



Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems¹

This standard is issued under the fixed designation F1412; 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 Pipe is produced in Schedule 40 and 80 IPS sizes, and in DR IPS sizes for two polyolefins, polyethylene (PE) and polypropylene (PP).

1.3 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.

1.4 Pipe and fittings are joined by the heat fusion method (Practice D2657 for PP butt and saddle fusion, Practice F2620 for PE butt, saddle and socket fusion and Practice F1290 for polyolefin electrofusion) or by using mechanical joints recommended by the manufacturer.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.63 on DWV. Current edition approved Nov. 1, 2022. Published March 2023. Originally approved in 1992. Last previous edition approved in 2016 as F1412 – 16. DOI: 10.1520/F1412-22

2. Referenced Documents

2.1 ASTM Standards:²

- D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents
 - D570 Test Method for Water Absorption of Plastics
 - D618 Practice for Conditioning Plastics for Testing
 - D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
 - D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
 - D2444 Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
 - D2657 Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
 - D3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
 - D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
 - D4101 Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
 - F412 Terminology Relating to Plastic Piping Systems
 - F1290 Practice for Electrofusion Joining Polyolefin Pipe and Fittings
 - F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
 - F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ### 2.2 Federal Standard:
- Fed. Std. No. 123 Marking for Shipment (Civil Agencies)³
- ### 2.3 Military Standard:
- MIL-STD-129 Marking for Shipment and Storage³

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 DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 <http://quicksearch.dla.mil/>

*A Summary of Changes section appears at the end of this standard

2.4 Other Document:
Uniform Plumbing Code⁴

3. Terminology

3.1 Definitions:

3.1.1 Definitions and abbreviations used in this specification are in accordance with the definitions and abbreviations given in Terminology F412, unless otherwise indicated.

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 polyolefin pipe made from polyethylene or polypropylene in iron pipe sizes.

4.2 This specification also includes molded fittings and in larger sizes (8 in., 10 in., 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 D3350.

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 Group 01, 02 or 03, as defined in Specification D4101.

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, Table 2, and Table 3 and shall be measured in accordance with Test Method D2122. The tolerance for out-of-roundness shall apply only to pipe prior to shipment.

6.1.2 Toe-In—The outside diameter when measured in accordance with Test Method D2122 shall meet the requirements of Table 1 and Table 2 when measured at any point within 1.5

TABLE 1 Outside Diameters and Tolerances for Polyolefin Pipe in. (mm)

Nominal Pipe Size	Average Outside Diameter	Tolerance	Out-of-Roundness (maximum minus minimum)
1¼	1.660 (42.16)	±0.005 (±0.13)	0.050 (1.27)
1½ ^A	1.750 (44.45)	±0.010 (±0.25)	0.060 (1.52)
1½	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)

^ANot an IPS size. Pipe shall be used with compatible fittings designed for this outside diameter. The wall thickness is the same as 1½ 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
1¼	0.140 (3.56)	+0.020 (+0.51)	0.191 (4.85)	+0.023 (+0.58)
1½	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)

TABLE 3 Wall Thickness and Tolerances for Polyolefin Pipe SDR 17 and 26, 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 Table 3.

Nominal Pipe Size	SDR 26		SDR 17	
	Minimum	Tolerance	Minimum	Tolerance
2	0.091 (2.32)	+0.020 (+0.51)	0.140 (2.32)	+0.017 (+0.43)
3	0.135 (3.42)	+0.020 (+0.51)	0.206 (3.43)	+0.025 (+0.63)
4	0.173 (4.40)	+0.021 (+0.53)	0.265 (4.40)	+0.032 (+0.81)
6	0.255 (6.47)	+0.031 (+0.78)	0.390 (6.47)	+0.047 (+1.19)
8	0.332 (8.43)	+0.040 (+1.01)	0.507 (8.43)	+0.061 (+1.55)
10	0.413 (10.50)	+0.050 (+1.26)	0.632 (10.50)	+0.076 (+1.93)
12	0.490 (12.46)	+0.059 (+1.50)	0.750 (12.46)	+0.090 (+2.29)

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 D2122.

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

⁴ Available from International Association of Plumbing and Mechanical Officials, 5001 E. Philadelphia St., Ontario, CA 91761, http://www.iapmo.org.

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 4.

6.2.5 For all fittings having taper pipe threads, threads shall conform to Specification F1498 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 D3311 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 D3311 shall not be excluded. For these fittings, laying lengths shall be provided by the manufacturer.

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 D543, 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 than 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 °F ± 3.6 °F (23 °C ± 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.

8.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 73.4 °F ± 3.6 °F (23 °C ± 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 D543.

