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An American National Standard

# Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings[1]

This standard is issued under the fixed designation F1290; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope*

1.1 This practice describes general procedures for making joints with polyolefin pipe and fittings by means of electrofusion joining techniques. This practice is applicable to electrofusion fittings that utilize resistance wire as the heating element. These should be regarded as general procedures and not as a substitute for the installation procedures specified by the manufacturers. Manufacturers should be requested to supply specific recommendations for joining their products. This practice does not purport to address all possible electrofusion joining procedures, or to preclude the use of qualified procedures developed by other parties that have been proven to produce reliable electrofusion joints.

NOTE 1—Reference to the manufacturer in this practice is defined as the electrofusion fitting manufacturer.

1.2 The techniques covered are applicable only to joining polyolefin pipe and fittings of related polymer chemistry, for example, polyethylenes to polyethylenes using a polyethylene electrofusion fitting. Consult the manufacturer's recommendations for compatibility of the electrofusion fitting with the specific pipe or fitting material to be joined.

1.3 The electrofusion joining technique described can produce sound joints between polyolefin pipe and fittings, provided that all products involved (that is, pipe and fittings) meet the appropriate ASTM specifications.

1.4 This practice is not limited by pipe or fitting size, however additional steps or procedures may be necessary when electrofusion joining to pipe of larger diameters. Consult the fitting manufacturer for additional specific instructions for joining their product.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1600 Terminology for Abbreviated Terms Relating to Plastics

F412 Terminology Relating to Plastic Piping Systems

F1055 Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing

## 3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *control box*—the apparatus placed between the power source and the electrofusion fitting to regulate energy input to the fitting.

3.2.2 *peeler*—a pipe surface preparation tool that uses a sharpened floating cutting blade to remove a controlled amount of outer pipe or fitting spigot material during the pipe preparation process for electrofusion joining.

3.2.3 *scraper*—a pipe surface preparation tool that uses a smooth or serrated blade that is dragged over the pipe surface to remove outer pipe or fitting spigot material during the pipe preparation process for electrofusion joining.

## 4. Significance and Use

4.1 Using the procedures in Sections 8 and 9, the manufacturer's instructions and equipment, pressure-tight joints can be made between manufacturer-recommended combinations of pipe that are as strong as the pipe itself.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

## 5. Operator Experience

5.1 Skill and knowledge on the part of the operator are required to obtain a good quality joint. Each operator shall be qualified in accordance with recommended procedures and any regulatory agency or industry organization that has jurisdiction over these practices.

5.2 These procedures require the use of electrical and mechanical equipment. The person responsible for the joining of polyolefin pipe and fittings should ensure that recommended procedures developed for the electrofusion fittings involved, including the safety precaution to be followed, are issued before joining operations commence. It is especially important that the operator be aware of specific instructions regarding the use of electrical equipment in the presence of a potentially explosive environment.

## 6. Electrofusion Joining Processes

6.1 Electrofusion is a heat-fusion joining process where a heat source is an integral part of the fitting. When electric current is applied, heat is produced, melting and joining the components. Fusion occurs when the joint cools below the melt temperature of the material. The specified fusion cycle used requires consideration of the properties of the materials being joined, the design of the fitting being used, and the environmental conditions. See Specification F1055 for performance requirements of polyethylene electrofusion fittings.

6.2 Adequate joint strength for field testing is attained when the fitting is not disturbed or moved until the joint material cools (Note 2). Bond strength can be affected if the joint is not allowed to cool sufficently.

NOTE 2—Polybutylene undergoes a crystalline transformation for several days after cooling below its melt temperature. Although this phenomenon has an effect on the ultimate physical properties of the material, its effect on testing of joints has not been found to be significant. If there is any question concerning the effects of crystallization, tests should be conducted on joints that have been conditioned for different periods of time in order to establish the conditioning-time relationship.

## 7. Classification

7.1 *Technique 1: Socket Type*—The electrofusion socket technique involves heat fusion of pipes with a fitting having tubular socket ends. Pipe sections (Note 3) are inserted in each end of the fitting. The socket contains an internal heat source. The heat source is a resistance wire coil located on the inner surface of the fitting. When electric current is applied, heat is produced in the fitting melting the inside of the fitting and the outside of the pipe. The melted material from the two components flow together and fuse as the joint cools. A clamping device should be used to secure the joint and hold it in axial alignment during the joining process. The device may be either an external clamp or one which is integral to the coupling.

NOTE 3—In 7 "pipe" refers to the end of a length of pipe or to a spigot end of a fitting such as a tee, elbow, valve, etc., having pipe dimensions that is the inlet or outlet of the component being joined.

7.2 *Technique 2: Saddle Type*—The electrofusion saddle technique involves heat fusion of a saddle fitting to the outer surface of a pipe. The heat source is located on the fusion surface of the concave base of the saddle fitting and can be either: (*1*) a resistance wire coil, or (*2*) a conductive polymer. When electric current is applied, heat is produced at the interface of the pipe and fitting, melting the surface of the two components. The fusion bond occurs when the melted materials of the two components flow together and cool below the melting temperature of the material. During the fusion process, a clamping device should be used to hold the fitting in place on the pipe. This device may be either an external clamp or one that is integral to the saddle fitting itself.

## 8. Apparatus

8.1 *General Recommendations:*

8.1.1 *Power Source*—An adequate source of electricity is required. Consult the manufacturer's recommendations for the type of power (ac or dc), input voltage, frequency (Hertz) and power output (KW) required for proper fusion of fittings. A transformer may be required if the source voltage differs from the voltage recommended by the manufacturer.

8.1.2 *Extension Cord*—If the power source is remote from the installation site, an extension cord may be required. Select an extension cord of sufficient conductor size to deliver the required voltage to the control box.

8.1.3 *Control Box*—A control box is required to deliver the appropriate amount of energy to the electrofusion fitting. Semi-automatic and fully automatic control boxes may incorporate either timers or sensing circuits which monitor temperatures, current, or pressures in the fittings during the fusion process. Control boxes may *(1)* incorporate a barcode scanning device that reads the input parameters on the electrofusion fitting, or *(2)* incorporate other means of sensing a value provided by the electrofusion fitting that determine the fusion parameters, or *(3)* allow manual input of fusion parameters. Not all control boxes are compatible with all electrofusion fittings. Consult the manufacturer to determine the compatibility of control boxes not made by the same manufacturer as the fitting.

8.1.4 *Alignment Devices*—Various types of alignment devices are available and may be required for a particular fitting. The alignment device should prevent movement of the components being joined during the fusion and cooling cycles.

8.1.5 *Surface Preparation Equipment*—The purpose of surface preparation is to remove surface contamination and oxidation from pipe or fitting spigot (Note 4) being joined.

NOTE 4—Surface preparation is very important to assure total fusion. To remove surface oxidation and contaminants that can prevent the fusion process from taking place the outer pipe surface must be removed. Not all surface preparation tools perform equally. Tools such as peelers that are designed to remove a controlled and measureable amount of surface material are recommended. Witness marks made on the surface to be prepared can visually aid the installer in verifying that the outermost surface is removed.

8.1.5.1 *Tools*—A surface cleaning tool is required for certain fitting designs to remove the outer layer or skin of material on the pipe or fitting spigot surface prior to fusion. Tools used for that purpose are commonly called scrapers or peelers. Only qualified procedures and approved tools should be used. Emery cloth or sandpaper is not recommended.

8.1.6 *Miscellaneous*—The following equipment may be useful to assist in the electrofusion joining procedure: