PPFA
The Plastic Pipe and Fittings Association

Specification Sheet: Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe and Fittings for Hot and Cold Water Distribution Systems

1. Product name

Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe and Fittings for Hot and Cold Water Distribution Systems

2. Manufacturer

For a list of member manufacturers, contact the Plastic Pipe and Fittings Association, 800 Roosevelt Road, Building C, Suite 20, Glen Ellyn, IL 60137; (630) 858-6540; fax (630) 790-3095; www.ppfahome.org.

3. Product description

Basic Use: Hot and cold water distribution systems, including water recirculation lines. CPVC pipe can be used in residential, commercial and industrial applications. CPVC pipe and fittings are resistant to potable water disinfectants such as chlorine, chloramine, and ozone.

Pipe and fittings are joined by solvent cementing. A full complement of fittings, valves, and pipe is available for potable water applications. Pipe and fittings are available in Copper Tube Size (CTS) ½ through 2 inches, and in Iron Pipe Size (IPS) ¼ through 12 inches. Connections between CPVC pipe and other piping materials are accomplished by use of adapter fittings. Adapter fittings utilize threaded joints, compression connections, flanges or mechanical connections.

Composition and Materials: CPVC is a thermoplastic material, and the CPVC compounds meet the requirements of Class 23447 as referenced in ASTM D 1784.

Grades: CPVC pipe and fittings are made from CPVC compounds. CPVC CTS SDR 11 pipe and fittings (ASTM D 2846) are used in these systems. CPVC IPS pipe is available as Sch 40 & 80 or SDR-PR pipe. The CTS pipe has the same outside diameter as copper tube. The IPS pipes have the same outside diameter as the corresponding sizes of steel pipe. CTS is available in sizes $^1/_2$ through 2 inches. For installations larger than 2 inches, Schedule 40, Schedule 80, and SDR-PR pipe is available in sizes up to 12 inches.

Limitations: SDR 11 CTS CPVC pipe and fittings are pressure rated for continuous use at 400 psi at 73.4º F and 100 psi at 180º F. Each size of the sch 40 and 80 pipe has a different pressure rating, and as the temperature increases, the pressure rating decreases. Consult the tables in ASTM F 441 for full details. Under no circumstances should temperature exceed 212ºF for pressure piping, but CPVC temperature/pressure relief discharge pipes have been tested to 250º F.

Plastics are affected by ultraviolet radiation. Pigments are added to the CPVC materials to shield them from radiation effects. CPVC piping can be exposed to sunlight during construction; however, prolonged exposure to the sun is not advised unless protected by a water-based latex paint.

4. Technical data

Applicable Standards: ASTM D 2846 or CSA CAN/CSA B137.6 apply to CPVC SDR 11 (CTS) pipe and fittings. ASTM F 441 applies to Schedule 40 and 80 pipe. ASTM F 442 applies to SDR-PR pipe. ASTM F 438 applies to Schedule 40 socket fittings. ASTM F 439 applies to Schedule 80 socket fittings. ASTM F 493 applies to Solvent cements for CPVC.

Quality Control: Most pipe and fittings are evaluated and listed by an ANSI accredited third party listing agency (e.g., NSF or UL). These agencies certify CPVC piping as conforming with ANSI/NSF 14 and 61 for use in potable water systems and for strength and durability requirements. Contact the manufacturer for more information.

Chemical Resistance: CPVC pipe and fittings are resistant to chemicals used in disinfecting potable water. CPVC pipe resists certain chemical actions on the exterior of the pipe when located in hazardous environments. Contact manufacturer for a detailed list of chemicals CPVC pipe can resist.

Flow Characteristics: CPVC pipe does not corrode or accumulate mineral deposits. CPVC pipe should be designed with a water flow rate between 5 to 12 feet per second. See Table 1. Water velocities in excess of 5fps are not recommended for large diameter (greater than 6") IPS CPVC systems.

Friction loss for flow through fittings is based on equivalent length of pipe. Equivalent lengths of pipe for CTS fittings ½ inch through 2 inches are shown in Table 2. Consult the manufacturer's published tables for dimensions, friction loss data, and equivalent length of pipe for IPS sch 40 and sch 80 fittings.

Water Hammer: Intensity of water hammer in CPVC pipe is approximately $^1/_3$ the intensity of copper or steel pipe.

Laying Lengths: CPVC pipe is available in 10 and 20-foot lengths. The smaller sizes (1" max.) of CPVC CTS are also available in coils. Minimum laying lengths for CPVC SDR 11 (CTS) fittings are identified in Table 3.

Expansion and Contraction: CPVC pipe has a higher coefficient of expansion and contraction than metallic pipe. The coefficient of linear expansion for CPVC plastic is 0.000034 in/in/º F. This translates into an expansion of 2.04 inches for every 50 feet with a temperature change of 100º F.

