVCFTA 1/2"
3/4"	CPVCFTA034SJ	CPVC FTA 3/4"
1"	CPVCFTA100SJ	CPVC FTA 1"
11/4"	CPVCFTA114SJ	CPVC FTA 1.1/4"
11/2"	CPVCFTA112SJ	CPVC FTA 1.1/2"
2"	CPVCFTA200SJ	CPVC FTA 2"



Female Threded Adoptor (FTA) Brass Insert Heavy Duty		
Size	Material Code	Material Description
1/2"	CPVCFTA012BHD	CPVC FTA 1/2"
3/4"	CPVCFTA034BHD	CPVC FTA 3/4"
1"	CPVCFTA100BHD	CPVC FTA 1"
11/4"	CPVCFTA114BHD	CPVC FTA 1.1/4"
11/2"	CPVCFTA112BHD	CPVC FTA 1.1/2"
2"	CPVCFTA200BHD	CPVC FTA 2"

Reducing Female Threded Adoptor (FTA) Brass Insert		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRFTA034012B	CPVC REDUCING FTA 3/4"X1/2"
1" x 1/2"	CPVCRFTA100012B	CPVC REDUCING FTA 1"X1/2"

End Cap Solvent Type		
Size	Material Code	Material Description
1/2"	CPVCECP012SJ	CPVC END CAP 1/2"
3/4"	CPVCECP034SJ	CPVC END CAP 3/4"
1"	CPVCECP100SJ	CPVC END CAP 1"
11/4"	CPVCECP114SJ	CPVC END CAP 1.1/4"
11/2"	CPVCECP112SJ	CPVC END CAP 1.1/2"
2"	CPVCECP200SJ	CPVC END CAP 2"

Reducing Bush Solvent Type		
Size	Material Code	Material Description
3/4" x 1/2"	CPVCRB034012SJ	CPVC REDUCING BUSH 3/4"X1/2"
1" x 1/2"	CPVCRB100012SJ	CPVC REDUCING BUSH 1"X1/2"
1" x 3/4"	CPVCRB100034SJ	CPVC REDUCING BUSH 1"X3/4"
11/4" x 1/2"	CPVCRB114012SJ	CPVC REDUCING BUSH 1.1/4"X1/2"
11/4" x 3/4"	CPVCRB114034SJ	CPVC REDUCING BUSH 1.1/4"X3/4"
11/4" x 1"	CPVCRB114100SJ	CPVC REDUCING BUSH 1.1/4"X1"
11/2" x 1/2"	CPVCRB112012SJ	CPVC REDUCING BUSH 1.1/2"X1/2"
11/2" x 3/4"	CPVCRB112034SJ	CPVC REDUCING BUSH 1.1/2"X3/4"
11/2" x 1"	CPVCRB112100SJ	CPVC REDUCING BUSH 1.1/2"X1"
11/2" x 11/4"	CPVCRB112114SJ	CPVC REDUCING BUSH 1.1/2"X1.1/4"
2" x 1/2"	CPVCRB200012SJ	CPVC REDUCING BUSH 2"X1/2"
2" x 11/4"	CPVCRB200114SJ	CPVC REDUCING BUSH 2"X1.1/4"
2" x 11/2"	CPVCRB200112SJ	CPVC REDUCING BUSH 2"X1.1/2"

Pipe Clip Plastic		
Size	Material Code	Material Description
1/2"	CPVCPC012	CPVC PIPE CLIP 1/2"
3/4"	CPVCPC034	CPVC PIPE CLIP 3/4"
1"	CPVCPC100	CPVC PIPE CLIP 1"
11/4"	CPVCPC112	CPVC PIPE CLIP 1.1/2"
11/2"	CPVCPC114	CPVC PIPE CLIP 1.1/4"
2"	CPVCPC200	CPVC PIPE CLIP 2"

Step Over Bend Solvent		
Type	SizeMaterial	CodeMaterial Description
1/2"	CPVCSTOB012	CPVC STEP OVER BEND 1/2"
3/4"	CPVCSTOB034	CPVC STEP OVER BEND 3/4"
1"	CPVCSTOB100	CPVC STEP OVER BEND 1"

