NOTICE: This standard has either been superseded and replaced by a new version or discontinued.
Contact ASTM International (www.astm.org) for the latest information.

Designation: D 3035 – 95

An American National Standard

Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter[1]

This standard is issued under the fixed designation D 3035; 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 specification covers polyethylene (PE) pipe made in thermoplastic pipe dimension ratios based on outside diameter and pressure rated for water (see Appendix X1). Included are criteria for classifying PE plastic pipe materials and PE plastic pipe, a system of nomenclature for PE plastic pipe, and requirements and test methods for materials, workmanship, dimensions, sustained pressure, burst pressure, and environmental stress cracking. Methods of marking are also given.

1.2 All pipes produced under this specification may be used for the transport of water, industrial process liquids, effluents, slurries, municipal sewage, etc. The user should consult the manufacturer to determine whether the material being transported is compatible with polyethylene pipe and will not affect the service life beyond limits acceptable to the user.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 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 792 Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement[2]

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer[2]

D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials[2,3]

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique[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[2,3]

D 1603 Test Method for Carbon Black in Olefin Plastics[4]

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

D 2290 Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method[3]

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

D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials[3,5]

F 412 Terminology Relating to Plastic Piping Systems[3]

2.2 *NSF Standards:*

Standard No. 14 for Plastic Piping Components and Related Materials[6]

Standard No. 61 for Drinking Water Systems Components—Health Effects[6]

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.

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.

[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.

Current edition approved Sept. 10, 1995. Published November 1995. Originally published as D 3035 – 72. Last previous edition D 3035 – 93.

[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] *Annual Book of ASTM Standards*, Vol 08.03.

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

Copyright © ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, United States.

3.2.3 *relation between dimension ratio, hydrostatic design stress, and pressure rating*—the following expression, commonly known as the ISO equation,[7] is used in this specification to relate dimension ratio, hydrostatic design stress, and pressure rating:

$$2S/P = R-1 \text{ or } 2S/P = (D_0/t) - 1 \quad (1)$$

where:

S = hydrostatic design stress, psi (MPa),
P = pressure rating, psi (MPa),
D_0 = average outside diameter, in. (mm)
t = minimum wall thickness, in. (mm), and,
R = thermoplastic pipe dimension ratio (D_0/t for PE pipe).

3.2.4 *thermoplastic pipe dimension ratio (DR)*—the ratio of pipe diameter to wall thickness. For PE pipe covered by this specification it is calculated by dividing the average outside diameter of the pipe, in inches, by the minimum wall thickness, in inches. If the wall thickness calculated by this formula is less than 0.062 in. (1.6 mm), it shall be arbitrarily increased to 0.062 in.

3.2.5 *thermoplastic pipe materials designation code*—the polyethylene pipe materials designation code shall consist of the abbreviation PE for the type of plastics, followed by the ASTM 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 zero shall be used before the number. Thus, a complete material code shall consist of two letters and four figures for PE plastic pipe materials (see Section 5).

4. Pipe Classification

4.1 *General*—This specification covers PE pipe made from seven PE plastic pipe materials in various dimension ratios and water pressure ratings.

4.2 *Thermoplastic Pipe Dimension Ratios* (DR)—This specification covers PE pipe in various dimension ratios such as, but not limited to, DR 11, DR 13.5, DR 17, and DR 21. The pressure rating is uniform for all nominal sizes of pipe for a given PE pipe material and DR. (See Table X1.1.)

4.3 *Special Sizes*—Where existing system conditions or special local requirements make other diameters or dimension ratios necessary, other sizes or dimension ratios, or both, shall be acceptable in engineered products when mutually agreed upon by the customer and manufacturer if (*1*) the pipe is manufactured from plastic compounds meeting the material requirements of this specification and (*2*) the strength and design requirements are calculated on the same basis as those used in this specification.

5. Materials

5.1 *General*—Polyethylene 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 strength tests.

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

NOTE 1—Piping intended for use in the transport of potable water should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority. The evaluation should be in accordance with requirements for chemical extraction, taste, and odor that are no less restrictive than those included in NSF Standard No. 14. The seal or mark of the laboratory making the evaluation should be included on the piping.

