If a tapered pipe thread connection between the CPVC and metal components must be made, use a CPVC male thread adapter. Consult the fittings manufacturer for additional limitations.

Thread Sealants

Threaded CPVC fittings with tapered pipe threads (e.g. male thread adapters) must be used with a suitable thread sealant to insure leak-proof joints. Over the years, TPFE (Teflon® or equivalent) tape has been the preferred thread sealant and it is still the most widely accepted and approved sealant.

Some paste sealants can affect CPVC fittings; therefore only sealants recommended for use with CPVC by the thread sealant manufacturer should be used.

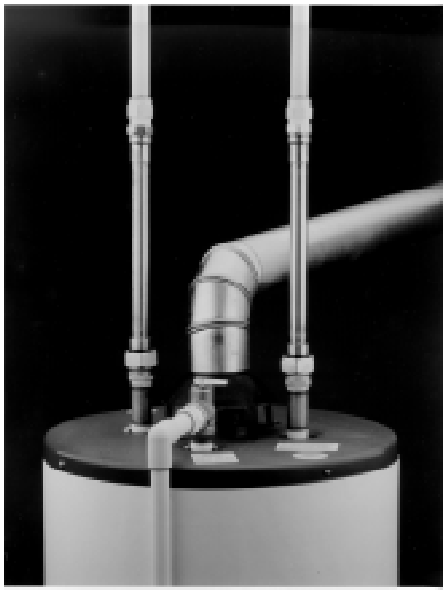
Water Heater Connections

Some plumbing codes contain detailed requirements for connections to gas or electric storage type water heaters. Determine whether your code has such requirements and satisfy them.

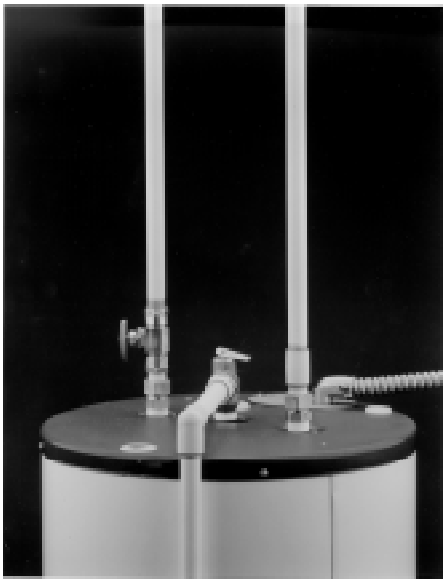
If no detailed requirements exist, use the following information. On electric water heaters CPVC can be piped directly to the heater with special metal-to-CPVC transition fittings (photo L). On gas water heaters there should be at least 6 inches of clearance between the exhaust flue and any CPVC piping (photo K). Twelve-inch long metal nipples or appliance connectors should be connected directly to the heater so that the CPVC tubing cannot be damaged by the build-up of excessive radiant heat from the flue.

An approved temperature/pressure (T/P) relief valve should be installed so that the probe or sensing element is in the water at the top of the heater. CPVC is approved by all the model codes for use as relief valve drain line piping. Use a metal-to-CPVC transition fitting to connect to the relief valve and continue the pipe full size to the outlet. For horizontal runs, slope the pipe toward the outlet and support it at three-foot centers or closer. The pipe must discharge to the atmosphere at an approved location.

Do not use CPVC pipe and fittings with commercial-type, non-storage water heaters.



K



L

Pressure Testing (Joint Cure Time)

When pressure testing CPVC piping, the focus is on time required for the solvent-cemented joints to gain sufficient strength to permit pressure testing without affecting the long-term strength and durability of the system. ASTM D2846 contains pipe OD and socket ID tolerance requirements that are more restrictive than those in most other pressure piping standards. Because of this, the solvent-cemented joints gain strength very quickly after assembly.

Furthermore, it is widely recognized that pipe size is also a factor in the joint setting and curing process.

Joint setting time refers to the time required for the solvent-cement joint to reach handling strength.

While the joint set times are rarely measured or reported, workers very quickly recognize them as being a function of pipe size, temperature, degree of interference, and even length of the pipes being handled.

The joint cure time is the time required before a system containing newly cemented joints can be pressure tested and/or put into service. While minimum joint cure times are usually not a factor in new installations, they may be a factor in repair jobs or minor revisions to piping. The following Table and text taken from ASTM D2846 Appendix X deal with this subject.

X2.3.3 Pressure Testing — CPVC piping systems made of $^{1}/_{2}$" through 2" sizes per ASTM D2846 can be pressure tested (using cold tap water only) at line pressure (150 psi max.) after the solvent cement joints have cured for at least the following amount of time:

Minimum Cure Times

Ambient Temperature	Pipe Sizes $^{1}/_{2}$" - 1"	Pipe Sizes 1 - $^{1}/_{4}$" - 2"
Over 60°F	1hr.	2 hr.
40-60°F	2 hr.	4 hr.

Consult solvent cement manufacturers' installation instructions for more detailed cure times.

CPVC must not be used for piping systems intended to convey air or other compressed gases and should not be tested with air or other compressed gases.