Ball Valve Solvent		
Type	SizeMaterial	CodeMaterial Description
1/2"	CPVCBV012SJ	CPVC BALL VALVE 1/2" (20) SOLVENT TYPE
3/4"	CPVCBV034SJ	CPVC BALL VALVE 3/4" (25) SOLVENT TYPE
1"	CPVCBV100SJ	CPVC BALL VALVE 1" (32) SOLVENT TYPE
11/4"	CPVCBV114SJ	CPVC BALL VALVE 1.1/4" (40) SOLVENT TYPE
11/2"	CPVCBV112SJ	CPVC BALL VALVE 1.1/2" (50) SOLVENT TYPE
2"	PVCBV200SJ	CPVC BALL VALVE 2" (63) SOLVENT TYPE

Ball Valve heavy Duty Solvent Type		
Size	Material	CodeMaterial Description
1/2"	CPVCBV012HD	CPVC BALL VALVE 1/2" (20) HEAVY DUTY
3/4"	CPVCBV034HD	CPVC BALL VALVE 3/4" (25) HEAVY DUTY
1"	CPVCBV100HD	CPVC BALL VALVE 1" (32) HEAVY DUTY
11/4"	CPVCBV114HD	CPVC BALL VALVE 1.1/4" (40) HEAVY DUTY
11/2"	CPVCBV112HD	CPVC BALL VALVE 1.1/2" (50) HEAVY DUTY
2"	CPVCBV200HD	CPVC BALL VALVE 2" (63) HEAVY DUTY

Tank connector		
Size	Material	CodeMaterial Description
3/4"	CPVCTC034	CPVC TANK CONNECTOR 3/4"
1"	CPVCTC100	CPVC TANK CONNECTOR 1"
11/4"	CPVCTC114	CPVC TANK CONNECTOR 1.1/4"
11/2"	CPVCTC112	CPVC TANK CONNECTOR 1.1/2"
2"	CPVCTC200	CPVC TANK CONNECTOR 2"

Solvent Cement:

The CPVC pipes and fittings supplied by Jains are recommended to be joined by using Permafix CPVC solvent cement. Permafix solvent cement is produced conforming to ASTM F 493 – 04.

Advantages

- Permafix is produced using virgin CPVC resin.
- It contains minimum 10% of CPVC resin.
- It is free flowing.
- It does not contain lumps / undissolved resin.
- Gelation / stratification can be removed by stirring.

Joint Set up Time:

Handling / Set up Time is the time required prior to handling the joint. In humid conditions, allow 50% extra time for set up than specified below.

Sr. No.	Set Time		
	Temperature Range	Pipe Size ½" to 1 ¼"	Pipe Size 1½" to 2"
1	4.4 -15.5°C (40 - 60 ° F)	5 minutes	10 minutes
2	15.5- 38°C (60 - 100.4 ° F)	2 minutes	5 minutes

Joint Cure Time:

Joint cure time is the time required before pressure testing the system. In humid conditions allow 50% extra time for cure than specified in below table.

Sr. No.	Cure Time		
	Temperature Range	Pipe Size ½" to 1 ¼"	Pipe Size 1½" to 2"
1	4.4 -15.5°C (40 - 60 ° F)	12 Hours	24 Hours
2	15.5- 38°C (60 - 100.4 ° F)	6 Hours	12 Hours

Above charts can be used as a guideline to determine joint set & cure time. Conditions in the field may vary.

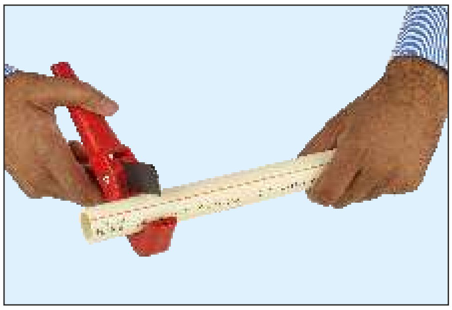
Packing Detail:

PIPE	COLOR	PACKAGING
CPVC	ORANGE	100, 250, 500, 1000 & 5000 ML

Installation Procedure:

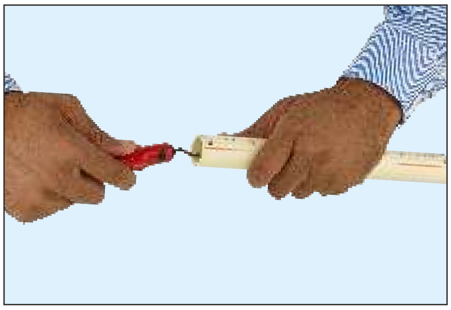
For fast and reliable joints of CPVC pipes and fittings use Permafix CPVC solvent cement and follow the below explained steps-

1) Cutting the Pipe :



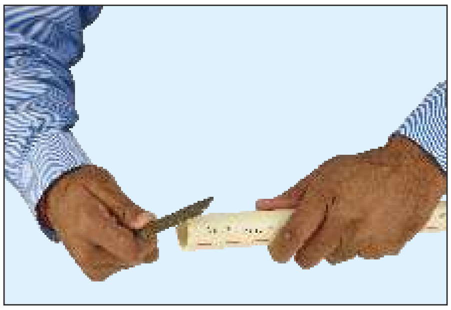
It is important to cut the pipe square by using suitable pipe cutter. A square cut pipe provides the surface of the pipe with the maximum bonding area. Tools used to cut pipe must be designed for plastic use and must be in good condition. If there is any indication of pipe damage or evidence of pipe cracking, cut off at least 50mm beyond any such defect.

2) Deburring:



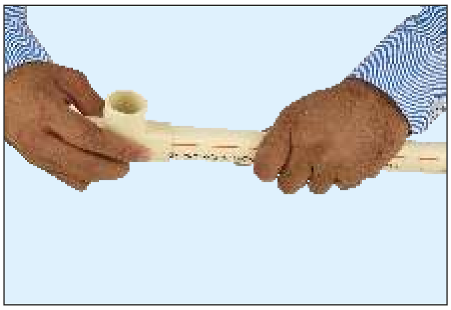
Burrs and filings can prevent proper contact between pipe and fitting during assembly, and must be removed from the outside and the inside of the pipe before assembly. Use de burring tool to remove such burrs.

3) Bevelling



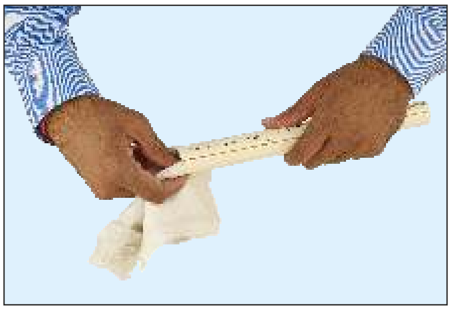
A chamfering tool or a file is suitable for this purpose. A slight bevel (approximately 10°-15° chamfer and a minimum width of 3/32 of an inch) shall be placed at the end of the pipe for ease entry of the pipe into the fitting socket. This will minimize the chance that the edges of the pipe will wipe solvent cement or will scrape softened surface material from the fitting socket during the insertion of the pipe.

4) Test Dry Fit of the Joint



The pipe should enter the fitting socket easily 1/3 to 2/3 of the socket length for a tight interference fit. Contact between pipe and fitting is essential in making a good joint. This contact allows the solvent cement to effectively join the pipe and fitting.

5) Cleaning



Using a clean dry cloth, wipe any dirt and moisture from the fitting socket and the pipe end. Moisture will slow the cure time, and excessive water can reduce joint strength.

6) Solvent cement application:

Apply Permafix CPVC solvent cement to the pipe end. Be aggressive to break down the surface tension and to soften the surfaces.

Apply a very light layer of solvent cement to the inside of the fitting socket. This will prevent puddling of the solvent cement inside of the pipe or fitting. Excessive solvent cement applied to the fitting socket can cause the joint to clog and the wall of the pipe or fitting to weaken due to softening by the accumulation of the excessive solvents.

7) Assembly

Without delay, while the solvent cement is still wet, assemble the pipe and fitting, and while doing so twist a ¼ turn as the pipe is being inserted (if possible), Once the pipe end has reached the fitting socket end, stop the insertion and rotation. Continuation of rotating further could break any fusion that is starting to occur.

8) Hold On

Hold the pipe and fitting together for approximately 30 seconds to avoid push out. Adjust the hold on time based on surrounding conditions.

9) Wipe out excess cement

A bead of solvent cement must be around the entire socket fitting entrance. With a clean, dry cloth, remove the excess solvent cement from the pipe and fitting socket entrance. This will allow the solvent to evaporate from within the joint.

Anchoring points-

While installation, the pipe and fittings should be properly anchored for better product performance and life. Support locations are dependent on pipe size, piping configuration, the location of valves and fittings, and the structure that is available for the support of the piping. No firm rules or limits exist which will positively fix the location of each support on a piping system. Instead, the engineer must exercise his own judgment in each case to determine the appropriate anchor location. The suggested maximum spans between anchor points listed in table below reflect the practical considerations involved in determining support spacing's on straight runs of standard wall pipe.