5.2 *Basic Materials*—This specification covers PE pipe made from five PE plastics as defined in Specification D 1248, in which the requirements are based on short-term tests. These are Grade P 14, Grade P 23, Grade P 24, Grade P 33, and Grade P 34. The PE plastics can also be described in accordance with the appropriate cell classification as defined in Specification D 3350. The 176°F (80°C) sustained pressure performance requirements of 6.8 (pipe test category in Table 5) are not currently in PE material Specifications D 1248 or D 3350. To identify the correct pipe test category (C1 to C 7), the PE material base resin density and melt index must be obtained from the PE material supplier.

NOTE 2—Committee F-17 has requested that Committee D-20 add the 176°F (80°C) sustained pressure performance requirements to Specifications D 1248 and D 3350.

5.3 *Hydrostatic Design Stresses*—This specification covers PE pipe made from PE plastics as defined by four hydrostatic design stresses developed on the basis of long-term tests (Appendix X1).

5.4 *Compound*—The PE plastic extrusion compound shall meet the requirements of either Grade P 14, Class B or C; Grade P 23, Class B or C; Grade P 24, Class B or C; Grade P 33, Class B or C; or Grade P 34, Class B or C materials as described in Specification D 1248. As shown in Specification D 1248, these codes describe type, class, category, and grade, for example, for the Type I, Class C, Category 4, Grade P 14 Compound, the code is D 1248-IC4-P14. The compound may also be described by the comparable cell classification as defined in Specification D 3350.

5.4.1 Class B compounds shall have sufficient UV stabilizer to protect pipe from deleterious effects due to continuous outdoor exposure during storage and shipping. Pipe produced from Class B compounds are not suitable for exposed outdoor application. Class B and C compounds shall have sufficient antioxidants to meet requirements in Specification D 3350.

NOTE 3—Pipe users should consult with the pipe manufacturer about the outdoor exposure life of the product under consideration.

5.5 *Rework Material*—Clean, rework material, of the same type and grade generated from the manufacturer's own pipe production, may be 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

iTeh Standards (https://standards.iteh.ai) Document Preview
ASTM D3035-95
https://standards.iteh.ai/catalog/standards/sist/bc6330...-4e90e32/astm-d3035-95

TABLE 1 Outside Diameters and Tolerances for DR-PR PE Plastic Pipe

Nominal Pipe Size, in.	Outside Diameter, in. (mm)	Tolerances, in. (mm)
½	0.840 (21.34)	±0.004 (0.10)
¾	1.050 (26.7)	±0.004 (0.10)
1	1.315 (33.4)	±0.005 (0.13)
1¼	1.660 (42.2)	±0.005 (0.13)
1½	1.900 (48.3)	±0.006 (0.15)
2	2.375 (60.3)	±0.006 (0.15)
3	3.500 (88.9)	±0.008 (0.20)
4	4.500 (114.3)	±0.009 (0.23)
6	6.625 (168.28)	±0.011 (0.28)
8	8.625 (219.08)	±0.013 (0.33)
10	10.750 (273.05)	±0.015 (0.38)
12	12.750 (323.85)	±0.017 (0.43)
14	14.000 (355.60)	±0.063 (1.60)
16	16.000 (406.40)	±0.072 (1.83)
18	18.000 (457.20)	±0.081 (2.06)
20	20.000 (508.00)	±0.090 (2.29)
22	22.000 (558.80)	±0.099 (2.51)
24	24.000 (609.60)	±0.108 (2.74)

accordance with Test Method D 2122. For diameters not shown in Table 1, the tolerances shall be the same percentage of the outside diameter as those for the closest listed diameter.

6.2.2 *Wall Thicknesses*—The wall thicknesses and tolerances shall be as shown in Table 2 when measured in accordance with Test Method D 2122. For wall thicknesses (DRs) not shown in Table 2, the tolerances shall be the same percentage of the calculated minimum wall as for the closest listed minimum wall thickness.

6.2.3 *Wall Thickness Range*—The wall thickness range shall be within 12 % when measured in accordance with Test Method D 2122.

