Designation: D2122 – 98 (Reapproved 2004)

An American National Standard

Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[1]

This standard is issued under the fixed designation D2122; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of diameter, wall thickness, and length dimensions of thermoplastic pipe. Included are procedures for measurement of the inside diameter of pipe intended to be joined by internal fittings, measurement of the average outside diameter for roundable pipe where out-of-roundness is not of primary concern, out-of-roundness measurement and measurement of the average outside diameter of non-roundable pipe, and for determining length and straightness.

1.2 This test method also includes procedures for dimensioning molded thermoplastic pipe fittings.

1.3 The values given in parentheses are provided for information purposes only.

1.4 *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]

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

F412 Terminology Relating to Plastic Piping Systems

F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings

2.2 *ANSI Standard:*[3]

B 2.1 Pipe Threads (Except Dryseal)

3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions are in accordance with Terminology F412, unless otherwise specified.

3.1.2 *deviation from straightness*—the maximum deviation from a straight line exhibited by a pipe specimen divided by the length of the specimen.

3.1.3 *nonroundable pipe*—pipe made from a material having a tensile or flexural modulus of elasticity of 150 000 psi (103 MPa) or greater, as determined by Test Method D638 or D790, and in addition, having an outside diameter/wall thickness ratio of less than 20.

3.1.3.1 *Discussion*—The above definitions apply to thermoplastic pipe and are based on the ability or inability of a pipe to round out when forced into a tapered socket.

3.1.4 *roundable pipe*—(*1*) pipe made from material having a tensile or flexural modulus of elasticity less than 150 000 psi (103 MPa) as determined by Test Method D638 or D790; and (*2*) pipe made from a material having a tensile or flexural modulus of elasticity of 150 000 psi (103 MPa) or greater, as determined by Test Method D638 or D790, and in addition, having an outside diameter/wall thickness ratio of 20 or greater.

3.1.5 *socket bottom*—the point at which the pipe stop radius intersects wall.

4. Summary of Test Method

4.1 *Alternate Methods*—Alternate methods and procedures for obtaining dimensions (such as apparatus and procedures using laser, electronic, nuclear, ultrasonic, or other means) are not prohibited.

4.1.1 The user of an alternate method shall validate the alternate method. The alternate method is validated when both the product is measured according to the Apparatus and Procedure sections presented in this test method, and when found to be in compliance with product specifications.

NOTE 1—Validation of the alternate method is a necessary step in ensuring compliance with product specifications. Validation generally involves statistical analysis of data generated using the alternate method.

[1] This test method is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.40 on Test Methods.

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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.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

At a minimum, the analysis should include calculating 99 % confidence limits and verifying that these limits are within the product specification tolerances. For guidance on this type of analysis, the user should consult the *Manual on Presentation of Data and Control Chart Analysis.*[4]

4.1.2 Compliance with product specifications shall be based on the measuring apparatus and procedures in this test method. While alternate methods are not prohibited, the measuring apparatus and procedure in this test method shall be the referee method.

5. Significance and Use

5.1 This test method provides for determining the physical dimensions of thermoplastic pipe and fittings. This test method is suitable for determination of dimensional compliance with product specifications.

6. General

6.1 *Specimen Preparation*—Pipe specimens shall be cleanly cut and burrs removed. Some materials, such as polyolefin plastics, may undergo dimensional change near cut ends due to internal stresses. When this condition is noted, care shall be taken to make measurements at a location which is not so affected.

6.2 *Conditioning*—Condition the test specimens at 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D618, for those tests where conditioning is required.

6.3 *Test Conditions*—Conduct tests in the Standard Laboratory Atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity, unless otherwise specified in the test methods or in this test method.

7. Wall Thickness—Pipe and Fittings

7.1 *Apparatus*—A cylindrical or ball anvil tubing micrometer accurate to within ±0.001 in. (±0.02 mm) shall be used for wall thickness measurements.

NOTE 2—Care should be taken to avoid excessive closure pressure when using ball anvil micrometers, which may compress the specimen and give falsely low readings. Care should be taken to avoid misalignment of the anvil with the longitudinal axis of the specimen when using cylindrical anvil micrometers, which may bridge specimen surface curvature or indentations and give falsely high readings.

7.2 *Procedure*—Make a series of measurements at closely spaced intervals to ensure that the minimum and maximum wall thicknesses have been determined. Make a minimum of eight measurements.

7.3 *Calculation*:

7.3.1 Calculate the average wall thickness by taking the average of all values measured.

7.3.2 Calculate the wall thickness range, E, as a percent, as follows:

$$E = \frac{A - B}{A} 100 \quad (1)$$

where:

A = maximum wall thickness at any cross section, and
B = minimum wall thickness at any cross section.

7.4 *Report*—Report the following information:

7.4.1 Observed minimum and maximum wall thicknesses,

7.4.2 Calculated average wall thickness, and

7.4.3 Calculated wall thickness range in percent.

8. Inside Diameter Measurement of Roundable Pipe

8.1 *Apparatus*—Depending on the requirements, the following apparatus shall be used:

8.1.1 *Tapered Plug Gage*, for checking conformance to an average inside diameter tolerance, having uniform taper of 1:100 and accurate to within ±1 % of its taper and to within ±0.001 in. (±0.02 mm) of its diameter. For each given pipe size and tolerance specification, a mandrel shall be scribed at the diameters representing the minimum and maximum allowable inside pipe diameters. To aid rounding, a 45° by ⅛-in. (3-mm) face bevel shall be provided on the entrance end of the gage.

NOTE 3—Where internal stresses cause change in dimension at the cut end of pipe, tapered plug or sleeve gage measurements may give misleading results.

8.1.2 *Metal Rule* (if it is desired to determine the actual average inside diameter) with at least 0.01-in. (0.2-mm) graduations.

8.2 *Procedure*:

8.2.1 Cut the end of the pipe square and remove burrs. Insert the plug gage into the pipe, causing it to round out but not to expand. Observe whether the end of the pipe falls between the scribed diameters.

8.2.2 In cases of disagreement between the purchaser and the seller, the proper insertion distance as indicated in 8.1.1 shall be defined as that point where an internal light source is just occluded.

8.2.3 If the actual average inside diameter is required, measure the distance from the maximum scribed diameter to the end of the pipe.

8.3 *Calculations*—Calculate the average inside diameter as follows:

$$d = d_m - kl \quad (2)$$

where:

d = average inside diameter, in. (or mm),
d_m = maximum scribed diameter, in. (or mm),
k = taper of plug gage, in. (or mm) of diameter per in. (or mm) of length, and
l = distance from maximum scribed diameter to end of pipe, in. (or mm).

8.4 *Report*—Report the following information:

8.4.1 When determining conformance to tolerances, report whether the average inside diameter is less than the minimum, greater than the maximum, or within the allowable limits as indicated by the position of the scribed diameters with respect to the end of the pipe.

8.4.2 If the actual average inside diameter is required, the result of the calculation in 8.3, as well as the values used in the

[4] Committee E11 on Quality and Statistics, *Manual on Presentation of Data and Control Chart Analysis,* Chapter 2, ASTM International, West Conshohocken, PA, 1990, p. 38.