Pipe Size		21°C(70°F)	49°C(120°F)	71°C(160°F)	82 °C(180°F)
Nominal size	Nominal O.D (MM)	Anchoring spacing in Ft.			
½”	15.9	5.5	4.5	3.0	2.5
¾”	22.2	5.5	5.0	3.0	2.5
1”	28.6	6.0	5.5	3.5	3.5
1 ¼”	34.9	6.5	6.0	3.5	3.5
1 ½”	41.3	7.0	6.0	3.5	3.5
2”	54.0	7.0	6.5	4.0	3.5

Thermal expansion:

Changes in Length – When a pipe is anchored at one end but can otherwise freely move in the axial direction, an increase in temperature causes the pipe to increase in overall length. A decrease in temperature would cause an opposite change. The following expression predicts the net expansion/contraction in the length of a fully unrestrained pipe that occurs in consequence of a given change in temperature-

$\Delta L = \alpha \cdot L \cdot \Delta T$ -------------------------- (Equation 1)

Where: ΔL = change in pipe length, mm

L = initial pipe length, mm

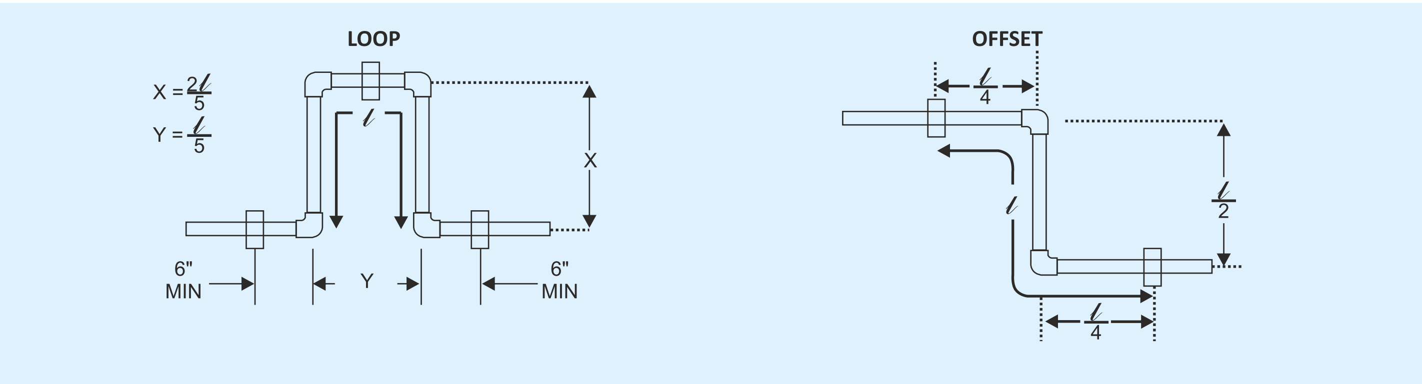
ΔT = change in pipe temperature, °F

α = coefficient of linear expansion/contraction, mm/mm °F

(For CPVC α = 3.4 / 100000 mm/mm °F)

Offset and expansion loop:

A compressive or tensile axial stress in a straight run of pipe may be relieved by transforming it to a bending stress at an offset.



As illustrated by Figure, the offset length (l) acts as a cantilevered beam to the long pipe runs (L). Under thermal expansion, length 'L' increases by ΔL, which forces offset 'ℓ' to bend, and thereby absorb the expansion stresses. The length of the offset, ℓ, needs to be sufficient so that the neither the resultant bending stresses nor the resultant bending moments exceed the working strength limits of the offset, including that of all included fittings. The minimum calculated length of offset may be distributed as segments of a loop or other means for imparting flexibility. Recommended minimum lengths for each segment are also illustrated in the above figure.

"ℓ" is the total offset length. The minimum length of offset, ℓ, that will safely absorb the thermal load in a long straight length of pipe, L, may be calculated from the equation -

$\ell = [3/2 \bullet E/S]^{1/2} \bullet [D \bullet \Delta L]^{1/2}$ ------------------- (Equation 2)

Where:

ℓ = Minimum length of offset leg, mm

E = Effective modulus for range of operating temperature, psi

S = Maximum allowable bending stress for range of anticipated operating conditions, psi

D = outside pipe diameter, mm

ΔL = anticipated maximum change in length in pipe length L, mm (calculated by means of Equation 1)

When the conservative assumptions of short-term modulus and long-term strength are used to calculate minimum offset length, the ignoring of the differences in rate of change of E and S within a material's allowable operating temperature range has no significant consequence on the result. The ratio of the long-term strength to the short-term modulus (S/E) of most thermoplastic piping materials lies around the value of 0.005 inch/inch. Putting this in equation 2

$\ell = [3/2 \bullet (1/0.005)]^{1/2} \bullet [D \bullet \Delta L]^{1/2}$

$\ell = 17.32 \bullet [D \bullet \Delta L]^{1/2}$

so putting the value of pipe diameter and change in length of total pipe length in the above equation will give the total length of offset (ℓ)

Find below the change in length of 25 meter long pipe and the required length of expansion or Offset Loop for the different pipe diameters.

