



Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings¹

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1. Scope

1.1 This practice describes criteria for the training, assessment and qualification of heat fusion equipment (HFE) operators in, but not limited to, a field environment in order to establish and maintain competency in the joining of Polyethylene (PE) and Polyamide (PA) piping systems.

1.2 This HFE operator training and qualification is applicable to heat fusion joining of PE pipe and fittings to other PE pipe and fittings of related polymer chemistry specified in the heat fusion procedures or standards used. It is also applicable to heat fusion joining of PA pipe and fittings to other PA pipe and fittings of the same polymer chemistry specified in the heat fusion procedures or standards used. The heat fusion between PE pipe and fittings to PA pipe and fittings is **NOT** allowed.

1.3 The HFE operator training and qualification shall be for butt fusion for either PE or PA piping products, using the specific brand and size range of fusion machine to be used by the HFE operator and the heat fusion procedures or standards specified. If the HFE operator trainee requests, the training shall also include saddle and/or socket fusion of PE pipe and fittings of related polymer chemistry specified in the heat fusion procedures or standards used. This standard does not include training on the electro-fusion of these piping products.

1.4 The HFE operator qualification shall be for one specific manufacturer's fusion machine or a size range of that manufacturer's hydraulic fusion machines or equipment that all operate in the same manner with the same hydraulic design and controls and the same heater and facer design. For smaller pipe sizes (6 in. and smaller), the qualification can be on a specific fusion machine or a combination of butt, saddle and/or socket fusion machines or equipment.

1.5 The HFE operator qualification shall be on specific heat fusion procedures or standards specified for PE and PA pipes. For PE pipe and fittings, this shall include Practice **F2620** or other company or pipe manufacturer's procedures, or a combination thereof. For PA-11 pipe and fittings, this shall include

Plastics Pipe Institute (PPI) Technical Report TR-45 or other company or pipe manufacturer's procedures. For other PA pipe materials, use other company or pipe manufacturer's procedures.

1.6 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2634 Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method

F3124 Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings

2.2 PPI Standards:³

TR-45 Butt Fusion Joining Procedure For Field Joining of Polyamide-11 (PA-11) Pipe

3. Terminology

3.1 Definitions:

3.1.1 *heat fusion equipment operator (HFE)*—an operator who has been trained to use specified heat fusion equipment to join specific thermoplastic pipe in accordance with a specified standard or procedure and has passed the tests outlined in this practice.

3.1.2 *heat fusion equipment (HFE) operator training organization*—a training organization dedicated to providing

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.

³ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.

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quality heat fusion training for HFE operators and instructors in accordance with Annex A1 of this practice.

3.1.3 *qualified (HFE) Operator Training Instructor*—an instructor who has been trained in the operation of the heat fusion equipment and the heat fusion procedure or standard being specified and has satisfied the requirements in A1.3 of this practice.

4. Summary of Practice

4.1 In order to obtain a HFE operators qualification card, the operator shall complete a training course from a Heat Fusion Equipment Operator Training Organization (see Annex A1) and pass a written examination and a performance examination.

4.2 The HFE operator trainee shall obtain training for the written examination from the Heat Fusion Equipment Operator Training Organization. This training can be in a training class or through an internet based training course or a combination of both and the written examination shall be given at the end of the training. The HFE operator trainee shall be trained in the areas outlined in Table 1 and Table 2 for the written and performance examination. The HFE operator trainee shall be given a minimum of 50 multiple choice questions and the HFE operator trainee is required answer 80% or more of the questions correctly to pass. The HFE operator trainee shall be allowed to use all course material provided, standard procedures provided and any notes the trainee has made during the training, while taking the written examination. The maximum time allowed for completing the examination shall be two (2) minutes times the number of questions on the examination.

4.3 The HFE operator trainee shall obtain performance training on the proper and safe operation of the specific brand and size range of fusion equipment the HFE operator trainee will be using. The training shall cover the heat fusion procedure or standard specified and how to use the fusion equipment

TABLE 1 Theoretical and General Information

Health and Safety
Pipe Handling
General personal protective equipment (PPE)
Electrical shock
Equipment is not explosion proof
Hydraulic pressure safety topics
Heater temperature issues
Pipe handling, installation and removal from the fusion machine
Operating the fusion machine carriage off of the chassis for in-ditch fusion
Safe lifting practices
How to fuse in adverse weather conditions
Pinch point to be aware of
Fuel, oil, etc. handling
Exhaust emission issues
Facer blades are sharp
Operating on an incline (fore and aft and side to side)
Pipe Information
ASTM standards for PE or PA pipes for different markets
Markings on the pipes and what they mean
Size and DR designations
Standard lengths of straight pipes
How to deal with coiled pipes
Standard fittings available for PE or PA pipes
General
Working in a trench and lifting the equipment
Power requirements for all fusion equipment

TABLE 2 Practical Information

Procedure Information
ASTM standard heat fusion procedures for butt, saddle and socket fusion as required or other joining procedure as required, or manufacturer's qualified procedures as required
Discuss the heat fusion joining procedures in detail
Discuss interfacial pressure, heater temperature, heater removal time and cooling time in detail
Go through the calculation details to obtain the fusion pressure and cooling time for a specific pipe OD and DR on a specific fusion hydraulic machine
On manual butt fusion machines, discuss the application of the fusion force in detail
Discuss data recording of the fusion process on hydraulic butt fusion machines and what it records.
Common causes of failures that is, insufficient soak, improper alignment/gap, heating under pressure, contamination
Equipment Information and Operation
Range of equipment and pipe sizes that the training will cover
Safety training on the equipment to be trained on
Basic operation information on the equipment to be trained on
Maintenance on the equipment and how to make sure the machine meets the manufacturer's specifications
Performance training on equipment to be trained on using the specified fusion procedure
On hydraulic machines, train each operator on using a Data Recording device on the equipment – how to use it and how to review the joint after the fusion. Remove the carriage from the chassis on the hydraulic fusion machines being trained on and show how to connect them together and operate them for in-ditch fusion applications, if applicable.
Show how to butt fuse fittings to the pipe
Teach how to detect and avoid typical fusion defects
Visual Inspection
How to evaluate the Data How to evaluate the fusion bead in accordance with the trained procedure
Recording Device information in accordance with the ASTM standard
Destructive Test Methods to check ductility in the butt fusion joints
Guided Side Bend Test
High Speed, Tensile Impact Test
In Field Tensile Test
Standard bend test for small diameter, thin wall pipe

to satisfy the heat fusion procedure or standard. At the end of the training, the HFE operator trainee shall be given an operator's performance examination which will include making a heat fusion joint to the heat fusion procedure or standard specified under the supervision of a qualified HFE operator training instructor and be able to do a visual inspection of the joint.

4.4 A destructive test or non-destructive test shall be performed on the heat fusion joint, made by the HFE operator trainee during the performance examination. The HFE operator trainee must pass 100% of the performance examination criteria, which includes following the specified heat fusion procedure or standard to make the heat fusion joint, passing the visual inspection of the joint made, accompanied by a passing result of the destructive joint tests or non-destructive tests (if approved by national codes or standards). The HFE operator trainee shall obtain the Heat Fusion Equipment Operators Qualification card if he or she passes the written examination and passes the performance examination outlined in this standard. This card shall outline the training organization, the name of the qualified operator, the specific manufacturer of the fusion equipment and the size range of the fusion equipment the operator is qualified to operate, and the specific heat fusion procedure or standard the operator was qualified on. The card may also have a mechanism to access the specific equipment the operator is qualified to operate on line, such as a web URL,