Designation: D 2737 – 0~~1~~3

An American National Standard

Standard Specification for Polyethylene (PE) Plastic Tubing[1]

This standard is issued under the fixed designation D 2737; 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) tubing pressure rated for water (see appendix). Included are criteria for classifying PE plastic tubing materials and PE plastic tubing, and requirements and test methods for materials, workmanship, dimensions, sustained pressure, burst pressure, and environmental stress cracking. This specification differs from the pipe specifications in their outside diameters. Methods of marking are also given.

1.2 The text of this specification references notes, footnotes, and appendixes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

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.

NOTE 1—PE plastic tubing is often used with fittings that require flaring the tubing. The technique used to make the flare is highly important to produce leak-free joints. For further information, refer to Practice D 3140.

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:*

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

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D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]
D 792 Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement[2]
D 1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer[2]
D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable[2]
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]
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 2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials[3]
D 3140 Practice for Flaring Polyolefin Pipe and Tubing[4]
D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials[5]
F 412 Terminology Relating to Plastic Piping Systems[3]
2.2 *NSF Standard:*
Standard No. 14 for Plastic Piping Components and Related Materials[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. The abbreviation for polyethylene plastic is PE.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *hydrostatic design stress*—the estimated maximum tensile stress the material is capable of withstanding continuously with a high degree of certainty that failure of the pipe will not occur. This stress is circumferential when internal hydrostatic water pressure is applied.

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

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

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

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

3.2.4 *standard dimension ratio (SDR)*—the average outside diameter in inches divided by the minimum wall thickness in inches, rounded to the nearest 0.5.

3.2.5 *standard thermoplastic tubing materials designation code*—the tubing materials designation code shall consist of the abbreviation PE for the type of plastic, 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 code contains less than two figures, a cipher shall be used before the number. Thus a complete material code consists of two letters and four figures for PE plastic tubing materials (see Section 5).

3.2.6 *tubing*—for the purpose of this specification, pipe made to specific outside diameters as shown in Table 1.

4. Tubing Classification

4.1 *General*—This specification covers PE tubing made from four PE plastic tubing materials in three standard dimension ratios and three water pressure ratings (appendix).

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[2] *Annual Book of ASTM Standards*, Vol 08.01.
[3] *Annual Book of ASTM Standards*, Vol 08.04.
[4] Discontinued, see 1999 edition of *Annual Book of ASTM Standards*, Vol 08.034.
[5] Available from the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.
[5] *Annual Book of ASTM Standards*, Vol 08.03.
[6] ISO R 161-1960, Pipes of Plastics Materials for
[6] Available from the Transport of Fluids (Outside Diameters and Nominal Pressures) Part 1, Metric Series. National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.
[7] This test method is based on the use
[7] ISO R 161-1960, Pipes of "Igepal CO-630," a trademark Plastics Materials for a nonylphenoxy poly(ethyleneoxy)ethanol, which may be obtained from GAF Corp., Dyestuff the Transport of Fluids (Outside Diameters and Chemical Div., 140 West 51st St., New York, NY 10020. Nominal Pressures) Part 1, Metric Series.

TABLE 1 Outside Diameters and Tolerances for PE Plastic Tubing

Nominal Tubing Size, in.	Outside Diameter, in.	Tolerance	
		For Average, in.	For Max and Min (out-of-roundness),[A] in.
½	0.625	±0.004	±0.015
⅝	0.750	±0.004	±0.015
¾	0.875	±0.004	±0.015
1	1.125	±0.005	±0.015
1¼	1.375	±0.005	±0.015
1½	1.625	±0.006	±0.015
2	2.125	±0.006	±0.015

[A] The maximum and minimum (out-of-roundness) tolerances apply only to tubing as extruded.

4.2 *Standard Thermoplastic Pipe Dimension Ratios* (*SDR*)—This specification covers PE tubing in three standard dimension ratios, namely, 7.3, 9, and 11. These are referred to as SDR 7.3, SDR 9, and SDR 11, respectively. The pressure rating is uniform for all nominal tubing sizes for a given PE pipe material and SDR with the exception of SDR 9 with PE-3408 material (appendix).

5. Materials

5.1 *General*—Polyethylene plastics used to make tubing 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.

5.2 *Basic Materials*—This specification covers PE tubing made from three PE plastics as defined in Specification D 1248, in which the requirements are based on short-term tests of Grade P23, Grade P24, Grade P33, and Grade P34. The 80°C sustained pressure performance requirements of 6.9 are not currently in PE material Specifications D 1248 or D 3350. To identify the correct tubing test category (C1 to C7), 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 80°C sustained pressure performance requirements to Specifications D 1248 and D 3350.

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

5.4 *Compound*—The PE plastic extrusion compound shall meet the requirements of either Grade P23, Class B or C; Grade P24, Class B or C; Grade P33, Class B or C; or Grade P34, Class B or C, material as described in Specification D 1248.

5.4.1 Class B compounds shall have sufficient UV stabilizer to protect pipe from deleterious affects 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*—The manufacturers shall use only their own clean rework pipe material and the pipe produced shall meet all the requirements of this specification.

6. Requirements

6.1 *Workmanship*—The tubing shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects. The tubing 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. Out-of-roundness (deviations of maximum and minimum outside diameters from the average outside diameter) shall be ±0.015 in. (±0.38 mm) as extruded. Coilings increase the out-of-roundness to some degree, depending on the coiling method and coil dimensions.

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.

6.2.4 *Thickness of Outer Layer*—For tubing produced by simultaneous multiple extrusion, that is, tubing containing two or more concentric layers, the outer layer shall be at least 0.5 mm (0.020 in.) thick.

6.3 *Bond*—For tubing produced by simultaneous multiple extrusion, the bond between the layers shall be strong and uniform. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly at any point.

6.4 *Carbon Black*—Class C polyethylene tubing extrusion compound shall contain at least 2 % carbon black when tested in accordance with 7.5. For tubing produced by simultaneous extrusion, this requirement shall apply only to the outer layer.

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

TABLE 2 Wall Thickness and Tolerances for PE Plastic Tubing

Nominal Tubing Size, in.	Wall Thickness, in.[A]					
	PE2305 SDR 7.3		PE2306, PE2406, PE3306 PE3406, PE3408 SDR 9		PE3408 SDR 11	
	Minimum	Tolerance	Minimum	Tolerance	Minimum	Tolerance
½	0.086	+0.010	0.069	+0.010	0.062	+0.010
⅝	0.103	+0.010	0.083	+0.010	0.068	+0.010
¾	0.120	+0.012	0.097	+0.010	0.080	+0.010
1	0.154	+0.015	0.125	+0.012	0.102	+0.010
1¼	0.188	+0.019	0.153	+0.015	0.125	+0.012
1½	0.233	+0.022	0.181	+0.018	0.148	+0.015
2	0.291	+0.029	0.236	+0.024	0.193	+0.019

[A] The minimum is the lowest wall thickness of the tubing 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.

NOTE 5—There is evidence that indicates that type, particle size, and dispersion quality of the carbon black affects the long-term stability and weatherability of the tubing. The problem is being investigated and when reliable test methods are developed, requirements for long-term stability and weatherability, or other suitable requirements to cover this property, will be included in a revision of this specification.

6.5 *Density*—When determined in accordance with 7.6, the polyethylene base resin (uncolored PE) in the tubing compound shall have a density in the range from 0.926 to 0.940 Mg/m ^{3} for tubing made from Grade P23 and Grade P24; 0.941 to 0.965 Mg/m ^{3} for tubing made from Grade P33; and 0.941 to 0.965 Mg/m^{3}for tubing made from Grade P34 of Specification D 1248.

6.6 *Burst Pressure*—The minimum burst pressure for PE plastic tubing shall be as given in Table 3, when determined in accordance with 7.9.

6.7 *Environmental Stress Cracking*— There shall be no loss of pressure in the tubing when tested in accordance with 7.10.

6.8 *Sustained Pressure*—Pipe made from PE materials designated PE2406, PE3406 or PE3408 shall meet the requirement of 6.8.1. Pipe made from other PE materials shall meet the requirements of 6.8.2 and 6.8.3.

6.8.1 The average failure time and the failure time of two of the three specimens shall meet or exceed the minimum values shown in Table 4, when tested in accordance with 7.11.1.

6.8.2 *Sustained Pressure*—The tubing shall not fail, balloon, burst, or weep as defined in Test Method D 1598, at the test pressures given in Table 5, when tested in accordance with 7.8.

6.8.3 *Elevated Temperature Sustained Pressure*—The average failure time must meet or exceed the specified minimum average failure time in Table 6 for both hoop stresses of a given tubing test category when tested in accordance with 7.11.

7. Test Methods

7.1 *Conditioning*—Condition the test specimens at 73 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity for not less than 40 h prior to the test in accordance with Procedure A of Practice D 618, for those tests where conditioning is required. In cases of disagreement the tolerances shall be ±1°C (±1.8°F) and ±2 % relative humidity.

7.2 *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 specification. In cases of disagreement the tolerances shall be ±1.8°F (±1°C) and ±2 % relative humidity.

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

7.3.1 *Test Specimens*—Not less than 50 % of the test specimens required for any pressure test shall have at least a part of the marking in their central sections. The central section is that portion of pipe which is at least one pipe diameter away from an end closure.

7.4 *Dimensions and Tolerances*—Use any length of tubing to determine the dimensions. Measure in accordance with Test Method D 2122.

TABLE 3 Burst Pressure Requirements for Water at 23°C (73.4°F) for PE Plastic Tubing

Nominal Tubing Size, in.	Minimum Burst Pressures[A]
	PE2305, PE2306, PE2406, PE3306, PE3406, PE3408
SDR 7.3 and 9	630 psi (4.34 MPa)
SDR 11	504 psi (3.47 MPa)

[A] The fiber stresses used to derive these test pressures are as follows:

PE2305	2000 psi (13.8 MPa)
PE2306, PE2406, PE3306, PE3406, PE3408	2520 psi (17.4 MPa)

TABLE 4 Minimum Average Time to Failure (h) versus Test Hoop Stress

Base Resin Density (g/cc)	Minimum Average Failure Time (h)	
	S = 580 psi (4 MPa)	S = 670 psi (4.6 MPa)
>0.935	1000	170

TABLE 5 Sustained Water Pressure Test Conditions for PE Plastic Tubing

Nominal Tubing Size, in.	Material	Pressure[A] Required for Test, psi (MPa)	
		At (23°C)	73.4°F
All sizes	PE2305	(2.28)	330
	PE2306	(2.28)	330
	PE2406	(2.28)	330
	PE3306	(2.28)	330
	PE3406	(2.28)	330
	PE3408 (SDR 9)	(2.76)	400
	PE3408 (SDR 11)	(2.21)	320

[A] The fiber stresses used to derive these test pressures are as follows:

	MPa	psi
At 23°C (73.4°F):		
PE2305	7.24	1050
PE2306	9.10	1320
PE2406	9.10	1320
PE3306	9.10	1320
PE3406	9.10	1320
PE3408	11.0	1600

TABLE 6 176°F (80°C) Sustained Pressure Requirements for Water Pipe[A,B]

Pipe Test Category[C]	Base Resin Melt Index, D 1238 (g/10 min)	Base Resin Density,[D] D 1505 (g/cm^3)	Minimum Average Hours to Failure		
			S = 725 psi (5 MPa)	S = 580 psi (4 MPa)	S = 435 psi (3 MPa)
C1	<0.05	0.941–0.948	100	200	—
C2	<0.05	0.935–0.940	100	200	—
C3	0.05–0.25	0.941–0.948	60	150	—
C4	0.05–0.25	0.935–0.940	60	150	—
C5	>0.25	0.941–0.948	45	100	—
C6	>0.25	0.935–0.940	45	100	—
C7	>0.50	0.926–0.940	—	80	150

[A] For inside diameter controlled pipe, calculate internal pressure in accordance with the following formula:

$$P = \frac{2S}{\frac{D_i}{t}} + 1$$

[B] For outside diameter controlled pipe, calculate internal pressure in accordance with the following formula:

$$P = \frac{2S}{\frac{D_o}{t}} - 1$$

where:
P = pressure, psig (MPa),
S = hoop stress, psi (MPa),
D_i = average inside diameter, in. (mm),
D_o = average outside diameter, in. (mm), and
t = minimum wall thickness, in. (mm).

[C] Supplier to determine pipe test category appropriate for his product.
[D] Pipe categories for water pipe with resin density below 0.926 g/cm^3 or above 0.948 g/cm^3 will be added to this table when the data are available.

7.4.1 *Outside Diameter*—Measure the outside diameter of the tubing in accordance with Test Method D 2122. The average outside diameter is the arithmetic average of the maximum and minimum diameter at any cross section. The tolerance for out-of-roundness shall apply only to tubing prior to shipment.

7.4.2 *Wall Thickness*—Make micrometer measurements of the wall thickness in accordance with Test Method D 2122 to determine the maximum and minimum values. Measure the wall thickness at both ends of the tubing to the nearest 0.001 in.

7.4.3 *Wall Thickness Range*—Measure in such a manner that the maximum, *A*, and the minimum, *B*, wall thicknesses of each cross section measured are obtained. Calculate the wall thickness range, *E*, for each cross section as follows:

$$E, \% = [(A - B)/A] \times 100$$

7.5 *Carbon Black*—For all pipe manufactured with Class C extrusion compound, or the outer layer of pipe produced by simultaneous multiple extrusion, determine in duplicate the carbon black content in accordance with Test Method D 1603.

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

7.7 *Base Density*:

7.7.1 *Class C Compounds*—Determine the percentage of carbon black by weight in accordance with 7.5. Calculate the density of the PE base resin (uncolored PE) in the tubing compound as follows:

$$D_R = D_P - 0.0044C$$

where:

D_R = density of resin, mg/m^3,
D_P = density of pipe compound, mg/m^3, and
C = percentage by weight of carbon black.

7.7.2 *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 the pipe compound manufacturer for the procedure to determine base density for specific compounds.

7.8 *Sustained Pressure Test*—Select the test specimens at random. Test individually with water under the pressures given in Table 5, six specimens of tubing, each specimen at least ten times the nominal diameter in length, but not less than 10 in. (250 mm) or more than 3 ft (1 m) between end closures, and containing the permanent marking on the tubing. Maintain the specimens at the pressures indicated for the appropriate temperature for a period of 1000 h. Hold pressure as closely as possible, but within ±10 psi (±0.07 MPa). Condition the specimens for at least 2 h to within± 3.6°F (±2°C) of the specified test temperature. Test in accordance with Test Method D 1598, except maintain the pressure at the values given in Table 5 for 1000 h. At least five specimens out of six tests shall pass. Failure of the tubing shall be as defined in Test Method D 1598, namely:

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

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

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

7.8.4 *Seepage or Weeping*—Failure that occurs through essentially microscopic breaks in the tubing wall frequently only at or near the test pressure.

NOTE 6—At lower pressures, the pipe may carry liquids without evidence of loss of liquids.

7.9 *Burst Pressure*—The test equipment, procedures and failure definitions shall be as specified in Test Method D 1599. In addition, the failure must be ductile.

7.10 *Environmental 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 1000-psi (6.89-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 5 for 73.4°F (23°C), the valve closed, 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 the 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. Apply a coating of "Igepal-630"[8] to the tubing surface with a brush. Take care to keep the wetting agent at least ½ in. (13 mm) away from the clamps used on each end of the tubing. Use fresh reagent for each test and take care to store reagent in closed containers because it is hygroscopic. Keep the coated tubing assembly at room temperature for 3 h and then examine. Discard specimens that leak at a connection and retest. Loss of pressure caused by expansion of the tubing shall not be cause for rejection.

7.11 *Elevated Temperature Test*—Determine tubing test category in Table 6 for a given tubing material. Base resin melt index is determined in accordance with Test Method D 1238 and base resin density is determined in accordance with Test Method D 1505. Prepare at least three test specimens as in 7.8. Test at 176°F (80°C) and the hoop stress (*S*) specified in Table 6 for the given tubing category in accordance with Test Method D 1598. Use water as the internal test medium. Two of three specimens must meet or exceed the specified minimum average failure time.

7.11.1 Prepare at least three specimens as in 7.8 for the appropriate test hoop stress given in Table 4. Test at 176°F (80°C) and the hoop stresses given in Table 4 in accordance with Test Method D 1598.

[8] This test method is based on the use of "Igepal CO-630," a trademark for a nonylphenoxy poly(ethyleneoxy)ethanol, which may be obtained from GAF Corp., Dyestuff and Chemical Div., 140 West 51st St., New York, NY 10020.

8. Retest and Rejection

8.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again only by agreement between the purchaser and the seller. Under such agreement, minimum requirements shall not be lowered, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

9. Marking

9.1 Marking on the tubing shall include the following, spaced at intervals of not more than 5 ft:

9.1.1 Nominal tubing size (for example, 1 in.).

9.1.2 Type of PE plastic tubing material in accordance with the designation code prescribed in 3.2.6 (for example, PE2305).

9.1.3 Pressure rating for water at 73.4°F (23°C), 160 psi.

9.1.4 ASTM designation D 2737, with which the tubing complies.

9.1.5 The manufacturer's name (or trademark) and code (Note 2).

9.1.6 Tubing intended for the transport of potable water shall also include the seal or mark of the laboratory making the evaluation for this purpose, spaced at intervals specified by the laboratory.

NOTE 7—Manufacturers using the seal or mark of a laboratory must obtain prior authorization from the laboratory concerned.

9.1.7 Tubing test category in accordance with Table 6.

9.2 *Using Color to Identify Piping Service*—It is not mandatory to use color to identify piping service, but when color is applied expressly to identify piping service, such as with stripes, a color shell or solid color, blue is used for potable water; green is used for sewer; and purple (violet, lavender) is used for reclaimed water.

10. Quality Assurance

10.1 When the product is marked with this designation, D 2737, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

SUPPLEMENTARY REQUIREMENTS POTABLE WATER REQUIREMENT

This requirement applies whenever a Regulatory Authority or user calls for product to be used to convey or to be in contact with potable water.

S1. Products intended for contact with potable water shall be evaluated, tested and certified for conformance with ANSI/NSF Standard No. 61 or the health effects portion of NSF Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

APPENDIX

(Nonmandatory Information)

X1. SOURCE OF HYDROSTATIC DESIGN STRESSES

X1.1 The hydrostatic design stresses recommended by the Plastics Pipe Institute are used to pressure rate PE plastic tubing. These hydrostatic design stresses are 500 psi (3.45 MPa), 630 psi (4.34 MPa), and 800 psi (5.5 MPa) for water at 73.4°F (23°C), and 400 psi (2.76 MPa), 500 psi (3.45 MPa), and 630 psi (4.34 MPa) for water at 100°F (37.8°C), respectively. These hydrostatic design stresses apply only to tubing meeting all the requirements of this specification.

X1.2 Six PE tubing materials are included, based on the requirements of Specification D 1248 and the PPI-recommended hydrostatic design stresses as follows:

X1.2.1 Grade P23, with a hydrostatic design stress of 500 psi (3.45 MPa) for water at 73.4°F (23°C), designated as PE2305.

X1.2.2 Grade P23, with a hydrostatic design stress of 630 psi (4.34 MPa) for water at 73.4°F (23°C), designated as PE2306.

X1.2.3 Grade P24, with a hydrostatic design stress of 630 psi (4.34 MPa) for water at 73°F (23°C), designated as PE2406.

X1.2.4 Grade P33, with a hydrostatic design stress of 630 psi (4.34 MPa) for water at 73.4°F (23°C), designated as PE3306.

X1.2.5 Grade P34, with hydrostatic design stress of 630 psi (4.34 MPa) for water at 73.4°F (23°C), designated as PE3406.

X1.2.6 Grade P34, with hydrostatic design stress of 800 psi (5.5 MPa) for water at 73.4°F (23°C), designated as PE3408.

X1.3 Information regarding the test method and other criteria used in developing these hydrostatic design stresses may be obtained from the Plastics Pipe Institute, a division of The Society of the Plastics Industry, 355 Lexington Ave., New York, NY 10017 (Note X1.1). These hydrostatic design stresses may not be suitable for materials that show a wide departure from a straight-line plot of log stress versus log time to failure. All the data available to date on PE tubing materials made in the United States exhibit a straight-line plot under these plotting conditions.

NOTE X1.1—Refer also to Test Method D 2837.

X1.4 The tubing is rated for use with water at 73.4°F (23°C) at the maximum internal pressures shown in Table X1.1. Lower pressure ratings may be recommended, at the option of the tubing manufacturer, in which case a star placed after the pressure rating shall be included in the marking. Experience of the industry indicates that PE plastic tubing meeting the requirements of this specification gives satisfactory service under normal conditions for a long period at these pressure ratings. The sustained pressure requirements (see 6.6) are related to these ratings through the slopes of the strength-time plots of these materials in tubing form.

X1.5 The hydrostatic design stresses recommended by the Plastics Pipe Institute are based on tests made on pipe and tubing ranging in size from ½ to 2 in.

TABLE X1.1 Maximum Internal Pressures

Material	SDR	Internal Pressure, MPa (psi)	
		(73.4°F) 23°C	(100°F) 37.8°C
PE2305	7.3	160 (1.10)	125 (0.86)
PE2306, PE2406, PE3306, PE3406	9	160 (1.10)	125 (0.86)
	. . .	. . .	. . .
PE3408	9	200 (1.38)	160 (1.10)
PE3408	11	160 (1.10)	125 (0.86)