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An American National Standard

Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems[1]

This standard is issued under the fixed designation F 1412; 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.

1. Scope

1.1 This specification covers requirements for non-pressure polyolefin pipe and fittings for corrosive waste drainage systems.

1.2 This specification is a companion to the Canadian Standard, CAN/CSA-B181.3.[2]

1.3 Pipe is produced in Schedule 40 and 80 IPS sizes in two polyolefins, polyethylene (PE) and polypropylene (PP).

1.4 The interchangeability of pipe and fittings made by different manufacturers is not addressed in this specification. Transition fittings for joining pipe and fittings of different manufacturers is provided for in this specification.

1.5 Pipe and fittings are joined by the heat fusion method (D 2657 and F 1290) or by using mechanical joints recommended by the manufacturer.

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

1.7 The following safety hazards caveat pertains only to the test method, Section 8, 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 543 Test Method for Resistance of Plastics to Chemical Reagents[3]

D 570 Test Method for Water Absorption of Plastics[3]

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[3]

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

D 1600 Terminology for Abbreviated Terms Relating to Plastics[3]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[4]

D 2321 Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications[4]

D 2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading[4]

D 2444 Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)[4]

D 2657 Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings[4]

D 3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns[4]

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

D 4101 Specification for Propylene Plastic Injection and Extrusion Materials[5]

F 412 Terminology Relating to Plastic Piping Systems[4]

F 1290 Practice for Electrofusion Joining Polyolefin Pipe and Fittings[4]

F 1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings[4]

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[6]

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[6]

2.4 *Canadian Standard:*

CAN/CSA-B 181.3 Polyolefin Laboratory Drainage Systems[2]

2.5 *Other Document:*

Uniform Plumbing Code[7]

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions used in this specification are in accordance with the definitions given in Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

[1] This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.63 on DWV.

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[2] Available from the Canadian Standards Association, 178 Rexdale Boulevard, Rexdale (Toronto), Ontario, Canada M 9W 1R3.

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

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

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

[6] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[7] Available from the International Association of Plumbing and Mechanical Officials, 20001 Walnut Drive South, Walnut, CA 91789-2825.

3.1.2 The plumbing terminology used in this specification is in accordance with the definitions given in *Uniform Plumbing Code*, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *toe-in*—a small reduction of the outside diameter at the cut end of a length of thermoplastic pipe.

4. Classification

4.1 *General*—This specification covers Schedule 40 and 80 polyolefin pipe made from polyethylene or polypropylene in iron pipe sizes.

4.2 This specification also includes molded fittings and in larger sizes (8, 10, 12 in.) fabricated fittings.

5. Materials and Manufacture

5.1 Polyethylene (PE) virgin material for pipe or fittings shall be from a single compound manufacturer and shall be made from PE material that meets or exceeds the cell-classification requirements of 112110, 213330 or 324430 as defined in Specification D 3350.

5.1.1 This specification covers PE pipe made from PE plastics as defined by hydrostatic design stresses developed on the basis of long-term tests.

5.2 Polypropylene (PP) virgin material for pipe or fittings shall meet the requirements for polypropylene Type 110 or 210, as defined in Specification D 4101.

5.3 The polyolefin material shall contain suitable stabilizers and antioxidants and may contain pigments and fillers not detrimental to pipe and fittings provided the pipe and fittings produced meet the requirements of this specification.

5.3.1 Polyolefin material can be produced in both regular and flame-retardant compounds for pipe and fittings.

5.4 *Rework Material*—Clean rework material generated from the manufacturer's own pipe or fitting products may be used by the same manufacturer, using the same type and grade resin, provided that the pipe or fittings produced meet the requirements of this specification.

6. Requirements

6.1 *Dimensions and Tolerances—Pipe*:

6.1.1 Dimensions and tolerances for pipe shown in Table 1 and Table 2 shall be measured in accordance with Test Method D 2122. The tolerance for out-of-roundness shall apply only to pipe prior to shipment.

TABLE 1 Outside Diameters and Tolerances for Polyolefin Pipe Schedules 40 and 80, in. (mm)

Nominal Pipe Size	Average Outside Diameter	Tolerance	Out-of-Roundness (maximum minus minimum)
1 1/4	1.660 (42.16)	±0.005 (±0.13)	0.050 (1.27)
1 1/2	1.750 (44.45)	±0.010 (±0.25)	0.060 (1.52)
[A] 1 1/2	1.900 (48.26)	±0.006 (±0.15)	0.060 (1.52)
2	2.375 (60.32)	±0.006 (±0.15)	0.070 (1.78)
3	3.500 (88.90)	±0.008 (±0.20)	0.080 (2.03)
4	4.500 (114.30)	±0.009 (±0.23)	0.100 (2.54)
6	6.625 (168.28)	±0.011 (±0.28)	0.100 (2.54)
8	8.625 (219.08)	±0.015 (±0.38)	0.150 (3.81)
10	10.750 (273.05)	±0.015 (±0.38)	0.150 (3.81)
12	12.750 (323.85)	±0.015 (±0.38)	0.150 (3.81)

[A] Not an IPS size. Pipe shall be used with compatible fittings designed for this outside diameter. The wall thickness is the same as 1 1/2 in. IPS Schedule 40 shown in Table 2.

TABLE 2 Wall Thickness and Tolerances for Polyolefin Pipe Schedules 40 and 80, in. (mm)

NOTE 1— For fittings, the wall thickness is a minimum value, except that a 10 % variation resulting from core shift is allowable. In such a case, the average of the two opposite wall thicknesses shall equal or exceed the value shown in the Schedule 40 table.

Nominal Pipe Size	Schedule 40		Schedule 80	
	Minimum	Tolerance	Minimum	Tolerance
1 1/4	0.140 (3.56)	+0.020 (+0.51)	0.191 (4.85)	+0.023 (+0.58)
1 1/2	0.145 (3.68)	+0.020 (+0.51)	0.200 (5.08)	+0.024 (+0.61)
2	0.154 (3.91)	+0.020 (+0.51)	0.218 (5.54)	+0.026 (+0.66)
3	0.216 (5.49)	+0.026 (+0.66)	0.300 (7.62)	+0.036 (+0.91)
4	0.237 (6.02)	+0.028 (+0.71)	0.337 (8.56)	+0.040 (+1.02)
6	0.280 (7.11)	+0.034 (+0.86)	0.432 (10.97)	+0.052 (+1.32)
8	0.322 (8.18)	+0.039 (+0.99)	0.500 (12.70)	+0.060 (+1.52)
10	0.365 (9.27)	+0.044 (+1.12)	0.593 (15.06)	+0.071 (+1.80)
12	0.406 (10.31)	+0.049 (+1.24)	0.687 (17.45)	+0.082 (+2.08)

6.1.2 *Toe-In*—The outside diameter when measured in accordance with Test Method D 2122 shall meet the requirements of Table 1 and Table 2 when measured at any point within 1.5 pipe diameters or 11.8 in. (300 mm), whichever is less, to the cut end of the pipe length.

6.2 *Dimensions and Tolerances—Fittings*.

6.2.1 The minimum wall thickness of the body of all fittings shall not be less than the corresponding Schedule 40 pipe size and shall be measured in accordance with Test Method D 2122.

6.2.2 Spigot ends of fittings shall conform to the diameter and out-of-roundness requirements for pipe.

6.2.3 Socket ends of fittings shall conform to the dimensional requirements for size and tolerances as provided on request by the manufacturer.

6.2.4 The average minimum diameters of waterways of fittings excluding adapters shall be as specified in Table 3.

6.2.5 For all fittings having taper pipe threads, threads shall conform to Specification F 1498 and be gaged in accordance with 8.7.

6.2.6 The patterns, dimensions, and laying lengths of molded fittings, including adaptors, shall meet the requirements of Specification D 3311 or shall be of a proven design and shall allow a smooth transition of fluid flow from one direction to another. Specialty fittings or fittings with laying lengths exceeding those shown in D 3311 shall not be excluded. For these fittings, laying lengths shall be provided by the manufacturer.

TABLE 3 Average Waterway Diameter, in. (mm)

Nominal Pipe Size	Unthreaded Fittings, min	Threaded Male Adapters	
		Min	Max
1 1/4	1.227 (31.17)	1.220 (31.00)	1.280 (32.50)
1 1/2	1.446 (36.73)	1.458 (37.00)	1.501 (38.10)
2	1.881 (47.78)	1.915 (48.60)	1.946 (49.40)
3	2.820 (71.63)	2.849 (72.30)	2.983 (75.70)
4	3.737 (94.92)	3.806 (96.60)	3.972 (100.80)
6	5.646 (143.41)	5.851 (148.50)	6.005 (152.40)
8	7.490 (190.25)	. . . . .	. . . . .
10	9.407 (238.94)	. . . . .	. . . . .
12	11.197 (284.40)	. . . . .	. . . . .

6.2.7 *Cleanouts*—All polyolefin fitting cleanouts having female threads shall be supplied with polyolefin plugs to suit.

6.2.8 Cleanouts, cleanout plugs, and caps, as commonly used in the manufacturer's laboratory drainage system, shall have a thread size and depth sufficient to ensure that the minimum waterway sizes are maintained.

6.2.9 *Traps*—All traps shall have a minimum water seal of 2 in. (50 mm).