6.3 *Carbon Black*—Class C polyethylene pipe extrusion compound shall contain at least 2 % carbon black when tested in accordance with 7.4.

NOTE 4—The amount of pigment in Class B polyethylene is not established by the specification other than the compound shall meet all other requirements and the piping shall meet all long- and short-term requirements of this specification.

6.4 *Density*—The polyethylene base resin (uncolored PE) in the pipe compound shall have a density in the range from 0.910 to 0.925 g/cm^3 for pipe made from Grade P 14; 0.926 to 0.940 g/cm^3 for pipe made from Grade P 14; 0.926 to 0.940 g/cm^3 for pipe made from Grade P 23 and Grade P 24; and 0.941 to 0.965 g/cm ^{3} for pipe made from Grade P 33 or Grade P 34 of Specification D 1248, when determined in accordance with 7.5.

6.5 *Sustained Pressure*—The pipe shall not fail, balloon, burst, or weep as defined in Test Method D 1598, at the test pressures given in Table 3, when tested in accordance with 7.7.

6.6 *Burst Pressure*—The minimum burst pressure for PE plastic pipe shall be as given in Table 4, when determined in accordance with Test Method D 1599.

6.7 *Environmental Stress Cracking*— There shall be no loss of pressure in pipes made from Grade P 14, P 23, and P 33 materials when tested in accordance with 7.8. Pipes made from Grade P 24 or Grade P 34 materials are exempt from this requirement because an environmental stress cracking requirement for these materials is included under Specification D 1248.

6.8 *Elevated Temperature Sustained Pressure*—The average failure time must meet or exceed the specified minimum average failure time in Table 5 for both hoop stresses of a given pipe test category when tested in accordance with 7.9.

6.9 *Apparent Ring Tensile Strength*— The minimum apparent ring tensile strength at yield shall be as shown in Table 6 when tested in accordance with 7.10.

NOTE 5—The short-term hoop stress of a PE plastic pipe can be determined in accordance with either 6.6 or 6.9.

7. Test Methods

7.1 *Conditioning*—Condition the test specimens for not less than 40 h prior to test in accordance with Procedure A of Practice D 618, for those tests where conditioning is required.

7.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 73 ± 3.6°F (23 ± 2°C), unless otherwise specified in the test methods or in this specification.

7.3 *Sampling*—The selection of the sample or samples of pipe shall be as agreed upon by the purchaser and the seller. In case of no prior agreement, random samples as selected by the testing laboratory shall be deemed adequate.

7.4 *Carbon Black*—Determine in duplicate the carbon black content of the Class C pipe compound in accordance with Test Method D 1603.

7.5 *Density*—Determine the density of the pipe compound in accordance with Test Method D 1505, or Test Method D 792, using three specimens.

7.6 *Base Density*:

7.6.1 *Class C Compounds*—Determine the percentage of carbon black by weight in accordance with 7.4. Calculate the density of the PE base resin (uncolored PE) in the pipe compound as follows:

$$D_R = D_p - 0.0044\,C \quad (2)$$

where:

D_R = density of resin, g/cm^3,
D_p = density of pipe compound, g/cm^3 and,
C = weight percent of carbon black.

7.6.2 *Class B Compounds*—The methods for determining percent pigment in Class B compounds and their effect on density varies with the type pigment. Consult with pipe compound manufacturer for procedure to determine base density for specific compounds.

7.7 *Substained Pressure Test*—Select the test specimens at random. Test 12 specimens of pipe, individually, with water at two controlled temperatures under the pressures given in Table 3. Test each specimen at least ten times the nominal diameter in length, but not less than 10 in. (250 mm) or more than 3 ft (1000 mm) between end closures and containing the permanent marking on the pipe. Test six specimens at each temperature. Maintain the specimens at the pressures indicated for the appropriate temperature for a period of 1000 h. Hold the pressure as closely as possible, but within ±10 psi (±70 kPa). Condition the specimens for at least 2 h to within ±3.6°F (±2°C) of the specified temperature. Test in accordance with Test Method D 1598, except maintain the pressure at the values given in Table 3 for 1000 h. Failure of two of the six specimens tested at either temperature constitutes failure in the test. Failure of one of the six specimens tested at either temperature

