Thermoplastic Pipe Joint Repair

SCOPE

The most common method for repairing faulty and leaking joints is hot gas welding at the fillet formed by the junction of the fitting socket entrance and the pipe. Hot gas welding (which is similar to gas welding with metals except that hot gas is used for melting instead of a direct flame) consists of simultaneously melting the surface of a plastic filler rod and the surfaces of the base material in the fillet area while forcing the softened rod into the softened fillet. Welding with plastics involves only surface melting because plastics unlike metal must never be "puddled". Therefore, the resulting weld is not as strong as the parent pipe and fitting material. This being the case, fillet welding as a repair technique is recommended for minor leaks only. It is not recommended as a primary joining technique for pressure rated systems.

WELDING TOOLS AND MATERIALS

- Plastic welding gun with pressure regulator, gauge and hose.
- Filler rod
- Emery cloth
- Cotton rags
- Cutting pliers
- Hand grinder (optional)
- Compressed air supply of bottled nitrogen
- Source of compressed air

WELD AREA PREPARATION

Wipe all dirt, oil and moisture from the joint area. A very mild solvent may be necessary to remove oil.

CAUTION: MAKE SURE THAT ALL LIQUID HAS BEEN REMOVED FROM THE PORTION OF THE PIPING SYSTEM WHERE THE WELD IS TO BE MADE.

If backwelding is required, all residual cement, which is easily scorched during welding, must be removed from the fillet by using emery cloth. If the weld is to seal a threaded joint, a file can be used to remove threads in the weld area in order to provide a smooth surface.

WELDING BACK JOINTS

1. Remove residual solvent cement from the weld area using emery cloth. When welding threaded joints, a file can be used to remove threads in the weld area.


2. Wipe the weld area clean of dust, dirt and moisture.
3. Determine the amount for the correct filler rod necessary to make one complete pass around the joint by wrapping the rod around the pipe to be welded. Increase this length enough to allow for handling of the rod to the end of the pass.

4. Make about a 60° angular cut on the lead end of the filler rod. This will make it easier to initiate melting and will insure fusion of the rod and base material at the beginning of the weld.

5. Welding temperatures vary for different thermoplastic materials (500°F - 550°F for PVC and CPVC, 550°F – 600°F for PP, 575°F - 600°F for PVDF). Welding temperatures can be adjusted for the various thermoplastic materials as well as any desired welding rate, by adjusting the pressure regulator (which controls the gas flow rate) between 3 and 8 PSI.

CAUTION: For welding guns which require compressed gas, nitrogen is preferred when the compressed plant air system does not contain adequate drying and filtration. (Presence of moisture in the gas stream causes premature failure in the heater element of the welding gun. Impurities in the gas stream, particularly those in oil, may oxidize the plastic polymer, resulting in loss of strength. Polypropylene is known to be affected in this manner).

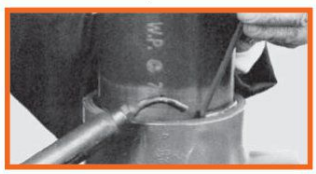
6. With air or an inert gas flowing through the welding torch, insert the electrical plug for the heating element into an appropriate electrical socket to facilitate heating of the gas and wait approximately 7 minutes for the welding gas to reach the proper temperature.

CAUTION: THE METAL BARREL OF THE WELDING TORCH HOUSES THE HEATING ELEMENT SO IT CAN ATTAIN EXTREMELY HIGH TEMPERATURES. AVOID CONTACT WITH THE BARREL AND DO NOT ALLOW IT TO CONTACT ANY COMBUSTIBLE MATERIALS.

7. Place the leading end of the filler rod into the fillet formed by the junction of the pipe and fitting socket entrance. Holding the filler rod at an angle of 90° to the joint for PVC, CPVC and Kynar, 75° to the joint for polypropylene, pre-heat the surfaces for the rod and base materials at the weld starting point by holding the welding torch steady at approximately

1/4 to 3/4 inches from the weld starting point and directing the hot gas in this area until the surfaces become tacky . While preheating, move the rod up and down slightly so that the rod slightly touches the base materials. When the surfaces become tacky, the rod will stick to the base material.

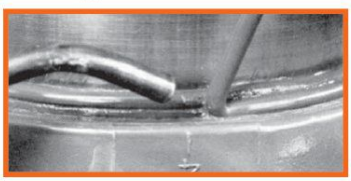
8. Advance the filler rod forward by applying a slight pressure to the rod. Simultaneously applying even heat to the surfaces of both the filler rod and base material by moving the torch with a fanning or arcing motion at a rate of about 2 cycles per second. The hot gas should be played equally on the rod and base material (along the weld line) for a distance of about 1/4 inch from the weld point.



IMPORTANT: If charring of the base or rod material occurs, move the tip of the torch back slightly, increase the fanning frequency or increase the gas flow rate. If the rod or base materials do not melt sufficiently reverse the previously discussed corrective procedures. Do not apply too much pressure to the rod because this will tend to stretch the weld bead causing it to crack and separate after cooling.

9. Since the starting point for a plastic weld is frequently the weakest part of the weld, always terminate a weld by lapping the bead on top of itself for a distance of 3/8 to 1/ 2 inches. Never terminate a bead by overlapping the bead side by side.

10. When welding large diameter pipe, three weld passes may be required. The first bead should be deposited at the bottom of the fillet and subsequent beads should be deposited on each side of the first bead. When making multiple pass welds, the starting points for each bead should be staggered and ample time must be allowed for each weld pass to cool before proceeding with additional welds.



11. Properly applied plastic welds can be recognized by the presence of small flow lines or waves on both sides of the deposited bead. This indicates that sufficient heat was applied to the surfaces of the rod and base materials to effect adequate melting and that sufficient pressure was applied to the rod to force the rod melt to fuse with base material melt. If insufficient heat is used when welding PVC, CPVC or PVDF, the filler rod will appear in its original form and can easily be pulled away from the base material. Excessive heat will result in a brown or black discoloration of the weld. In the case of polypropylene, excessive heat will result in a flat bead with oversized flow lines.

12. Always unplug the electrical connection to the heating element and allow the welding gun to cool before shutting off the gas or air supply to the gun.

WELDING PRINCIPLES

The procedures for making good thermoplastic welds can be summarized into four basic essentials:

1. Correct Heating – Excessive heating will char or overmelt. Insufficient heating will result in incomplete melting.
2. Correct Pressure – Excessive pressure can result in stress cracking when the weld cools. Insufficient pressure will result in incomplete fusion of the rod material with the base material.
3. Correct angle – Incorrect rod angle during welding will stretch the rod and the finished weld will crack upon cooling.
4. Correct speed – Excessive welding speed will stretch the weld bead and the finished weld will crack upon cooling.

Rod Size and Weld Passes

Filler rod size and the number of weld passes required to make a good plastic weld are dependent upon the size of the pipe to be welded as presented below. Do not use filler rod larger than 1/8" in diameter when welding with CPVC. Also, when welding CPVC, the number of passes for pipe sizes 1" through 2" should be increased to three.

PIPE SIZE	ROD SIZE	NUMBER OF PASSES
1/2" - 3/4"	3/32"	1
1" - 2"	3/32"	1 or 3
2-1/2" - 4"	1/8"	3
6" - 8"	1/8" or 5/32"	3
10" - 12"	5/32" or 3/16"	3

Pressure Testing

The strength of a plastic weld develops as it cools. Allow ample time for the weld to cool prior to 100% pressure testing.

CAUTION: Air or compressed gas is not recommended and should not be used as a media for pressure testing of plastic piping systems.