Thermo-Sealing (Socket Fusion) Instructions
For Polypropylene and PVDF Pressure Piping Systems

SCOPE
The socket fusion joining method which is detailed herein applies to all FABCO polypropylene and PVDF pressure piping systems including molded socket fittings, and socket type valve connections. This procedure involves the application of regulated heat uniformly and simultaneously to pipe and fitting mating surfaces so that controlled melting occurs at these surfaces.

All recommendations and instructions presented herein for socket fusion are based upon the use of a Thermo-Seal fusion tool for applying uniform heat to pipe and fittings.

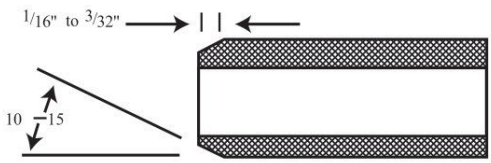
Joining Equipment and Materials
- Cutting tools
- Cotton rags
- Deburring tool
- Thermo-Seal tool
- Electric Model NA with 1/2" - 2" tool pieces or
- Electric Model NB with 1/2" - 4" tool pieces
- Vise

TYPES OF JOINING TOOLS
ELECTRIC MODEL tools are available for making socket fusion joints. They are the preferred socket fusion tools because the thermostatically controlled heat source automatically maintains fusion temperatures within the recommended range.

1. Electric Model NA. This tool which is electrically heated and thermostatically controlled, is used to join polypropylene and PVDF pipe, and valves and fittings in sizes 1/2" through 2". This unit operates on 110 VAC (6.7 amps; 800 watts) electrically and is fitted with ground wires.
2. Electric Model NB. This tool is also electrically heated and thermostatically controlled and is used to join polypropylene pipe and fittings in sizes 1/2" through 4". This unit operates on 110 VAC (1.38 amps; 1650 watts) electrically and is fitted with ground wires.

CAUTION: SOCKET FUSION AND FILLET WELDING INVOLVE TEMPERATURES IN EXCESS OF 540°F. SEVERE BURNS CAN RESULT FROM CONTACTING EQUIPMENT OR MOLTEN PLASTIC MATERIAL AT OR NEAR THESE TEMPERATURES.

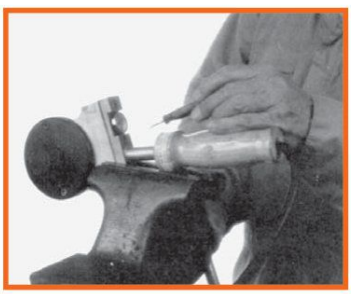
PREPARATION FOR JOINING
1. Cutting - Polypropylene or PVDF can be easily cut with a power or hand saw, circular or band saw. For best results, use the fine-toothed blades (16-18 teeth per inch). A circumferential speed of about 6,000 ft/min. is suitable for circular saws; band saw speed should be approximately 3,000 ft/min. Carbide-tipped blades are preferable when large quantities of pipe are to be cut. It is important that the pipe ends be cut square. To ensure square end cuts, a miter box, hold down or jig must be used. Pipe or tubing cutters can also be used to produce square, clean cuts, however, the cutting wheel should be specifically designed for plastic.
2. Deburring and Beveling - All burrs, chips, filing, etc., should be removed from both the pipe I.D. and O.D. before joining. Use a knife, deburring tool or half-round, coarse file to remove all burrs. All pipe ends should be beveled to approximately the dimensions shown below for ease of socketing and to minimize the chances of wiping melt material from the I.D. of the fitting as the pipe is socketed. The beveling can be done with a coarse file or a beveling tool.



3. Cleaning - Using a clean, dry cotton rag, wipe away all loose dirt and moisture from the I.D. and O.D. of the pipe end and the l.D. of the fitting. DO NOT ATTEMPT TO SOCKET FUSE WET SURFACES.
4. Joint Sizing - In order to provide excess material for fusion bonding, polypropylene and PVDF components are manufactured to socket dimensions in which the socket I.D. is smaller than the pipe O.D. Therefore, it should not be possible to easily slip the pipe into the fitting socket past the initial socket entrance depth and in no case should it ever be possible to bottom the pipe in the socket prior to fusion.
   Before making socket fusion joints, fittings should be checked for proper socket dimensional tolerances, based on the above discussion, by attempting to insert the pipe into the fitting socket. If a fitting socket appears to be oversize, it should not be used.
5. Planning Construction - Socket fusion joints are more easily made when there is sufficient space to properly secure the Thermo-Seal tool and to maneuver pipe and fittings into the Thermo-Seal tool. Therefore, it is recommended that the piping system be prefabricated, as much as possible, in an area where there is sufficient room to work, and that as few joints as possible should be made in areas where there is limited working space. Mechanical joints such as flanges or unions may be considered in extremely tight areas.
6. Thermo-Seal Tool Set Up
   a. Install the male and female tool pieces on either side of the Thermo-Seal tool and secure with set screws.

Thermo-Sealing Instructions

b. Insert the electrical plug into a grounded 110 VAC electrical source, and allow the tool to come to the proper operating temperature. The tool temperature is read directly from the mounted temperature gauge, and tool temperature can be adjusted by turning the thermostat adjustment screw with a screwdriver. (Counterclockwise) to raise the temperature and clockwise to lower the temperature.)



NOTE: One turn of the adjustment screw will give approximately a 25°F temperature change

IMPORTANT: Good socket fusion joints can be made only when the Thermo-Seal tool is operating at the proper temperature, and only when the length of time that the pipe and fittings remain on the heated tool pieces does not exceed those times recommended for the particular size of pipe and fitting to be joined. Please consult the user manual for your particular system.

Excessive temperatures and excessive heating times will result in excessive melting at and below the surfaces of the fitting socket I.D. and pipe O.D. When the pipe is inserted into the fitting socket, excessive melt material needed for socket fusion will be scraped from the socket wall and into the fitting waterway and the resulting joint will be defective. Low temperatures and insufficient heating times will result in a lack of or incomplete melting making it impossible to make a good socket fusion joint.

MAKING SOCKET FUSION JOINTS

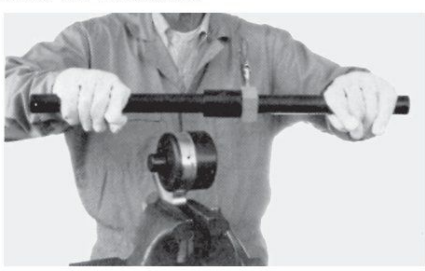
1. Place the proper size depth gauge over the end of the pipe.

2. Attach the depth gauging clamp to the pipe by butting the clampup to the end of the depth gauge and locking it into place. Then remove the depth gauge.

3. Simultaneously place pipe and fitting squarely and fully on heat tool pieces so that the I.D. of the fitting and the O.D. of the pipe are in contact with the heating surfaces. Care should be taken to insure that the pipe and fitting are not cocked when they are inserted on the tool pieces.

4. Hold the pipe and fitting on the tool pieces for the prescribed amount of time. During this time a bead of melted material will appear around the complete circumference of the pipe at the entrance of the tool piece.

5. Simultaneously remove the pipe and fitting from the tool pieces and immediately insert the pipe, squarely and fully and without purposeful rotation, into the socket of the fitting. Hold the completed joint in place and avoid relative movement between components for at least 15 seconds.



6. Once a joint has been completed the clamp can be removed and preparation for the next joint can be started.

7. The surfaces of the female and male tool pieces are Teflon coated to prevent sticking of the hot plastic. It is important that the tool pieces be kept as clean as possible. Any residue left on the tool pieces should be removed immediately by wiping with a cotton cloth. CAUTION: HOT PLASTIC MATERIAL CAN CAUSE SEVERE BURNS; AVOID CONTACT WITH IT.

Procedures for making good socket fusion joints can be summarized into five basic principles as follows:

1. The tool must be operated at the proper temperature.
2. The pipe end must be beveled.
3. The fitting must be slipped squarely onto the male tool while the pipe is simultaneously inserted into the female tool.
4. The fitting and pipe must not remain on the heat tool for an excessive period of time. Recommended heating times must be followed.
5. The pipe must be inserted squarely into the fitting socket immediately after removal from the heated tools.
6. The Thermo-Seal tool must be kept clean at all times.

PRESSURE TESTING

The strength of a socket fusion joint develops as the material in the bonded area cools. One hour after the final joint is made, a socket fusion piping system can be pressure tested up to 100% of its hydrostatic pressure rating.

CAUTION: AIR OR COMPRESSED GAS IS NOT RECOMMENDED AND SHOULD NOT BE USED AS A MEDIA FOR PRESSURE TESTING OF PLASTIC PIPING SYSTEMS.

FILLET WELDING

SCOPE

The joining procedure covered herein applies only to 6" polypropylene drainage or non-pressure systems. Fillet Welding is not recommended as a primary joining technique for pressure rated systems.

Joining Equipment and Materials

- Cutting and deburring tools
- Plastic welding gun with flexible hose, pressure regulator and gauge
- Welding and tacking tips
- Compresses air supply or bottled nitrogen (see note below)
- 1/8" welding rod
- Cotton rags

Joining

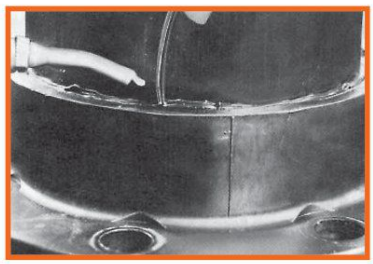
NOTE: Fillet welding of thermoplastics is quite similar to the acetylene welding or brazing process used with metals. The fundamental differences are that the plastic rod must always be the same basic material as the pieces to be joined; and heated gas, rather than burning gas, is used to melt the rod and adjacent surfaces. Because of its economy, compressed air is normally the gas of choice for most plastic welding. A welding gun which generates its own air supply is frequently desirable for field-made pipe joints where ultimate weld strength is not required. For welding guns which require compressed gas, nitrogen is preferable 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).