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ASTM D3035-95
https://standards.iteh.ai/catalog/standards/sist/bc6339...67-4566-9886-82a8a4e90e32/astm-d3035-95

TABLE 2 Wall Thicknesses and Tolerances[A] for DR-PR PE Plastic Pipe

Nominal Pipe Size, IPS, in.	DR 32.5				DR 26				DR 21				DR 17				DR 15.5			
	Mininum		Tolerance		Minimum		Tolerance		Minimum		Tolerance		Minimum		Tolerance		Minimum		Tolerance	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
½	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)
¾	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.068	(1.73)	0.020	(0.51)
1	0.062	(1.57)	0.020	(0.51)	0.062	(1.57)	0.020	(0.51)	0.063	(1.60)	0.020	(0.51)	0.077	(1.96)	0.020	(0.51)	0.084	(2.13)	0.020	(0.51)
1¼	0.062	(1.57)	0.020	(0.51)	0.064	(1.63)	0.020	(0.51)	0.079	(2.01)	0.020	(0.51)	0.098	(2.49)	0.020	(0.51)	0.107	(2.72)	0.020	(0.51)
1½	0.062	(1.57)	0.020	(0.51)	0.073	(1.85)	0.020	(0.51)	0.090	(2.29)	0.020	(0.51)	0.112	(2.84)	0.020	(0.51)	0.123	(3.12)	0.020	(0.51)
2	0.073	(1.85)	0.020	(0.51)	0.091	(2.31)	0.020	(0.51)	0.113	(2.87)	0.020	(0.51)	0.140	(3.56)	0.020	(0.51)	0.153	(3.89)	0.020	(0.51)
3	0.108	(2.74)	0.020	(0.51)	0.135	(3.43)	0.020	(0.51)	0.167	(4.24)	0.020	(0.51)	0.206	(5.23)	0.025	(0.64)	0.226	(5.74)	0.027	(0.69)
4	0.138	(3.51)	0.020	(0.51)	0.173	(4.39)	0.021	(0.53)	0.214	(5.44)	0.026	(0.66)	0.265	(6.73)	0.032	(0.81)	0.290	(7.37)	0.035	(0.89)
5	0.171	(4.34)	0.021	(0.53)	0.214	(5.44)	0.026	(0.66)	0.265	(6.73)	0.032	(0.81)	0.327	(8.31)	0.039	(0.99)	0.359	(9.12)	0.043	(1.09)
6	0.204	(5.18)	0.024	(0.61)	0.255	(6.48)	0.031	(0.79)	0.315	(8.00)	0.038	(0.97)	0.390	(9.91)	0.047	(1.19)	0.427	(10.85)	0.051	(1.30)
8	0.265	(6.73)	0.032	(0.81)	0.332	(8.43)	0.040	(1.02)	0.411	(10.44)	0.049	(1.24)	0.507	(12.88)	0.061	(1.55)	0.556	(14.12)	0.067	(1.70)
10	0.331	(8.41)	0.040	(1.02)	0.413	(10.49)	0.050	(1.27)	0.512	(13.00)	0.061	(1.55)	0.632	(16.05)	0.076	(1.93)	0.694	(17.63)	0.083	(2.11)
12	0.392	(9.96)	0.047	(1.19)	0.490	(12.45)	0.059	(1.50)	0.607	(15.42)	0.073	(1.85)	0.750	(19.05)	0.090	(2.29)	0.823	(20.90)	0.099	(2.51)
14	0.431	(10.95)	0.052	(1.32)	0.538	(13.67)	0.065	(1.65)	0.667	(16.94)	0.080	(2.03)	0.824	(20.93)	0.099	(2.51)	0.903	(22.94)	0.108	(2.74)
16	0.492	(12.50)	0.059	(1.50)	0.615	(15.62)	0.074	(1.88)	0.762	(19.35)	0.091	(2.31)	0.941	(23.90)	0.113	(2.87)	1.032	(26.21)	0.124	(3.15)
18	0.554	(14.07)	0.066	(1.68)	0.692	(17.58)	0.083	(2.11)	0.857	(21.77)	0.103	(2.62)	1.059	(26.90)	0.127	(3.23)	1.161	(29.49)	0.139	(3.53)
20	0.615	(15.62)	0.074	(1.88)	0.769	(19.53)	0.092	(2.34)	0.952	(24.18)	0.114	(2.90)	1.176	(29.87)	0.141	(3.58)	1.290	(32.77)	0.155	(3.94)
22	0.677	(16.94)	0.081	(2.06)	0.846	(21.49)	0.102	(2.59)	1.048	(26.62)	0.126	(3.20)	1.294	(32.87)	0.155	(3.94)	1.419	(36.04)	0.170	(4.32)
24	0.738	(18.75)	0.089	(2.26)	0.923	(23.44)	0.111	(2.82)	1.143	(29.03)	0.137	(3.48)	1.412	(35.86)	0.169	(4.29)	1.548	(39.32)	0.186	(4.72)