6.3 *Chemical Resistance*—Pipe and fitting materials shall be evaluated in accordance with Test Method D 543, Procedures I and II, using the chemicals listed in 8.3. The weight change shall not exceed 2 % nor shall apparent tensile strength change by more than 10 %. In cases where there is a change in the apparent tensile strength greater than 10 %, a further evaluation shall be made after removal from the chemical, and conditioning for 72 h. If after 72 h there is a minimum of 50 % recovery of tensile strength as compared to the unexposed specimen, and that figure is within ± 10 % of the original tensile strength of the unexposed specimen shall be considered acceptable.

6.4 *Water Absorption*—Pipe and fitting materials shall not change in weight more than 0.50 % when tested in accordance with 8.4.

6.5 *System Integrity*:

6.5.1 Fused joints and pipe associated with them shall withstand a pressure of 50 psi (0.35 MPa) without leaking when tested in accordance with 8.5.1.

6.5.2 Mechanical joints shall withstand a pressure of 14.5 psi (0.10 MPa) without leaking when tested in accordance with 8.5.2.

NOTE 1—Mechanical joints include transition, compression, threaded, and other mechanical type joints.

6.5.3 Mechanical joints shall incorporate a positive mechanical system for axial restraint in addition to any restraint provided by friction.

6.5.4 Mechanical joints shall show no evidence of separation at the joint under force *P* when tested in accordance with 8.6.1 nor shall they leak or show any other damage when tested in accordance with 8.6.2. Two fittings shall be tested and both shall pass.

6.6 All stainless steel internal grab rings shall be manufactured from corrosion-resistant steel containing not less than 16 % chromium and not less then 6 % nickel by weight.

6.7 *Sealing Rings*—Polyethylene sealing rings shall be of a Type 1 (LDPE) compound.

6.8 *Flattening*—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 8.8.

6.9 *Impact Resistance*—The impact resistance testing shall be in accordance with 8.9.

7. Workmanship, Finish, and Appearance

7.1 The manufacture of fittings and pipe shall be in accordance with good commercial practice so as to produce fittings meeting the requirements of this specification. Fittings and pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or injurious defects. The fittings and pipe shall be as uniform as commercially practicable in opacity, density, and other physical properties.

8. Test Methods

8.1 *Conditioning*—Condition the test specimens at 73.4 ± 3.6°F (23 ± 2°F) and 50 ± 5 % relative humidity 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.

8.2 *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.

8.3 *Chemical Resistance*—Determine the resistance to the following chemicals using the test method detailed in Test Method D 543.

Chemical	Percent in Water
Acetic acid	5 by volume
Acetone	100
Methyl alcohol	100
Ammonium hydroxide	10 by volume
Nitric acid	40 by volume
Sodium hydroxide	10 by weight

8.4 *Water Absorption*—Weigh three cleanly cut specimens having smooth edges to the nearest 0.001 g and immerse in distilled water at 73.4 ± 1.8°F (23 ± 1°C) for 24 h + ½–0 h, in accordance with Test Method D 570. Remove the specimens, wipe dry with a clean, dry cloth, and reweigh immediately. Calculate the average percent gain in weight to the nearest 0.01 % on the basis of the initial weight.

8.5 *Hydrostatic Pressure Tests*:

8.5.1 *Fused-Joint Pressure Test*—Select at random six specimens of pipe, each five times the nominal diameter or a maximum of 18 in. (450 mm) in length, for each size of piping and each type of system being considered. Also select three suitable couplings at random. Prepare three joined specimens by joining two pipe specimens with one coupling, using the fusion equipment and instructions supplied by the manufacturer of the system. Fill each specimen with water at 73.4 ± 3.6°F (23± 2°C) and cap, taking care to exclude all air from the system. Fix one end of the specimen to a pressurizing apparatus, and support the free end if necessary. Pressurize each specimen to 50 psi (0.35 MPa) for a minimum of 5 min and inspect for leaks. None of the three specimens shall leak (laboratory performance test only, not for field use).

8.5.2 *Mechanical Joint Pressure Test*— Perform the pressure test on mechanical joints on test specimens prepared in a manner similar to that described in 8.5.1, except use appropriate pipe specimens where the joint is intended to join pipes of similar or dissimilar material and sizes. Pressurize the assembly to 14.5 psi (0.10 MPa) for a period of 24 h + 15, − 0.0 min and inspect for signs of leakage. Apply this test to each size and type of joint being considered (laboratory performance test only, not for field use).

8.6 *Mechanical-Joint Pullout Test*:

8.6.1 Join two sections of pipe by a coupling with the positive mechanical axial restraint system removed or deactivated. Mount the assembly with the outer ends of the pipe sections fastened in the clamps of a tensile testing machine. Pull the two pipe sections apart at a rate of approximately 1 in./min (25 mm/min) until at least one pipe section has