Change in Temperature	10°C (18°F)	20°C (36°F)	30°C (54°F)	40°C (72°F)	50°C (90°F)
Change In Length (ΔL) in MM	15.3	30.6	45.9	61.2	76.5
Pipe Size	Length of Offset / Expansion Loop (l) in MM				
½"	270	382	468	540	604
¾"	319	451	553	638	714
1"	362	512	628	725	810
1¼"	400	566	693	800	895
1½"	435	616	754	871	974
2"	498	704	862	996	1113

Heat Tracing:

Heat tracing of thermoplastic pipes differs considerably than that of metals. Some of the important contrasts include: poor thermal conductivity of the pipe material, upper-temperature limitations of the pipe material due to low melting ranges and combustibility features, high expansion and contraction characteristics and the resulting insulation restrictions, poor grounding qualities for electrical currents, and the typical harsh environmental consideration to which plastic piping is frequently exposed to. External steam tracing is strongly not recommended, due to the upper temperature limitations.

However, there are two very reliable methods of providing freeze protection and/or temperature maintenance: external electrical heat tracing using "self-regulating" style electrical heaters, and the internal method of using a smaller diameter pipe that conveys a hot fluid to transfer heat to the fluid flowing in the annular space. Both methods require a slightly different design method, and also require their own unique fabrication techniques. When designing a system using either of these methods, it is suggested that the manufacturer be contacted for technical advice pertaining to the particular situation. Manufacturers of heat tracing also now offer computer programs to determine the proper system for an application.

Pressure Losses in Pipe:

The total pressure drop in a system is the sum of pressure losses due to friction, fittings and elevation changes.

I) Frictional Pressure Loss

Pressure loss due to friction in the pipe is calculated using the Hazen- Williams formula. This applies to systems pumping water and fluids of like viscosities. The Hazen-Williams formula is:

$$\Delta Pf = \frac{453 \times Q^{1.85}}{C^{1.85} \times d^{4.86}}$$

Where ,

ΔPf = Pressure loss due to friction, psi per 100 feet

C = Hazen-Williams Flow Factor Coefficient*

Q = Volumetric flow rate, gpm

d = Inside diameter, inches

Sample calculation for frictional head loss for 100 feet length of pipe at a flow velocity of 1.5 mtr. / second.

Size	½"	¾"	1"	1.25"	1.5"	2"
Frictional head loss in psi/ 100 Feet of pipe	10.45	6.60	4.89	3.88	3.19	2.32

i) Elevation Pressure Loss/Gain

The Hazen-Williams formula is used to establish only the pressure losses due to friction in the pipe. If there is a change in elevation, it is necessary to calculate the change in pressure due to elevation changes. The change in pressure may be either a positive change (down) or negative (up). In a line with an elevation change without a change in pipe diameter, the pressure loss can be calculated as follows:

H = (h2 - h1)

Where,

H = Change in pressure head due to elevation change, mtr

h2 = High point elevation, meters

h1 = Low point elevation, meters

ii) Pressure Loss in Fitting

Any calculation of the pressure drop in a piping system cannot be made accurately without consideration of the loss in pressure due to the presence of fittings in the system. The fluid flow, when encountering a fitting, is subjected to change in direction and the resultant degree of initiation of turbulence, or at least an interruption in the desirable steady flow condition which exists in the straight run of pipe, is an increase in head loss or pumping pressure. Due to the geometry and variance in flow conditions through the fitting, the exact pressure loss cannot be calculated in any practical sense. The pressure loss is calculated by expressing the fitting as an equivalent length of pipe expected to produce the same pressure loss.pressure rating or **Hydraulic**

Sr. No	Type of Fitting	Equivalent length of pipe
1	90° Elbow	16* D
2	45° Elbow	12* D
3	Running Tee	12* D
4	Branch	60* D

