



Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings¹

This standard is issued under the fixed designation F3124; 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 specifies the data recording information that is recorded, when data recording equipment is used, on heat butt fusion joints in a plastic piping system in order to compare the procedure used in making the joint to the heat butt fusion joining procedure specified. This practice is suitable for use with all heat butt fusion joining procedures such as Practice F2620, Specification F3372, Specification F2945 international standards or other qualified procedures. This practice primarily applies to hydraulically operated heat butt fusion machines and can be utilized for documenting heat butt fusion joints completed with manually-operated fusion machines.

1.2 This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title means only that the document has been approved through the ASTM consensus process.

1.3 *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.*

1.4 *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.*

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. Referenced Documents

2.1 ASTM Standards:

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2945 Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings

F3372 Practice for Butt Fusion Joining of PA12 Pipe and Fittings

3. Terminology

3.1 Definitions:

3.1.1 *Data Recording Device ("Device")*—This is an instrument that obtains and stores information.

3.1.1.1 *Discussion*—This is generally an electronic device that accepts sensor input for pressure and time and manual input for other information. These Devices are typically small, battery powered, portable, and equipped with a microprocessor, internal memory for data storage, and connections for pressure sensors to the hydraulic fusion machine. Devices may interface with a personal computer and may utilize software to activate the Device and to view and analyze the collected data. Other Devices may have a local interface device, such as a keypad or touch sensing, LCD display, and can be used as a standalone device.

4. Summary of Practice

4.1 The principle of heat butt fusion of plastic pipe is to apply heat, at a designated temperature, to two prepared pipe ends for a heat soak period and then fuse them together by the application of a sufficient force, thereby resulting in fusion. This practice identifies the information that is collected by the data recording device about the heat butt fusion joint.

4.2 The Device records the hydraulic pressures and times during the butt fusion process for individual joints and manual entries as listed in 6.1.1.

4.3 The Device provides a reliable method for collecting and recording the parameters of the heat butt fusion process used to make heat butt fusion joints. This data can be compared to the Specified Standard or Procedure to review conformance.

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

5. Significance and Use

5.1 The Device record includes information about how the heat butt fusion joint was made (heater temperature, pressures and times for the heating, fusion and cooling steps) and other important information about the process, job, equipment used, etc. The Device record is compared to the specified heat butt fusion procedure parameters to determine if the procedure was followed correctly. For comparison purposes, a graph of time versus pressure is generated from the data record to show pressure changes that occur during the butt fusion process. Comparing the time versus pressure graph to the steps in the procedure helps determine that the procedure parameters were observed, (Note 1). (See Appendix X1.) These records may be downloaded from the device and stored.

5.2 When used in conjunction with manually-operated machines, the Device records information about the procedure used, the operator, the equipment, and the piping material. The Device may capture photographs of the set up (alignment and cleanliness) as well as the completed fusion bead. These records may be downloaded from the device and stored.

NOTE 1—The Device cannot show all aspects of the heat butt fusion conditions (such as wind, cold weather, blowing dust and sand, etc.) and does not preclude periodic joint testing as described in the applicable fusion standard or procedure.

6. Apparatus—General Requirements

6.1 Data Recording Device:

6.1.1 The Device shall be capable of collecting the following information:

- the heater plate temperature at the beginning of the heat cycle and the pressures applied during the heating, fusing and cooling cycle (hydraulic machine fusions)
- time for each stage of the process from the beginning of the heat cycle through the end of the cool cycle
- the operators name or identification number, or both
- the job name and/or number
- joint number
- the date and time
- the location
- the equipment manufacturer
- equipment model and serial number used
- temperature measuring device serial number (if present)
- the heat butt fusion procedure or standard used
- angle of miter (as applicable)
- the pipe/fitting manufacturer
- the pipe OD and DR
- pipe material and material designation
- lot # for pipe material (if available)
- drag pressure (hydraulic machine fusions)
- the interfacial pressure used (unless already included in the gauge pressure determination) (hydraulic machine fusions)
- Photos, as applicable per 7.4 and 7.5
- plus any notes about the job that would help evaluate the record such as:
 - o weather conditions: ambient temperature, wind speed
 - o job set-up issues
 - o use of an enclosure.

6.1.2 The Device shall be able to operate accurately under environmental conditions under which fusions may be accomplished.

6.1.3 The Device shall be able to output the data for the production of a time versus pressure graph of the fusion process when using a hydraulically-operated machine. See Appendix X1 for an example of a time versus pressure graph

that shows the pressures and times of the different steps in the heat butt fusion process.

6.1.4 The Device shall be able to record and store at least 24 h of continuous operation of heat butt fusion joint data.

6.1.5 The records in the Device shall be downloadable to a computer or other data storage device. (see Note 2.)

NOTE 2—The records should not be overwritten prior to downloading without a warning message to the user. Records should be offloaded before deleting the records from the Device.

6.1.6 Calibration requirements shall be followed per the manufacturer's recommendations.

6.1.7 The Device shall be capable of connecting to the hydraulic system of the butt fusion machine in order to record the pressures during the fusion cycle.

6.1.8 The Device, when used in conjunction with a hydraulically-operated machine shall calculate and recommend heat butt fusion pressures based on entered/provided pipe size information, interfacial pressure and type of heat butt fusion.

6.2 Pressure Transducer:

6.2.1 The pressure transducer shall be capable of measuring the hydraulic pressure used on the hydraulic fusion machine during the heat butt fusion procedure.