1. Insert pipe fully and squarely into the fitting after removing all dirt, oil, moisture and loose particles of plastic material from thewelding surfaces by wiping with a clean cotton cloth.

2. Adjust the nitrogen/air pressure between approximately 3 and 8 psi and further adjust the pressure as necessary to control both temperature and rate of welding.

NOTE: Tacking required prior to welding. 6" polypropylene joints require a slip fit. Therefore, they must be dry fitted and tack welded to prevent movement of the pipe and fitting prior to the application of welding rod. Special welding gun tips are required for tacking. A low strength bond is accomplished by pulling the heated tacking tip along while directly in contact with the interface of pipe and fitting at an angle of 75° to 80° . Initially, joints are tack-fused at four intervals.

Then at least one complete revolution around the joint is made to provide a uniform groove for subsequent rod welding.



3. Holding the polypropylene welding rod at an angle of 75° to the joint and while maintaining pressure on the rod, apply heat uniformly to the rod and the pipe and fitting with an arching motionof the welding torch.

The degree of heating can be controlled by regulating the nitrogen/air flow to the welding gun or by regulating the distance from the tip of the welding gun to the work. Too much heat will over melt the polypropylene material and cause it to splash. Too little heat will result in incomplete fusion. Lay three separate weld beads in the following manner for a full fillet weld:

A. Pipe to fitting
B. Pipe to bead
C. Fitting to bead

When terminating each weld bead, the bead should be lapped on top of (never along-side) itself for a distance of 3/8" to 1/2" insights to hot gas welding see REPAIRING THERMOPLASTIC PIPE JOINTS.

FLANGED JOINTS

SCOPE

Flanging is used extensively for plastic process lines that require periodic dismantling. Plastic flanges are factory flanged valves and fittings in PVC, CPVC, PVDF and polypropylene are available in a full range of sizes and types for joining to pipe by solvent welding, threading or socket fusion as in the case with polypropylene with PVDF.

Gasket seals between the flange faces should be an elastomeric full flat faced gasket with a hardness of 50 to 70 durometer. FABCO can provide neoprene gaskets in the 1/2" through 12" range having an 1/8" thickness. For chemical environments too aggressive for neoprene another resistant elastomer should be used.

When it is necessary to bolt plastic and metal flanges - use flat face metal flanges - not raised face, and use recommended torques shown in table under "INSTALLATION TIPS".

DIMENSIONS

Bolt circle and number of bolt holes for the flanges are the same as Class 150 metal flanges per ANSI B16.5. Threads are tapered iron pipe size threads per ANSI B1.20.1. The socket dimensions conform to ASTM D-2467 which describes 1/2" through 8" sizes and ASTM D439 for Schedule 80 CPVC which gives dimensional data for 1/2" through 6". Internal Fabco specifications have been established for the 10" and 12" PVC patterns and 8" CPVC design, as well as socket designs for polypropylene and PVDF.

PRESSURE RATING

As with all other thermoplastic piping components, the maximum non-shock operating pressure is a function of temperature.

Maximum pressure rating for FABCO valves, unions and flanges is 150 psi. Above 100°F refer to the TEMPERATURE CORRECTION FACTOR CHART HEREIN.

SEALING

The faces of flanges are tapered back away from the orifice area at a 1/2 to 1 degree pitch so that when the bolts are tightened the faces will be pulled together generating a force in the water way area to improve sealing.

INSTALLATION TIPS

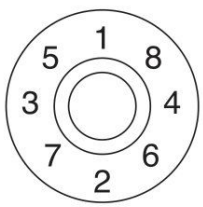
Once a flange is joined to pipe, the method for joining two flanges together is as follows:

1. Make sure that all the bolt holes of the mating flanges match up. It is not advisable to twist the flange and pipe to achieve this.
2. Use flat washers under bolt heads and nuts.
3. Insert all bolts. (Lubricate bolts.)
4. Make sure that the faces of the mating flanges are not separated by excessive distance prior to bolting down the flanges.
5. The bolts on the plastic flanges should be tightened by pulling down the nuts diametrically opposite each other using a torque wrench. Complete tightening should be accomplished in stages and the final torque values shown in the table should be followed for the various sizes of flanges. Uniform stress across the flange will eliminate leaky gaskets.

FLANGE SIZE	RECOMMENDED TORQUE*
1/2 - 1-1/2"	10 - 15 ft.lbs.
2 - 4"	20 - 30 ft.lbs.
6 - 8"	33 - 50 ft.lbs.
10"	53 - 75 ft.lbs.
12"	80 - 110 ft.lbs.

*For a well lubricated bolt with flat washers under bolt head and nut.

The following tightening pattern is suggested for the flange bolts.



6. If the flange is mated to a rigid and stationary flanged object, or a metal flange, particularly in a buried situation where settling could occur with the plastic pipe, the adjacent plastic pipe must be supported or anchored to eliminate potential stressing of the flange joint.