Shock/Water Hammer

Hydraulic shock or water hammer is a momentary pressure rise resulting when the velocity of the liquid flow is abruptly changed. The longer the line and higher the change in liquid velocity, the greater the shock load from the surge. For the piping system to keep its integrity the surge pressure plus the operating pressure in the piping system must not exceed the specified pressure rating or maximum suggested design pressure of the lowest rated component in the piping system. The main factors that influence the severity of water hammer are:

- Liquid Velocity
- Length of Pipe Run
- Modulus of Elasticity of Piping Material
- Inside Diameter of Pipe
- Pipe Wall Thickness
- Valve and Pump Closing Times
- Entrapped Air

First, the speed a surge wave travels through the piping system must be calculated. Since the pressure wave travels at different speeds through each piping material, it is necessary to compute the speed of sound in the water as it is changed by the pipe material.

$a = 1403 / [1 + (k/E)*(SDR-2)]^{1/2}$

Where:

a = wave velocity, Mtr./sec.

k = Fluid bulk modulus, 300,000 psi for water at 73°F

E = Modulus of elasticity of pipe

SDR = Dimension ratio of pipe

The pressure surge in the water system can now be calculated using the change in flow rate or system velocity and the speed of the pressure wave. The following formula is used for this determination:

H = av/g

Where

H = Surge Pressure, Meters of water column

a = speed of pressure wave, meter/seconds

v = change in flow velocity, meter/second

g = gravitational force, meter/second^2

Surge Time:

T = 2*L/a

Where

T = critical surge period, seconds

L = Length of pipe in meters

A = speed of pressure wave in meter/second

Temperature Compensation Multiplier :

Approximate multiplication factor for estimating effective modulus of CPVC for temperatures other than 73.4°F is give n below -

Material	0°C (32°F)	23°C (73.4°F)	37.8°C (100°F)	60°C (140°F)	82.2°C (180°F)
CPVC	1.40	1.0	0.90	0.62	0.48

Do’s & Dont's for CPVC Pipe and Fittings

Do's

- Read the manufacturer's installation instructions.
- Keep pipe and fittings in original packaging until needed.
- Use tools specifically designed for use with plastic pipe and fittings.
- Cut the pipe ends square.
- Deburr and bevel the pipe ends with a chamfering tool.
- Use the proper solvent cement and follow application instructions.
- Rotate the pipe at least ¼ turn when bottoming the pipe into the fitting.
- Avoid use of excess cement in fittings and pipe.
- Allow CPVC tube slight movement to permit thermal expansion.
- Use plastic pipe straps that fully encircle the tube.
- Use protective pipe isolators when penetrating steel studs.
- Use metallic clevis of tear drop hangers when suspending tube from anchor.
- Use compatible sleeve material and tape while using under slab.
- Securely tape the top of the sleeve to the pipe.
- Extend pipe sleeve 12" above and below the slab.
- Backfill and cover underground piping prior to spraying termiticide in concrete pour.

Don'ts

- Don't use petroleum or solvent based sealants, lubricants.
- Don't use edible oils, for a lubricant.
- Don't use solvent cement that has exceeded its shelf life or has become thick.
- Don't pressures test until the recommended joint cure times are met.
- Don't thread, groove, or drill CPVC pipe.
- Don't over tighten or lock down the systems.
- Don't install in cold weather without allowing for thermal expansion
- Don't use tube straps which tend to restrict expansion/contraction.
- Don't use wood or plastic wedges that strain the tube as it passes them.
- Don't terminate a run of tube against an immovable object .
- Don't allow heavy concentration of termiticides to come into direct contact with CPVC pipe while using under slab.
- Don't inject termiticides into the annular space between the pipe materials.
- Don't spray termiticide, when preparing a slab, without first backfill underground piping.
- Don't cut sleeve too short. Sleeve material should extend 12" above slab.
- Don't apply short cuts, while jointing

Frequently Asked Questions

1)What is Thermal Expansion?

- Expansion and contraction of piping systems due to temperature changes is not unique to plastics. Changes in temperature tend to cause a change in dimensions of any matter. But, the amount of dimensional change for a given temperature change can vary significantly depending on the material characteristics.

2)How to restrain thermal expansion?

- The restraining of the tendency of a piping system to expand/contract can result in significant stress reactions in pipe and fittings, or between the piping and its supporting structure. The allowing of a moderate change in length of an installed piping system as a consequence of a temperature change is generally beneficial. Allowing controlled expansion/contraction to take place in one part of a piping system is an accepted means to prevent added stresses to rise to levels in other parts of the system that could compromise the performance of, or cause damage to the structural integrity of a piping component, or to the structure which supports the piping. Everyone is familiar with the typical expansion loops that are periodically placed in long pipelines subject to wide temperature changes

3)How to prevent freezing?