Nominal Pipe Size, IPS, in.	DR 13.5				DR 11				DR 9.3				DR 9				DR 7			
	Mininum		Tolerance		Minimum		Tolerance		Minimum		Tolerance		Minimum		Tolerance		Minimum		Tolerance	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
½	0.062	(1.57)	0.020	(0.51)	0.076	(1.93)	0.020	(0.51)	0.090	(2.29)	0.020	(0.51)	0.093	(2.36)	0.020	(0.51)	0.120	(3.05)	0.020	(0.51)
¾	0.078	(1.98)	0.020	(0.51)	0.095	(2.41)	0.020	(0.51)	0.113	(2.87)	0.020	(0.51)	0.117	(2.97)	0.020	(0.51)	0.150	(3.81)	0.020	(0.51)
1	0.097	(2.46)	0.020	(0.51)	0.120	(3.05)	0.020	(0.51)	0.141	(3.58)	0.020	(0.51)	0.146	(3.71)	0.020	(0.51)	0.188	(4.78)	0.023	(0.58)
1¼	0.123	(3.12)	0.020	(0.51)	0.151	(3.84)	0.020	(0.51)	0.178	(4.52)	0.021	(0.53)	0.184	(4.67)	0.022	(0.56)	0.237	(6.02)	0.028	(0.71)
1½	0.141	(3.58)	0.020	(0.51)	0.173	(4.39)	0.021	(0.53)	0.204	(5.18)	0.024	(0.61)	0.211	(5.36)	0.025	(0.64)	0.271	(6.88)	0.033	(0.84)
2	0.176	(4.47)	0.021	(0.53)	0.216	(5.49)	0.026	(0.66)	0.255	(6.48)	0.031	(0.79)	0.264	(6.71)	0.032	(0.81)	0.339	(8.61)	0.041	(1.04)
3	0.259	(6.58)	0.031	(0.79)	0.318	(8.08)	0.038	(0.97)	0.376	(9.55)	0.045	(1.14)	0.389	(9.88)	0.047	(1.19)	0.500	(12.70)	0.060	(1.52)
4	0.333	(8.46)	0.040	(1.02)	0.409	(10.39)	0.049	(1.24)	0.484	(12.29)	0.058	(1.47)	0.500	(12.70)	0.060	(1.52)	0.643	(16.33)	0.077	(1.96)
5	0.412	(10.46)	0.049	(1.24)	0.506	(12.85)	0.061	(1.55)	0.598	(15.19)	0.072	(1.83)	0.618	(15.70)	0.074	(1.88)	0.795	(20.19)	0.095	(2.41)
6	0.491	(12.47)	0.059	(1.50)	0.602	(15.29)	0.072	(1.83)	0.712	(18.08)	0.085	(2.16)	0.736	(18.69)	0.088	(2.24)	0.946	(24.03)	0.114	(2.90)
8	0.639	(16.23)	0.077	(1.96)	0.784	(19.91)	0.094	(2.39)	0.927	(23.55)	0.111	(2.82)	0.958	(24.33)	0.115	(2.92)	1.232	(31.29)	0.147	(3.73)
10	0.796	(20.22)	0.096	(2.44)	0.977	(24.82)	0.117	(2.97)	1.156	(29.36)	0.139	(3.53)	1.194	(30.33)	0.143	(3.63)	1.536	(39.01)	0.184	(4.67)
12	0.944	(23.98)	0.113	(2.87)	1.159	(29.44)	0.139	(3.53)	1.371	(34.82)	0.165	(4.19)	1.417	(35.99)	0.170	(4.32)	1.821	(46.25)	0.219	(5.56)
14	1.037	(26.34)	0.124	(3.15)	1.273	(32.33)	0.153	(3.89)	1.505	(38.23)	0.181	(4.60)	1.556	(39.52)	0.187	(4.75)	2.000	(50.80)	0.240	(6.10)
16	1.185	(30.10)	0.142	(3.61)	1.455	(36.96)	0.175	(4.45)	1.720	(43.69)	0.206	(5.23)	1.778	(45.16)	0.213	(5.41)	2.286	(58.06)	0.274	(6.96)
18	1.333	(33.86)	0.160	(4.06)	1.636	(41.55)	0.196	(4.98)	1.935	(49.15)	0.232	(5.89)	2.000	(50.80)	0.240	(6.10)	2.571	(65.30)	0.309	(7.85)
20	1.481	(37.62)	0.178	(4.52)	1.818	(46.18)	0.218	(5.54)	2.151	(54.64)	0.258	(6.55)	2.222	(56.44)	0.267	(6.78)	2.857	(72.57)	0.343	(8.71)
22	1.630	(41.40)	0.196	(4.98)	2.000	(50.80)	0.240	(6.10)	2.366	(60.10)	0.284	(7.21)	2.444	(62.08)	0.293	(7.44)	3.143	(79.83)	0.377	(9.58)
24	1.778	(45.16)	0.213	(5.41)	2.182	(55.42)	0.262	(6.65)	2.581	(65.56)	0.310	(7.87)	2.667	(67.74)	0.320	(8.13)	3.429	(87.10)	0.411	(10.44)