Thermal Conductivity, Condensation, & Sweating

In general, plastic materials have low coefficients of thermal conductivity when compared with metallic materials (see table below). Because of this, some people ask whether insulation is necessary to prevent heat loss from hot water piping or sweating of cold water piping. Generally, it is not necessary to insulate CPVC piping within heated buildings. Following are some factors to support this:

- 2" Sch. 80 CPVC pipe (2.375" OD - 0.230" wall) would lose about 140 BTU/h/LF while conveying 170° F water in a 70° F air environment.
- 2" Type M copper tube (2.125" OD - 0.060" wall) would lose about 5,000 BTU/h/LF under the same conditions.
- However, both the CPVC and the copper pipe will cool to ambient temperature in a short time when there is no flow.
- CPVC piping carrying 180° F water will have an outside surface temperature of about 150° F in an air conditioned building.
- Under most use conditions that cause copper tube to sweat and drip, CPVC will remain free of condensation.

Thermal conduction is defined as "transfer of heat from one part of a body to another part of the same body, or from one body to another in physical contact with it, without appreciable displacement of the particles of the body." This definition leads us to the commonly used "K" factor which refers to thermal conductivity.

Typical "K" Factors

Material	BTU/h/SF/F°/in.	BTU/h/SF/F°/ft.
Copper	218.0	2616.0
Cast Iron	26.8 to 30.0	321.6 to 360.0
Steel	26.0	312.0
Concrete	0.54	6.5
Brick	0.4	4.8
Wood	0.06 to 0.12	0.7 to 1.4
PVC	0.11	1.3
CPVC	0.08	1.0

Insulation lubricants may cause severe stress cracking of CPVC fittings. Only non-lubricated insulation products (rubber or polyolefin) should be used with CPVC systems.

Freezing & Thawing

One of the most common conditions that can stop the function of the water distribution system is freezing. While this condition immediately stops the flow of water at the fixture, it may or may not have progressed to the point of rupturing the pipe. Therefore, immediate steps should be taken to locate the frozen section and alleviate the problem. As soon as the frozen section is located, close any outside openings with insulation, circulate warm air into the area, or direct heated air onto the piping. Limit the heat source to 180° F or less. If the frozen section is substantially inaccessible, it may be possible to cut open the line at an accessible point and insert a small flexible tube and pump hot water directly to the ice plug. As the hot water is pumped in and the ice is melted, the excess flows back out around the flexible tube.

Once the ice plug has melted, check to see if any pipe or fitting is ruptured, make repairs if necessary, and insulate the area or pipe to prevent future freezing. **Do not use an open flame to heat the frozen pipe.**

Hydraulic Shock (Water Hammer)

Although the peak surge pressure that results from interrupting flow in a CPVC pipe is smaller than the pressure in metal pipe, when the velocity is the same, both can produce "hydraulic shock." While some codes prescribe the use of accessible water hammer arresters adjacent to each solenoid operated valve, other codes do not speak to the subject and leave the decision up to the designer or installer.

Grounding

Because CPVC is electrically non-conductive, it cannot be used as an electrical ground, and care must be taken to provide a suitable ground whenever CPVC piping is installed to replace metal piping that has been used as a ground. Because plastic water service lines are being used extensively, and because of galvanic corrosion to metal piping systems from ground faults, many codes prohibit grounding to any type of hot and cold water pipe. Check your local code.

Fire Rated Construction

CPVC water piping can be used within fire rated buildings provided all penetrations of fire barriers (e.g. walls or floor slabs) are made in such a way that the fire rating of the barrier will not be compromised. Many codes and code officials accept penetration sealing systems or devices that have qualified for UL Certification and Listing or have passed appropriate ASTM E119 or E814 tests. The PPFA manual *Plastic Pipe in Fire Resistive Construction* provides more detailed information on this subject and lists available test reports. (Or see the current issue of the Underwriters Laboratories, Inc. Directories of Fire Resistance - Vol II or WHI Certification Listings.)

Underslab Installations

CPVC is approved for underslab installations, with joints, in all model plumbing codes.

When performing underslab installations, it is important that the tube is evenly supported on a smooth bottom. The back fill should be free of sharp rocks and other debris that could damage the tube. Systems with joints under slab must be pressure-tested* before pouring the slab. The tube should be sleeved where it penetrates the slab and at construction joints in the slab.

CPVC water piping, manufactured in accordance with ASTM D2846, is available in coils for underslab installations. When turning the end up through the slab, into walls, etc., be careful not to kink the pipe. Should a kink result, it must be cut out to avoid possible failure. Follow the pipe manufacturer's installation instructions for minimum radius permitted to be imposed on the coiled pipe.

*The IAPMO IS 20-93 (Installation Standard for CPVC SOLVENT CEMENTED HOT AND COLD WATER DISTRIBUTION SYSTEMS) requires a test of 150 psi for 2 hours. This requirement applies only to pipe installed under a slab.

CPVC in Plenums

Most building and mechanical codes restrict the use of combustible materials in plenums to materials that can meet 25 flame spread/50 smoke developed limits when tested under the ASTM E84 (Steiner Tunnel) test method. CPVC pipe filled with water was subjected to the same test conditions per UL 723 in an E84 tunnel and it met the 25/50 limiting requirements. For a copy of the report contact the BFGoodrich Company.

Revision Policy

The PPFA CPVC Product Line Committee has initial responsibility for assuring that the data and other information in this handbook are current and accurate. All suggestions and recommendations for revisions to this handbook should be addressed to PPFA, 800 Roosevelt Road, Building C, Suite 20, Glen Ellyn, IL 60137, Attn.: CPVC Product Line Committee, and the Committee will respond to them as promptly as reasonably possible. The CPVC Committee will review and update the handbook as required based on comments or questions. A complete review will be made at least once every three years.

PPFA

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