-There are two very reliable methods of providing freeze protection and/or temperature maintenance: external electrical heat tracing using "self-regulating" style electrical heaters, and the internal method of using a smaller diameter pipe that conveys a hot fluid to transfer heat to the fluid flowing in the annular space. Both methods require a slightly different design method, and also require their own unique fabrication techniques which need to be done during pipe installation. In case no care is taken during pipe installation, but still there is chance of exposure of pipes to freezing temperatures, it is important to fill the pipes with glycerin solution. High purity glycerin and propylene glycol solutions are the best antifreeze liquids.

4)What is the effect of excessive use of solvent cement?

- An installation problem that we occasionally see is the use of excessive solvent cement. The solvents in the cement themselves are readily absorbed into the wall of the CPVC pipe and inside fitting socket resulting in solvation/softening of the material. The solvents in the cement absorbed into the pipe wall resulting in softening of the pipe wall to the point that the pipe wall became swollen/ softened and no longer had sufficient strength to hold water pressure resulting in failure.

5)What is the effect of insufficient use of solvent cement?

-Sufficient solvent cement must be applied to end up with complete coverage of the matting portion of pipe outer and fittings inner surface so that a continuous bond is formed between the pipe and fitting surfaces. If insufficient cement is used, voids may develop in between the pipe and fitting. The presence of the voids results in a weakened assembly which may result in water leaking from the joint.

6)What is the life of CPVC?

-CPVC pipe and fittings, when installed underground as per the laid down procedures had a life expectancy of more than 50 years. CPVC pipes installed decades ago are still working satisfactorily.

7)What is the effect of external contacting material on the life of CPVC pipes & fittings?

-Care must be taken not to allow CPVC pipes to contact other materials that contain aromatic ester plasticizers and flame retardants. Phthalate esters are highly incompatible with CPVC pipes. Direct contact of such material with CPVC pipes results in premature failure.

Solder flux is another material that may contain chemicals that are incompatible with CPVC. If copper pipes are being soldered in the vicinity of CPVC pipes, hot flux can fall, spatter, or vaporize and condense on the outside surface of the CPVC pipes causing ESC failure.Polyurethane spray foam (PUSF) insulation can be a problem. PUSF generates heat as it cures. If the heat is trapped by a thick layer of foam against the wall of the pipe, the heat can weaken and distort the pipe.

Also, each PUSF manufacturer has formulations that contain additives such as fire retardants. Some of these formulations may not be compatible with CPVC. one should consult with the PUSF manufacturer before applying PUSF in spaces where it may contact CPVC pipes & fittings for its chemical compatibility with CPVC.

8)Can we use CPVC pipes and fittings immediately after the solar water heater storage tank?

- No, for water heaters lacking reliable temperature control, this distance should be ideally 1 m. A metal nipple or flexible appliance connecter should be utilized. This measure eliminates the potential for damage to plastic piping that might result from excessive radiant heat.

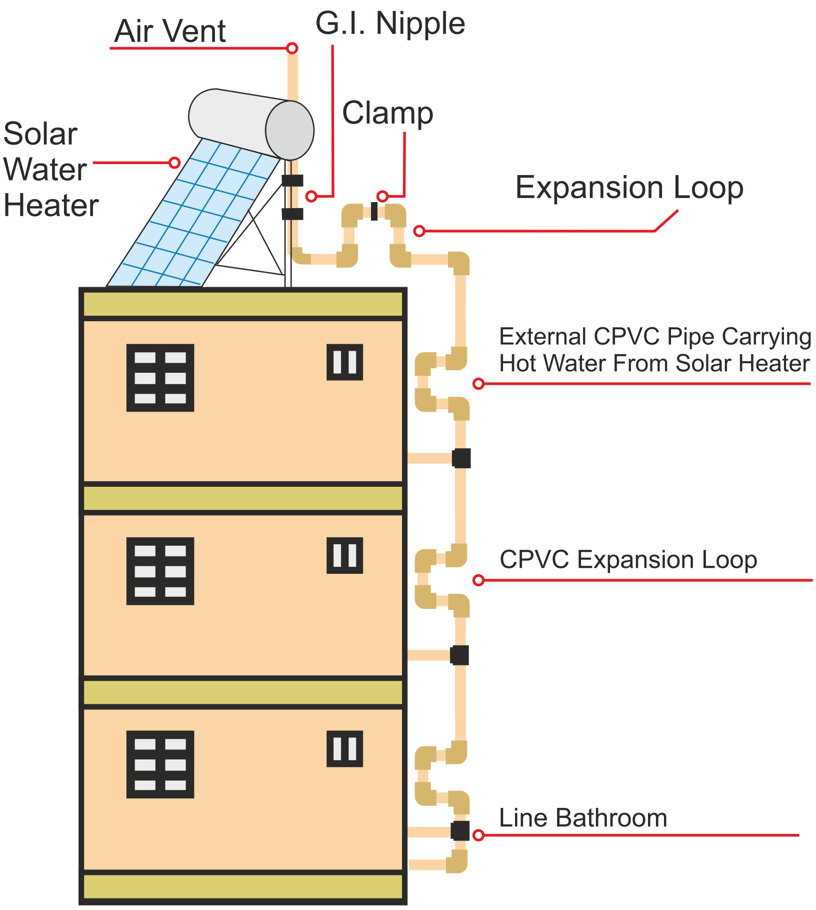
9)Can we use CPVC pipes & Fittings immediately after gas water heater?