Where CPVC pipe is installed in long straight lengths, compensation for expansion and contraction must be provided. This can be accomplished at changes in direction or with offset piping arrangements such as loops or bends, so that pipe flexibility provides for thermal expansion.

Hangers and Supports: CPVC pipe must be supported at 3 foot intervals for pipe 1 inch and less in diameter and 4 foot intervals for pipe 1¼ to 2 inches. For larger sizes of sch 40 and 80 pipe, consult the tables that show support spacing as a function of both size and temperature. Vertical pipe shall be supported at each floor level with mid-story guides. Where the design engineer has made provisions for expansion, they must be followed. Install hangers and supports to allow for thermal expansion and contraction. Avoid the use of hangers and supports that contain chemicals which are known plasticizers.

Fire Protection: CPVC pipe and fittings may be used in residential, commercial and industrial buildings, even those that require non-combustible construction.

Through penetrations of fire resistance rated assemblies by CPVC pipe are accepted in the model building codes when such assemblies have successfully met the requirements of ASTM E 814. These penetration assemblies are listed by ANSI accredited testing agencies such as UL and Intertek. Verify local code interpretations related to through penetrations with the jurisdiction having authority. Refer to the local building department for regulations concerning use of CPVC pipe and fittings.

Flame Spread and Smoke Developed Rating: When tested in an ASTM E 84 tunnel, water-filled CPVC pipe (2½ inches and smaller) had a flame spread of 25 or less and smoke developed rating of 50 or less. Contact pipe manufacturers for additional information.

5. Installation

Preparatory Work: CPVC pipe must be cut square with a wheeled tubing cutter, ratchet cutter, miter saw, or power saw designed for that use. Pipe ends must be deburred (inside and outside) and wiped clean and dry.

Methods: Solvent cementing of CPVC pipe and fittings requires joint preparation. The joint is made while the solvent cement is still wet. Follow the instructions for proper application and use of the CPVC solvent cements as provided by the pipe and fitting manufacturer and as printed on the container label. ASTM F493 is the standard for CPVC solvent cement. Two solvent cement systems are available — an orange cement that requires the use of a primer and a yellow cement that does not require a primer. Check the local code for approval prior to use and follow the instructions on the can label.

When threaded adapter fittings are installed, apply joint tape or paste thread sealant that is specifically approved for use with CPVC to the male threads. Adapter fittings must be installed in accordance with the manufacturer's installation instructions.

Precautions: Joining of CPVC pipe and fittings should be performed in well-ventilated locations. Contact of primer and solvent cement with the skin should be avoided. Eye protection is recommended during solvent cementing. See ASTM F 402 for more safe handling details.

Protect pipe from contact with sharp objects or building materials such as nails and metal studs. Care must be exercised to avoid rough handling or abrasion of the pipe and fittings. CPVC pipe should not be installed in close proximity to high heat sources.

Plumbing Codes: CPVC pipe is permitted to be used in hot and cold water distribution systems, without limitation, in the following model plumbing codes: BOCA National Plumbing Code, IAPMO Uniform Plumbing Code, ICC International Plumbing Code, NAPHCC National Standard Plumbing Code, and SBCCI Standard Plumbing Code. CPVC is also permitted in the CABO One & Two Family Dwelling Code.

Verify with the local code enforcement authorities having jurisdiction that CPVC piping is approved for hot and cold water distribution systems.

6. Availability and cost

Availability: CPVC pipe and fittings are available through local plumbing and supply wholesalers, hardware stores, farm and home centers throughout the United States and Canada.

Cost: CPVC pipe's installed cost is less than metallic piping materials used in hot and cold water distribution systems.

7. Warranty

CPVC pipe and fittings manufacturers generally warrant that their pipe and fittings are free from defects and conform to designated standards. However, most warranties contain limitations such as, for example, they are only applicable to pipe and fittings installed in accordance with manufacturer's installation instructions. Warranties should be read carefully. Manufacturers of the pipe and fittings are not responsible for improper use, handling, or installation of the product.

8. Maintenance

Normal maintenance as required.

9. Technical services

Manufacturers of CPVC pipe and fittings will provide technical manuals and engineering data upon request.

10. More information

Additional product information is available upon request from the Plastic Pipe and Fittings Association, 800 Roosevelt Rd., Building C, Suite 20, Glen Ellyn, IL 60137, (630) 858-6540, FAX (630) 790-3095; www.ppfahome.org.