[A]The minimum is the lowest wall thickness of the pipe allowable at any cross section. The maximum permitted wall thickness, at any cross section, is the minimum wall thickness plus the stated tolerance. All tolerances are on the plus side of the minimum requirement.

is cause for retest of six additional specimens at that temperature. Failure of one of six specimens tested at either temperature in retest constitutes failure in the test. Failure of the pipe shall be as defined in Test Method D 1598, namely:

7.7.1 *Failure*—Any continuous loss of pressure resulting from the transmission of the test liquid through the body of the specimen under test.

7.7.2 *Ballooning*—Any abnormal localized expansion of a pipe specimen while under internal hydraulic pressure.

7.7.3 *Bursting*—Failure by a break in the pipe with immediate loss of test liquid and continued loss at essentially no pressure.

7.7.4 *Seepage or Weeping*—Failure that occurs through essentially microscopic breaks in the pipe wall, frequently only at or near the test pressure. At lower pressures the pipe may carry liquids without evidence of loss of the liquids.

7.8 *Environmental Stress Cracking Test*— Use six randomly selected 10-in. (250-mm) long specimens containing the permanent marking for this test. Connect one end of each specimen to a 400-psi (2.8-MPa) pressure gage and the other end to an air or nitrogen supply through a suitable valve. Subject the specimens to the pressures listed in Table 3 for 73°F (23°C), close the valve, and disconnect in such a manner that the pressure is retained in the specimen. Apply enough pressure in excess of the listed value to compensate for the pressure lost during disconnection of the pressure source. Test the assembly for leaks by immersion in water. Eliminate leaks or substitute nonleaking specimens for those that leak. Take care to dry the test specimen completely after immersion. As an alternative and safer method of pressuring, fill each specimen with water and connect one end of each specimen to a 400-psi (2.8-MPa) pressure gage and the other end to a water supply

iTeh Standards (https://standards.iteh.ai) Document Preview