-Use of CPVC pipes immediately after the gas water heaters is permitted with some restriction. A care should be taken in such a way that at no point of time the flue gases from the heater directly or indirectly come in contact with the CPVC pipe, as the passing flue gases supply external heat to the pipe and if the flue gases temperature is high enough, it may damage the pipe. if flue gases cannot be controlled, in such cases avoid the use of CPVC pipe immediately after the gas water heater.

10)What extra care to be taken while installation of CPVC pipes & fittings in a construction?

Some products that are used in construction may contain chemicals that are not compatible with CPVC pipes and fittings. Therefore care must be exercised during installation to make sure that only chemically compatible products (e.g., metal pipe thread sealants, fire caulks, antifreeze, antibacterial lined pipes, etc.) are used during installation.

Chemical Resistance Chart Of CPVC –



Residential Tower

CPVC Pipes and Fittings

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Table below shows the chemical immersion of CPVC. The resistance is almost the same as that of PVC, but the resistance at higher temperature range is much higher.

Chemicals	Temperature°C				
	20	40	60	80	100
Hydrochloric acid (35%)	◎	◎	○	△	×
Nitric acid (75% and less)	○	○	×	×	×
Sulfuric acid (50% and less)	◎	◎	○	△	×
Acetic acid (80% and over)	◎	○	△	×	×
Acetic acid (80% and over)	○				
Glacial acetic acid	×				
Chloroacetic acid	◎	◎	○	○	×
Hypachlorous acid	◎	◎	◎	◎	◎
Oxailc acid	◎	◎	◎	◎	◎
Lactic acid	◎	◎	◎	◎	◎
Butyric acid (20%)	◎				
Butyric acid (dense)	×				
Stearic acid	◎	◎	◎	○	
Oleic acid	◎	◎	◎	○	
Malelc acid	◎	◎	○	○	
Picric acid	×				
Fatty acid	◎	◎	◎	○	
Chromic acid (30%)	◎	○	△	×	×
Chroride of most metals	◎	◎	○	○	○
Potassium bichromate	◎				
Potassium permanganate (10%)	◎	◎			
Hydrogen peroxide (30%)	×				
Ethanol	◎	◎			
Methanol	◎	○	△	×	×
Carbon tetrachloride	×	×	×	×	×
Glycerin	◎	◎	◎	◎	◎
ASTM oil no. 3	◎	◎	◎	◎	◎
Oil fat	◎	◎	◎	○	○
Methyl ether	×				
Hexane	×				
Toluene	×				
Acetone	×				
Formalin (35%)	◎	○	△	×	×
Phenol	◎	△	×	×	×
Caustic soda	◎	◎	◎	○	○
Caustic potash (10%)	◎	◎	◎	○	○
Starch sugger solution	◎	◎	◎	◎	○
Petroleum	○	○	○	○	○
Chloroform	×				
Benzine	◎	◎	◎	○	○
Ketone groupe	×				
Acetaldehyde	×				
Distilled water	◎	◎	◎		
Bleacher	◎	◎	○	○	○
Beer brewing water	◎	◎	◎	◎	○

◎ : Not Affected ○ : Hardly Affected △ : Affected a little yet serviceable × : Not usable

THE COMPANY

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