TABLE 1

Frictional losses for CTS CPVC pipe at different water velocitites

Velocity	½" CTS Flow	½" CTS Head Loss*		¾" CTS Flow	¾" CTS Head Loss*		1" CTS Flow	1" CTS Head Loss*	
(fps)	(gpm)	(feet)	(psi)	(gpm)	(feet)	(psi)	(gpm)	(feet)	(psi)
2	1.14	4.28	1.86	2.47	2.78	1.20	4.11	2.07	0.90
4	2.2 9	15.56	6.75	4.94	10.02	4.34	8.22	7.47	3.24
5	2.87	23.64	10.25	6.17	15.12	6.55	10.27	11.28	4.89
6	3.44	33.07	14.34	7.40	21.18	9.18	12.32	15.81	6.85
8	4.59	56.41	24.45	9.87	36.10	15.65	16.43	26.94	11.68
10	5.74	85.35	37.00	12.34	54.49	23.66	20.54	40.73	17.66
12	6.89	119.77	51.92	14.81	76.58	33.20	24.65	57.27	24.83

Velocity	1¼" CTS Flow	1¼" CTS Head Loss*		1½" CTS Flow	1½" CTS Head Loss*		2" CTS Flow	2" CTS Head Loss*	
(fps)	(gpm)	(feet)	(psi)	(gpm)	(feet)	(psi)	(gpm)	(feet)	(psi)
2	6.14	1.64	0.71	8.58	1.34	0.58	14.72	1.02	0.44
4	12.28	5.93	2.57	17.17	4.84	2.10	29.44	3.68	1.60
5	15.36	8.98	3.89	21.46	7.31	3.17	36.81	5.56	2.41
6	18.43	12.58	5.45	25.75	10.25	4.44	44.17	7.80	3.38
8	24.57	21.42	9.29	34.34	17.47	7.57	58.89	13.28	5.76
10	30.71	32.38	14.04	42.92	26.40	11.44	73.61	20.08	8.71
12	36.85	45.29	19.63	51.50	37.00	16.04	88.33	28.16	12.21

***Head Loss/100' of pipe**

TABLE 2

Approximate equivalent length of pipe (ft.)
CPVC SDR 11 (CTS) pipe fittings

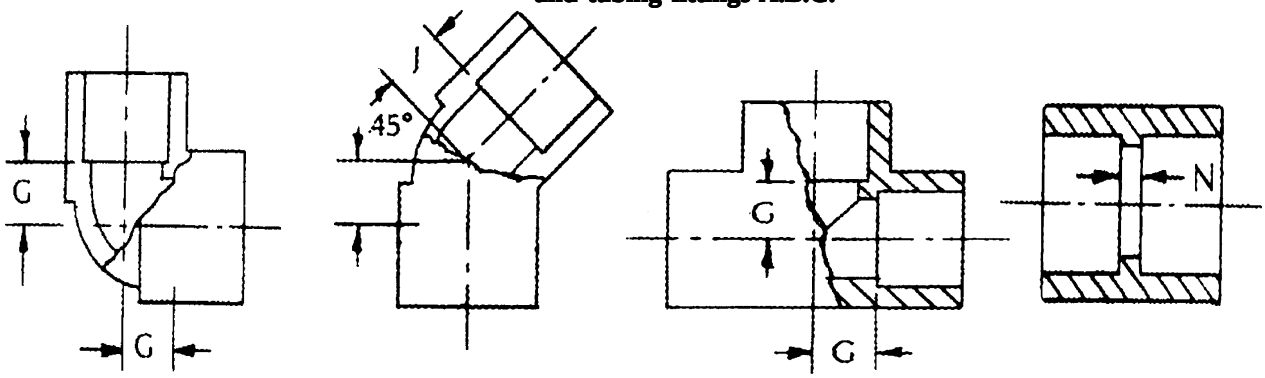
Pipe Size (in)	90° Elbow	45° Elbow	Through Tee Run	Through Tee Branch
½	1.6	0.8	1.0	3.1
¾	2.1	1.1	1.4	4.1
1	2.6	1.4	1.7	5.3
1¼	3.5	1.8	2.3	6.9
1½	4.0	2.1	2.7	8.1
2	5.2	2.8	3.5	10.3

TABLE 3

Minimum Laying lengths of CPVC CTS pipe fittings (in.)

Nominal Pipe Size (in.)	Elbow G	45° Elbow J	Tee G	Coupling N
½	0.382	0.183	0.382	0.102
¾	0.507	0.235	0.507	0.102
1	0.633	0.287	0.633	0.102
1¼	0.758	0.339	0.758	0.102
1½	0.884	0.391	0.884	0.102
2	1.134	0.495	1.134	0.102

Minimum dimensions from center to end of socket (laying length) for CPVC 41, SDR 11 plastic pipe and tubing fittings A.B.C.



The information herein has been prepared solely from publicly available sources or from consensus positions adopted by manufacturers of these products or other interested parties in the industry. PPFA disclaims warranties, expressed or implied, as to the fitness for any particular purpose or suitability for any specific installation.