Designation: D 3000 – 95a$^{\epsilon 1}$

An American National Standard

Standard Specification for Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Outside Diameter[1]

This standard is issued under the fixed designation D 3000; 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.

ε[1] NOTE—Changes were made editorially in October 1999.

1. Scope

1.1 This specification covers polybutylene (PB) pipe that is outside diameter controlled, made in standard thermoplastic pipe dimension ratios, and pressure rated for water (see Appendix). Included are criteria for classifying PB plastic pipe materials and PB plastic pipe, a system of nomenclature for PB plastic pipe, and requirements and methods of test for materials, workmanship, dimensions, sustained pressure, and burst pressure. Methods of marking are also given.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 7, of this specification: *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:*

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure[3]

D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings[3]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 1603 Test Method for Carbon Black in Olefin Plastics[2]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[3]

D 2581 Specification for Polybutylene (PB) Plastics Molding and Extrusion Materials[4]

D 2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials[3]

F 412 Terminology Relating to Plastic Piping Systems[3]

2.2 *NSF Standard:*

Standard No. 14 for Plastic Piping Components and Related Materials[5]

Standard No. 61 for Drinking Water Systems Components—Health Effects[5]

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified. The abbreviation for polybutylene plastic is PB.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *hydrostatic design stress*— the estimated maximum tensile stress in the wall of the pipe in the circumferential orientation due to internal hydrostatic water pressure that can be applied continuously with a high degree of certainty that failure of the pipe will not occur.

3.2.2 *pressure rating (PR)*—the estimated maximum pressure that water in the pipe can exert continuously with a high degree of certainty that failure of the pipe will not occur.

3.2.3 *relation between standard dimension ratio, hydrostatic design stress, and pressure rating*—the following expression, commonly known as the ISO equation,[6] is used in this specification to relate standard dimension ratio, hydrostatic design stress, and pressure rating:

$$2S/P = R - 1, \text{ or } 2S/P = (D_O/t) - 1 \quad (1)$$

where:

[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.26 on Olefin Based Pipe.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

[4] *Annual Book of ASTM Standards*, Vol 08.02.

[5] Available from the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

[6] ISO R 161–1960, Pipes of Plastics Materials for the Transport of Fluids (Outside Diameters and Nominal Pressures) Part 1, Metric Series.

S = hydrostatic design stress, Pa (or psi),
P = pressure rating, Pa (or psi),
D_O = average outside diameter, mm (or in.),
t = minimum wall thickness, mm (or in.), and
R = standard thermoplastic pipe dimension ratio (D_O/t for PB pipe).

3.2.4 *standard thermoplastic pipe dimension ratio (SDR)*—the standard thermoplastic pipe dimension ratio (SDR) is the ratio of pipe diameter to wall thickness. For PB pipe it is calculated by dividing the average outside diameter of the pipe in millimetres or in inches by the minimum wall thickness in millimetres or in inches. If the wall thickness calculated by this formula is less than 1.60 mm (0.062 in.), it shall be arbitrarily increased to 1.60 mm. The SDR values shall be rounded to the nearest 0.5.

3.2.5 *standard thermoplastic pipe materials designation code*—the pipe materials designation code shall consist of the abbreviation PB for the type of plastic, followed by the ASTM type and grade in Arabic numerals and the hydrostatic design stress in units of 100 psi with any decimal figures dropped. Where the hydrostatic design stress code contains less than two figures, a cipher shall be used before the number. Thus a complete number code shall consist of two letters and four figures for PB plastic pipe materials (see 5.2).

4. Pipe Classification

4.1 *General*—This specification covers PB pipe made from one PB plastic pipe material in four standard dimension ratios and four water pressure ratings.

4.2 *Standard Thermoplastic Pipe Dimension Ratios (SDR)*—This specification covers PB pipe in four standard dimension ratios, namely 9, 11, 13.5, and 17. These are referred to as SDR 9, SDR 11, SDR 13.5, and SDR 17, respectively. The pressure rating is uniform for all nominal pipe sizes for a given PB pipe material and SDR (see Table X1.1).

5. Materials

5.1 *General*—Polybutylene plastics used to make pipe meeting the requirements of this specification are categorized by means of two criteria, namely (*1*) short-term strength tests, and (*2*) long-term tests. Since the maximum physical properties of the pipe are not developed until 10 days after extrusion, burst testing must be delayed for this period.

5.2 *Basic Materials*—This specification covers PB pipe made from Type II, Grade 1 (PB) Plastic as defined in Specification D 2581.

5.3 *Hydrostatic Design Stress*—This specification covers PB pipe made from PB plastics as defined by hydrostatic design stress developed on the basis of long-term tests (Appendix).

5.4 *Compound*—The PB plastic extrusion compound shall meet the requirements of Type II, Grade 1, Class B, or Class C as described in Specification D 2581.

5.5 *Rework Material*—Clean, rework material generated from the manufacturer's own pipe production, is capable of being used by the same manufacturer, as long as the pipe produced meets all the requirements of this specification.

6. Requirements

6.1 *Workmanship*—The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.2 *Dimensions and Tolerances*:

6.2.1 *Outside Diameters*—The outside diameters and tolerances shall be as shown in Table 1 when measured in accordance with 7.4 and 7.4.1. Maximum and minimum (out-of-roundness) tolerances apply only to measurements made on pipe prior to coiling, or as rounded by manufacturer's recommended rounding tool.

6.2.2 *Wall Thicknesses*—The wall thicknesses and tolerances shall be as shown in Table 2 when measured in accordance with 7.4 and 7.4.2.

6.2.3 *Wall Thickness Range*—The wall thickness range shall be within 12 % when measured in accordance with 7.4 and 7.4.3.

6.3 *Carbon Black*—The polybutylene pipe extrusion compound, Type II, Grade 1, Class C, shall contain at least 2 % carbon black when tested in accordance with 7.5.

6.4 *Sustained Pressure*—The pipe shall not fail, balloon, burst, or weep as defined in Test Method D 1598, at the test pressures calculated to produce the specified fiber stress for each specimen's physical dimensions, when tested in accordance with 7.6.

6.5 *Burst Pressure*—The minimum burst pressure for PB plastic pipe shall be as calculated to produce the specified fiber stress for each specimen's physical dimensions, when determined in accordance with 7.7 and Table 3.

7. Test Methods

7.1 *Conditioning*—Because of the crystalline transformation which takes place after polybutylene resins are cooled from the melt, it is necessary to delay physical testing until 10 days after pipe extrusion. During this 10-day period the pipe shall be stored at temperatures between 4.4 and 37.8° C (40 and 100° F). The test specimen shall be taken after 8 days and conditioned at 23 ± 2° C (73.4 ± 3.6° F) and 50 ± 5 % relative humidity for not less than 40 h prior to test in

TABLE 1 Outside Diameters and Tolerances for PB Plastic Pipe

Nominal Pipe Size, in.	Average Outside Diameter, in.	Tolerances	
		For Average, in.	For Max and Min (Out-of-Roundness),[A] in.
½	0.840	±0.004	±0.008
¾	1.050	±0.004	±0.010
1	1.315	±0.005	±0.010
1¼	1.660	±0.005	±0.012
1½	1.900	±0.006	±0.012
2	2.375	±0.006	±0.012
2½	2.875	±0.007	±0.015
3	3.500	±0.008	±0.015
4	4.500	±0.009	±0.015
6	6.625	±0.011	±0.035

[A] Maximum and minimum (out-of-roundness) apply only to measurements made on pipe as extruded, or as rounded by manufacturers recommended rounding tool.