Designation: F3124 – 15ε1

Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings[1]

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.

ε[1] NOTE—The title was editorially corrected and keywords were added in March 2015.

1. Scope

1.1 This practice specifies the data recording information that is recorded, when data recording equipment is used, on 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 that require measurable time and pressure profiles, such as Practice F2620, Specification F2785, Specification F2945 international standards or other qualified procedures. This practice applies to hydraulically operated heat butt fusion machines only and does not apply to manually operated fusion machines or specialized fabrication equipment for fittings in a controlled environment with proprietary procedures and processes.

1.2 *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:*

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2785 Specification for Polyamide 12 Gas Pressure Pipe, Tubing, and Fittings

F2945 Specification for Polyamide 11 Gas Pressure Pipe, Tubing, 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. The Device records the hydraulic pressures and times during the butt fusion process for individual joints and manual entries such as operator identification, product information, fusion parameters, and heater surface temperature.

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. (See Appendix X1.) These records may be downloaded from the device and stored.

6. Apparatus—General Requirements

6.1 *Data Recording Device:*

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

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- the heater temperature at the beginning of the heat cycle and the pressures applied during the heating, fusing and cooling cycle
- 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 number
- joint number
- the date and time
- the equipment manufacturer
- equipment model and serial number used
- the heat butt fusion procedure or standard used
- the pipe/fitting manufacturer
- the pipe OD and DR
- pipe material and material designation
- drag pressure
- the interfacial pressure used (unless already included in the gauge pressure determination)
- 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 the ambient conditions for which it is designed.

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. 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 1.)

NOTE 1—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 shall calculate and recommend heat butt fusion pressures based on entered/provided pipe size information and interfacial pressure.

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.

7. Procedure

7.1 Enter the correct date and time in the Device.

7.2 Enter the operator's identification in the Device.

7.3 Enter the fusion equipment manufacturer, model and serial number being used on the job in the Device.

7.4 Enter the heat butt fusion standard or procedure parameters into the Device.

7.5 Enter the pipe information (manufacturer, pipe material and material designation, pipe OD and DR) into the Device.

7.6 Verify that the pipe ends and OD have been cleaned per the heat butt fusion standard or procedure being used.

7.7 Verify that the pipes have been faced and the faced ends meet the heat butt fusion standard or procedure being used.

7.8 Verify that the pipe OD alignment satisfies the heat butt fusion standard or procedure being used in the Device.

7.9 Verify that the heater surfaces were cleaned in accordance with the heat butt fusion standard or procedure.

7.10 Measure the heater surface temperature with a calibrated temperature measuring device and enter the heater surface temperature into the Device.

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

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

7.13 Insert the heater in the fusion machine and start the Device. Ensure that the pressure-time graph starting point has been established before bringing the pipe ends against the heater. Follow the specified heat butt fusion procedure steps and fuse the pipe.

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

7.15 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 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.

7.16 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. Keywords

8.1 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 Number:
4. Employee ID:
5. Fusion Machine Manufacturer:
6. Fusion Machine Model:
7. Fusion Machine Serial Number:
8. Pipe Manufacturer:
9. Pipe Material/Material Designation:
10. Specified Heat Butt Fusion Standard or Procedure:
11. Pipe OD:
12. Pipe DR:
13. 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:
14. Drag Pressure:
15. Pipe and pipe ends were cleaned prior to clamping (yes/no):
16. Pipe ends were faced per the specified procedure (yes/no):
17. Pipe OD alignment meets the requirement in the specified procedure (yes/no):
18. Heater Surface Temperature:
19. Heater was cleaned per the specified procedure (yes/no):
20. The melt bead size between the pipe ends and the heater met the specified procedure used before removing the heater (yes/no):
21. Device Manufacturer and Model:
22. Add any notes about the joint, job set-up, enclosure used or weather conditions that could affect the data recorded.
23. Record and Visual Inspection Completed (Acceptable/Unacceptable).

X1.2 Operator Training

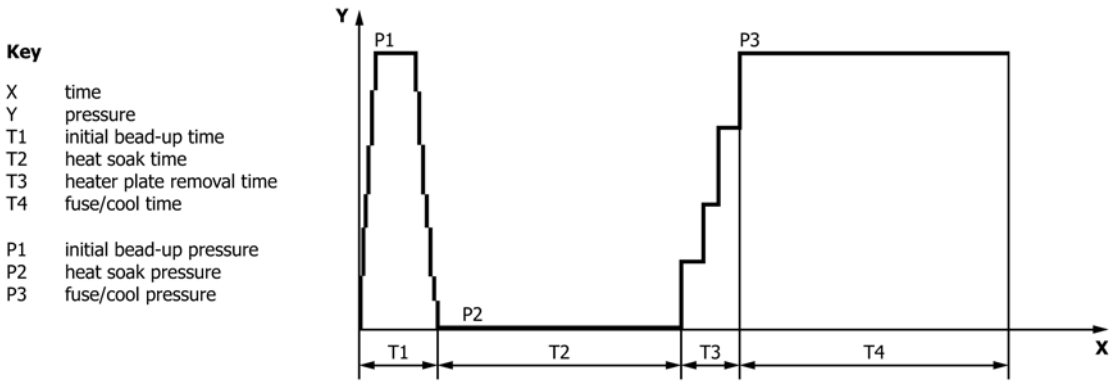
X1.2.1 The fusion machine operator should be trained on the specific fusion machine that is used to make the heat butt fusion joints and also should be trained on the operation of the Device used.

X1.3 Heat Butt Fusion Joint Quality

X1.3.1 Devices can provide 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 Company/Pipe Manufacturer Procedure, or both, to see if the proper parameters were followed. Be aware that this device can't show all aspects of the heat butt fusion conditions such as wind, cold weather, blowing dust and sand, etc. Because of this, it is suggested that, periodical joint testing should occur with an appropriate test (bend, tensile, etc.) to assure joint integrity.

X1.4 Marking of the Pipe

X1.4.1 So that joints may be identified at a later time, the joint should be permanently marked.



This graph will vary depending on the butt fusion procedure or material used. This is an example of a PE fusion graph per Practice F2620.

FIG. X1.1 Example Time versus Pressure Graph of the Fusion Joint