6.2.2 The pressure transducer shall be connected to the Device and to the hydraulic fusion machine for the purpose of transmitting hydraulic pressure data to the Device.

6.3 Temperature Measuring Device:

6.3.1 The temperature measuring device shall be capable of measuring the fusion equipment's heater plate surface temperature.

6.3.2 This temperature measuring device shall be a surface measuring device, infrared measuring device, or other method approved by company or pipe manufacturer's procedures, that is within its calibration period.

6.4 Data Security:

6.4.1 Data stored within the Device shall be protected to assure data integrity and confidentiality.

6.4.2 Fusion records collected by the Device shall not be deleted or edited.

6.4.3 Data exports from the Device shall be protected during transmission to ensure the information's privacy and that it cannot be deleted.

6.4.4 It is permissible for the fusion records of joints to be appended. (See 7.7.)

6.4.5 The Device shall be configured to ensure that all records of joints joint records are stored in such a manner to prevent deletion by the user.

7. Procedure

7.1 Unless automatically populated, the following information shall be entered into the Device:

7.1.1 Date and time

7.1.2 Operator's identification

7.1.3 Fusion equipment manufacturer, model and serial number being used on the job

7.1.4 The heat butt fusion standard or procedure parameters

7.1.5 Pipe information (manufacturer, pipe material and material designation, pipe OD and DR)

7.1.6 Pyrometer Temperature measuring device serial number (if present)

7.1.7 The type of fusion to be performed.

7.1.8 The location of the joint using GPS, other mapping tools, or other location reporting conventions.

7.2 The operator shall verify the following procedural requirements have been completed and document the completion into the Device.

7.2.1 The pipe ends and OD have been cleaned per the heat butt fusion standard or procedure being used.

7.2.2 The pipes have been faced, and the faced ends meet the heat butt fusion standard or procedure being used.

7.2.3 The pipe OD alignment satisfies the heat butt fusion standard or procedure being used

7.2.4 The heater surfaces were cleaned in accordance with the heat butt fusion standard or procedure.

NOTE 3—Photographs may be used to document the condition of the pipe ends prior to fusion and the alignment of the pipe

7.3 The operator shall measure the heater surface temperature with a temperature measuring device and enter the heater surface temperature into the Device.

7.4 When using a hydraulically-operated fusion machine the operator shall:

7.4.1 Measure the fusion machines drag pressure and enter the drag pressure in the Device.

7.4.2 Verify that the fusion pressure setting on the fusion machine agrees with the recommended fusion pressure from the Device.

7.4.3 Start the Device and insert the heater in the fusion machine.

7.4.4 Ensure that the pressure-time graph starting point has been established before bringing the pipe ends against the heater.

7.4.5 Follow the specified heat butt fusion procedure steps and fuse the pipe.

7.4.6 Once the cooling cycle is complete, stop recording on the Device. Compare the output of the Device to the specified fusion procedure parameters.

7.4.7 Consider capturing a photo of the completed joint.

7.5 When using a manually-operated fusion machine for heat butt fusion, the operator shall:

7.5.1 Verify the fusion parameters before starting the fusion procedure.

7.5.2 Start the Device and insert the heater in the fusion machine.

7.5.3 Follow the specified heat butt fusion procedure steps and fuse the pipe.

7.5.4 Once the cooling cycle is complete, stop recording on the Device.

7.5.5 Capture photo(s) of the completed joint.

7.6 The operator shall unclamp the fused pipe and visually inspect the joint in accordance with the specified heat butt fusion procedure. If the joint meets the visual inspection requirements and the recorded data (as applicable) agrees with the specified heat butt fusion procedure parameters, the joint is acceptable. If not, the joint record shall be recorded as unacceptable, the reason for the rejection recorded in the notes, and the joint shall be cut out.

7.7 The record of the joint in the Device shall be automatically locked at this point and no changes allowed except to add notes or pictures, or both, that might help clarify the record.

8. Operator Training

8.1 The fusion machine operator shall be trained on the specific fusion machine that is used to make the heat butt fusion joints and also shall be trained on the operation of the Device. Training documentation shall be retained.

9. Keywords

9.1 butt fusion; data recording; data recording device; heat fusion; time versus pressure graph

APPENDIX

(Nonmandatory Information)

X1. EXAMPLE DEVICE RECORD

X1.1 An example record is shown below. The record should include a time versus pressure graph from the time the pipe ends are brought against the heater plate through the end of the cooling cycle.

Example Record

1. Date/Time:
2. Joint Number:
3. Job Name and/or Number:
4. Employee ID:
5. Fusion Machine Manufacturer:
6. Fusion Machine Model:
7. Fusion Machine Serial Number:
8. Temperature measuring device serial number (if present)
9. Pipe Manufacturer:
10. Pipe Material/Material Designation:

11. Specified Heat Butt Fusion Standard or Procedure:
12. Pipe OD:
13. Pipe DR:
14. Type of fusion
15. For fusions completed using a hydraulically-operated fusion machine, recommended hydraulic butt fusion machine gauge pressure for the different steps in the heat butt fusion process:
 - Bead-up Pressure:
 - Heat Soak Pressure/Heat Pressure:
 - Fusion/Cooling Pressure/Heat Butt Fusion Pressure:
16. Drag Pressure:
17. Pipe and pipe ends were cleaned prior to clamping (yes/no):
18. Pipe ends were faced per the specified procedure (yes/no):
19. Pipe OD alignment meets the requirement in the specified procedure (yes/no):
20. Heater Surface Temperature: