Solvent welding thermoplastic pipe and fittings

PLASTIC PIPE, VALVES AND FITTINGS

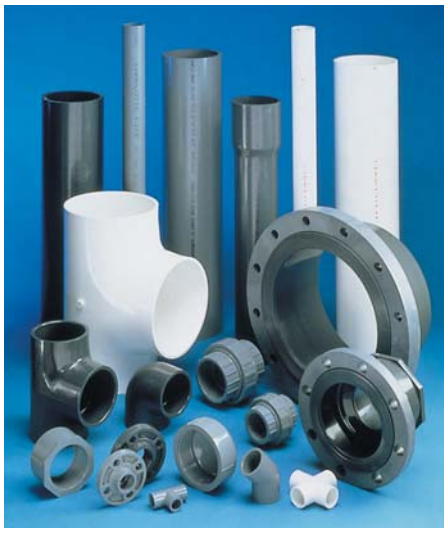
by Bill Morris

Solvent welding is a commonly used joining technique for thermoplastic pipe and fittings in the chemical processing industry. Polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) pipe and fittings are thermoplastic materials suitable for various chemical-processing applications. They are corrosion-resistant, can handle both acids and caustics and can withstand high temperatures and pressures. In addition, these materials are lower in cost and are easier to install and maintain than other alternatives.

Joining thermoplastic pipe and fittings to provide a tight, leak-free fit can be a simple task — if a few fundamentals are followed.

Cross-molecular bond and interference fit

Some installers believe a proper joint is made when the solvent cement hardens and fills the void between the pipe and the fitting. PVC and CPVC plastics, however, are softened, or "melted," by solvent cements. So when a softened pipe is forced into direct contact with a softened fitting, the thermoplastic material at the two surfaces forms a cross-molecular bond. Once the surfaces cure and harden back to their original state, the resulting weld is permanent.



Charlotte Pipe and Foundry manufactures a complete line of PVC Schedule 40 and 80, and Corzan® Schedule 80 industrial fittings and PVC and CPVC pipe.

The pipe and fitting must be forced in direct contact with each other to form a cross-molecular bond. For solvent-welded systems, the ASTM dimensional standards stipulate that the pipe outside diameter must be larger than the bottom of the fitting socket, creating an interference fit.

Six steps to a sound joint

Creating a sound joint requires more than an interference fit between pipe and fitting. Six basic steps help ensure a trouble-free piping system.

• *Cut the pipe square.* Because the joint seals at the very tip of the pipe, an angled cut diminishes the effect of the interference fit and may prevent the joint from sealing. Pipes should be cut square, properly de-burred and chamfered.

• *Heed ASTM adhesive standards.* The correct cement and primer must be used, as indicated by the applicable ASTM standard. Specifically formulated cements are available for PVC and CPVC plastics and varying pipe diameters. The wrong cement could provide unsatisfactory results. Primers remove contaminants, and also begin to soften the thermoplastic surface. Therefore, primer should be used on all PVC and CPVC Schedule 40 and 80 systems.

• *Choose the right applicator.* To make a proper joint, cement and primer must be applied with an applicator as wide or as long as one half the pipe's diameter. For example, a 6-inch system requires an applicator that is at least 3 inches wide or long. An undersized applicator prevents an adequate amount of cement or primer from being applied in the time necessary to make a proper joint.

• *Apply the materials properly.* Solvent cements and primers are designed to soften thermoplastics so long as the primer or cement is wet, they will continue to soften the surfaces. If the cement or primer is not properly applied, the pipe or fitting wall can be over-softened, resulting in joint failure, particularly in systems with a diameter of less than 2 inches.

A heavier coat of cement should be applied to the outside diameter of the pipe; a light trace coat to the inside diameter of the fitting socket. If this is done, any excess cement will be forced to the exterior of the socket when the pipe is inserted into the fitting, forming an even bead of cement at the socket entrance. An inspection of the interior of the assembly should show evidence of very little cement or primer.

• *Join securely and allow sufficient cure time.* The cure time is the time required to set a joint before performing a pressure test. Pipe diameter, air temperature, test pressure, fluid temperature and humidity influence cure times. For a 100-pounds-per-square-inch (psi) test with cold water, cure times can run from 10 minutes for ½-inch systems at 60°F, to as many as eight days for 16-inch systems at 0°F. Environments with higher test pressures, hot fluids, cooler air temperatures or high humidity all require longer cure times.

• *Specify pipe and fittings manufactured to the "nominal standard."* It is possible that pipe from one maker and fittings from another might not fit together properly, even though the materials meet all applicable ASTM standards. That's because according to ASTM standards, a 2-inch fitting, for example, can have an inside diameter that ranges between 2.365 and 2.375. A 2-inch pipe can have an outside diameter between 2.369 and 2.375, and still be within the standard.

If the pipe and fittings are manufactured to the middle of the standard (nominal), you would have a fitting measuring 2.370 and pipe measuring 2.375, ensuring contact during installation for a consistently tight or "interference" fit. But, if the fitting diameter is manufactured to the high end of the tolerance (2.375) and the pipe is manufactured to the low end

of the tolerance (2.369), you would have a gap between the pipe and fitting of .006, meaning insufficient contact between pipe and fitting for a strong weld (see box).

Specifying pipe and fittings manufactured to the nominal standard and following these simple installation steps will ensure a tight, reliable fit and a leak-free system every time. ■

Bill Morris is a technical sales manager at Charlotte Pipe and Foundry Company, Charlotte, NC. He may be reached at bmorris@charlottepipe.com. For further information, contact Charlotte Pipe and Foundry Company, P.O. Box 35430, Charlotte, NC 28235; (704) 372-5030, www.charlottepipe.com.

ASTM D-2467 PVC SCHEDULE 80	NOMINAL		ALLOWABLE VARIANCE	
2-inch Fitting (Socket Bottom)	2.370		2.370	
Tolerance +/- (0.005)	0.000		+0.005	
		2.370		2.375
2-inch Pipe	2.375		2.375	
	0.000		-0.006	
		2.375		2.369
Resulting Fit	Interference	+.005	Gap	-.006

Specifying pipe and fittings manufactured to the "nominal standard."