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 °F ± 1.8 °F (23 ± 1 °C) for 24 h + ½ –0 h, in accordance with Test Method D570. 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.

TABLE 4 Average Waterway Diameter, in. (mm)

Nominal Pipe Size	Unthreaded Fittings, min		Threaded Male Adapters	
	Min	Max	Min	Max
1¼	1.227 (31.17)	1.220 (31.00)	1.280 (32.50)	1.501 (38.10)
1½	1.446 (36.73)	1.458 (37.00)	1.501 (38.10)	1.501 (38.10)
2	1.881 (47.78)	1.915 (48.60)	1.946 (49.40)	1.946 (49.40)
3	2.820 (71.63)	2.849 (72.30)	2.983 (75.70)	2.983 (75.70)
4	3.737 (94.92)	3.806 (96.60)	3.972 (100.80)	3.972 (100.80)
6	5.646 (143.41)	5.851 (148.50)	6.005 (152.40)	6.005 (152.40)
8	7.490 (190.25)
10	9.407 (238.94)
12	11.197 (284.40)

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 $73.4\text{ }^{\circ}\text{F} \pm 3.6\text{ }^{\circ}\text{F}$ ($23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$) 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 separated from the coupling. Record the maximum force *F* applied.

8.6.2 Using the set-up described above, subject a complete joint assembled in accordance with the manufacturer’s instructions to an axial pullout force *P* of 25 lbf (110 N) greater than force *F*. In no case shall this force *P* be less than 50 lbf (220 N). Apply force *P* within 5 to 30 s and maintain for at least 60 s.

8.6.3 Remove the axial force and pressurize the complete joint assembly to 14.5 psi (0.10 MPa) hydrostatic pressure for a period of 1 h and inspect for leaks.

8.7 Threads—All taper pipe threads shall be gaged in accordance with Specification **F1498**.

8.8 Flattening—Using Test Method **D2412**, flatten three specimens of pipe 6 in. (152 mm) long, between parallel plates in a suitable press until the distance between the plates is 40 % of the original outside diameter of the pipe. The rate of vertical displacement shall be uniform and such that the flattening is completed within 2 to 5 min. On removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

8.9 Impact Resistance:

8.9.1 Polyolefin Pipe and Fittings—Determine and test polyolefin pipe and fitting impact values in accordance with Test Method **D2444**, using Tup A. The level of impact shall be in accordance with data provided by the manufacturer, which shall show impact values for each size at 73 °F (23 °C) that specifies adequate quality consistent with the polyolefin com-

pound used by that manufacturer. Test 10 specimens. When 9 or 10 specimens pass, accept the lot. When 4 or more specimens fail, reject the lot. When 2 or 3 specimens of 10 fail, test 10 additional specimens. When 17 of 20 specimens tested pass, accept the lot. When 7 or more of 20 fail, reject the lot. When 4, 5 or 6 of 20 fail, test 20 additional specimens. When 32 of 40 specimens pass, accept the lot. When 9 or more of 40 specimens fail, reject the lot. Failure in the test specimens shall be shattering or any crack or break extending entirely through the pipe wall visible to the unaided eye.

NOTE 2—This test is intended only for use as a quality control test, not as a simulated service test.

9. Retest and Rejection

9.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be followed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirement of this specification.

10. Product Marking

10.1 Quality of Marking—The markings shall be applied to the fittings and pipe in such a manner that they remain legible under normal handling and installation practices.

10.2 Content of Marking:

10.2.1 Fittings shall be marked with the following:

10.2.1.1 Manufacturer’s name or trademark.

10.2.1.2 Raw material designation and type in accordance with 5.1 or 5.2. Flame-retardant material shall be designated “FR”. For example, flame-retardant polypropylene shall be marked “PPFR 110” or “FRPP 110”.

10.2.1.3 If listed, the seal or mark of the laboratory making the evaluation for corrosive waste application.

10.2.1.4 Size.

10.2.1.5 This designation “F1412”, with which the fitting complies.

10.2.2 Marking on the pipe shall include the following, spaced at intervals of not more than 5 ft (1.5 m):

10.2.2.1 Manufacturer’s name or trademark,

10.2.2.2 Raw material and designation and type, in accordance with 5.1 or 5.2. Flame-retardant material shall be designated “FR”. For example, flame-retardant polypropylene shall be marked “PPFR 110” or “FRPP 110”.

10.2.2.3 If listed, the seal or mark of the laboratory making the evaluation for corrosive waste application,

10.2.2.4 Nominal pipe size (for example, 2 in.),

10.2.2.5 This designation “F1412”, with which the pipe complies.

10.2.2.6 Schedule size or DR (SCH40, SCH80, or SDR XX, whichever is applicable).

NOTE 3—Pressure pipe may be used for drainage.