



Standard Specification for Polyethylene (PE) Pipe and Fittings for Roof Drain Systems¹

This standard is issued under the fixed designation F 1901; 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 approval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers requirements for polyethylene (PE) pipe and fittings for nonpressure roof drain systems.

1.2 This specification covers pipe and fittings intended for normal residential and commercial uses and is not intended for use in unusual corrosive conditions.

NOTE 1—Before installing pipe for waste disposal use, the approval of the cognizant building code authority shall be obtained as conditions not found in normal use or temperatures approaching 140°F (60°C) may be encountered.²

1.3 Pipe is produced in dimensions based on outside diameters of 32 mm (1.250 in.) and larger in accordance with Specification F 714.

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, by the electrofusion method, or by using mechanical joints (excluding insert fittings) recommended by the manufacturer.

1.6 In referee decisions, the SI units shall be used for metric-sized pipe and inch-pound units for pipe sized in the IPS system (ANSI B36.10). In all cases, the values given in parentheses are provided for information only.

1.7 The following safety hazards caveat pertains only to the test method, 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 543 Test Method for Resistance of Plastics to Chemical Reagents³

D 570 Test Method for Water Absorption of Plastics³

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³

D 1600 Terminology for Abbreviated Terms Relating to Plastics³

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings⁴

D 2321 Practice for Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications⁴

D 2412 Test Method for External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading⁴

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 Polyolefin Pipe and Fittings⁴

D 3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns⁴

D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials⁵

D 4976 Specification for Polyethylene Plastics Molding and Extrusion Materials⁶

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics⁵

F 412 Terminology Relating to Plastic Piping Systems⁴

F 477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe⁴

F 714 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter⁴

F 1290 Practice for Electrofusion Joining Polyolefin Pipe and Fittings⁴

F 1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings⁴

2.2 ANSI Standard:

B36.10 Standard Dimensions of Steel Pipe (IPS)⁷

2.3 ISO Standards:⁷

161 Thermoplastic Pipe for the Transport of Fluids—Nominal Outside Diameters and Nominal Pressures

3607 Polyethylene Pipe: Tolerances on Outside Diameters and Wall Thicknesses

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. Current edition approved October 10, 1998. Published December 1998.

² Supporting data is available from ASTM Headquarters. Request Research Report: RR-F17-1044

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 08.03.

⁶ *Annual Book of ASTM Standards*, Vol 10.02.

⁷ Available from the American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

2.4 *Federal Standard:*⁸

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

2.5 *Military Standard:*⁸

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 *Definitions*— 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.

3.2 *Definitions of Terms Specific to This Standard:*

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

4. Materials and Manufacture

4.1 Polyethylene (PE) virgin material for pipe or fittings shall be from a single compound manufacturer and shall meet or exceed the requirements of Cell Classification PE345434 as defined in Specification D 3350 or by appropriate cell classification as defined in Specification D 4976.

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

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

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

NOTE 2—See Specification D 3350 and Guide D 5033 for information and definitions related to both rework and recycled plastics.

5. Requirements

5.1 *Dimensions and Tolerances—Pipe:*

5.1.1 *Outside Diameters*—These shall be in accordance with Table 1 (SI units) or Table 2 (inch-pound units), and shall be measured in accordance with Test Method D 2122 at any point not closer than 300 mm (11.8 in.) to the cut end of a length of pipe. Conditioning to standard temperature, but not to standard humidity, is required.

5.1.2 *Wall Thickness*— The minimum thicknesses shall be in accordance with Table 3 (millimeters) or Table 4 (inches) when measured in accordance with Test Method D 2122. Conditioning to standard temperature, but not to standard humidity, is required.

5.1.3 *Eccentricity*— The wall thickness variability as measured and calculated in accordance with Test Method D 2122 in any diametrical cross section of the pipe shall not exceed 12 %.

5.1.4 *Toe-In*—When measured in accordance with 5.1.1, the outside diameter at the cut-end of the pipe shall not be more than 1.5 % smaller than the undistorted outside diameter. Measurement of the undistorted outside diameter shall be made

TABLE 1 Outside Diameters and Tolerances

ISO Sizing System (ISO 161/1)			
Nominal Pipe Size	Equivalent	Outside Diameter Do, mm	
		min	max ^A
mm	in.		
32	1.260	32	32.3
40	1.575	40	40.4
50	1.969	50	50.5
55	2.165	55	55.5
56 ^B	2.205	56	56.5
63 ^B	2.480	63	63.6
65	2.559	65	65.6
75	2.953	75	75.7
90	3.543	90	90.8
110	4.331	110	111.0
160	6.299	160	161.4
200	7.874	200	201.8
250	9.843	250	252.3
280	11.024	280	282.5
315	12.402	315	317.8

^AAs specified in ISO 3607.

^BSpecial sizes.

TABLE 2 Outside Diameters and Tolerances

IPS Sizing System (ANSI B36.10)			
Nominal Pipe Size	Equivalent	Actual Outside Diameters in.	
		Average	Tolerances, ±
in.	mm		
1-¼	45.2	1.780	0.008
1-½	48.3	1.900	0.009
2	60.3	2.375	0.011
3	88.9	3.500	0.016
4	114.3	4.500	0.020
5	136.5	5.375	0.025
5 ^A	141.3	5.563	0.025
6	168.3	6.625	0.030
7	181.0	7.125	0.034
8 ^A	219.1	8.625	0.039
10	273.1	10.750	0.048
12	323.8	12.750	0.057

^A Special sizes.

TABLE 3 Minimum Wall Thickness

ISO Sizing System (ISO 161/1)		
Nominal Pipe Size	Equivalent	Wall Thickness
		min
mm	in.	mm
32	1.260	3.0
40	1.575	3.0
50	1.969	3.0
55	2.165	3.0
56 ^A	2.205	3.0
63 ^A	2.480	3.0
65	2.559	3.0
75	2.953	3.0
90	3.543	3.5
110	4.331	4.2
160	6.299	6.2
200	7.874	6.2
250	9.843	7.7
280	11.024	8.6
315	12.402	9.7

^ASpecial sizes.

no closer than 1.5 pipe diameter or 11.8 in. (300 mm), whichever distance is less, from the cut-end of the pipe. Undistorted outside diameter shall meet specifications in Table 1 or Table 2.

⁸ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Phila. PA 19111-5094, Attn: NPODS.

TABLE 4 Minimum Wall Thickness

IPS Sizing System (ANSI B36.10)			
Nominal Pipe Size	Actual Pipe Size	Equivalent Pipe Size	Wall Thickness in.
in.	in.	mm	min
1-1/4	1.780	45.2	0.143
1-1/2	1.900	48.3	0.145
2	2.375	60.3	0.154
3	3.500	88.9	0.216
4	4.500	114.3	0.237
5 ^A	5.375	136.5	0.258
5	5.563	141.3	0.258
6	6.625	168.3	0.280
7 ^A	7.125	181.0	0.300
8	8.625	219.1	0.322
10	10.750	273.1	0.365
12	12.750	323.8	0.375

^A Special sizes.

5.1.5 *Special Sizes*— When existing system conditions or special local requirements make other diameters or dimension ratios necessary, other sizes or dimension ratios, or both, shall be acceptable for engineered applications when mutually agreed upon by the customer and the manufacturer, if the pipe is manufactured from plastic compounds meeting the material requirements of this specification, and the strength and design requirements are calculated on the same basis as those used in this specification. For diameters not shown in Table 1 or Table 2, the tolerance shall be the same percentage as that shown in the corresponding tables for the next smaller listed size. Minimum wall thicknesses for DRs not shown in Table 3 or Table 4 shall comply with 5.1.2, and the tolerance shall comply with 5.1.3.

5.2 Dimensions and Tolerances—Fittings:

5.2.1 *Wall Thickness*— The minimum wall thickness of the body of all fittings shall not be less than that for the corresponding pipe size and shall be measured in accordance with Test Method D 2122.

5.2.2 *Eccentricity*— Spigot ends of fittings shall conform to the diameter and out-of-roundness requirements for pipe.

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

5.2.4 *Threads*—For all fittings having taper pipe threads, threads shall conform to Specification F 1498 and be gaged in accordance with 7.7.

5.2.5 *Patterns*—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 exceed those shown in Specification D 3311 shall not be excluded. For these fittings, laying lengths shall be provided by the manufacturer.

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

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

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

5.3 *Chemical Resistance*—Pipe fitting materials shall be evaluated in accordance with Test Method D 543, Procedures I and II, using the chemicals listed in 7.3. 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 72h. If after 72h there is a minimum of 90 % 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.

5.4 *Water Absorption*— Pipe and fitting materials shall not change in weight more than 0.50 % when used in accordance with 7.4.

5.5 System Integrity:

5.5.1 *Fused joints*, (including butt-fused and electrofused following practices described in Practices D 2657 and F 1290 respectively), and pipe associated with them shall withstand a pressure of 50 psi (0.35 MPa) without leaking when tested in accordance with 7.5.1.

5.5.2 *Mechanical joints* shall withstand a pressure of 14.5 psi (0.10 MPa) without leaking when tested in accordance with 7.5.2).

NOTE 3—Mechanical joints include transition, compression, threaded, and other mechanical type joints.

5.5.3 *Mechanical joints* shall show no evidence of separation at the joint under force *P* when tested in accordance with 7.6.1, nor shall they leak or show any other damage when tested in accordance with 7.6.2. Two fittings shall be tested and both shall pass.

5.6 Sealing Rings:

5.6.1 *Elastomeric sealing rings* shall meet the requirements of Specification F 477.

5.6.1.1 The basic polymer shall be natural rubber, synthetic elastomer, or a blend of both.

5.6.1.2 The sealing rings shall be designed with an adequate compressive force, so as to effect a positive seal under all combinations of joint tolerances.

5.7 *Flattening*—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 7.8.

5.8 *Impact Resistance*—The impact resistance testing shall be in accordance with 7.9.

6. Workmanship, Finish and Appearance

6.1 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 practical in opacity, density, and other physical properties.

7. Test Methods

7.1 *Conditioning*— Condition the test specimens prior to test at $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and 50 ± 5 % relative

humidity for not less than 40h 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 $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity, unless otherwise specified in the test methods or in this specification.

7.3 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 vol
Acetone	100
Methyl alcohol	100
Ammonium hydroxide	10 by vol
Nitric acid	40 by vol
Sodium hydroxide	10 by weight

7.4 Water Absorption—Weigh three cleanly cut specimens having smooth edges to the nearest 0.001 g and immerse in distilled water at $73.4 \pm 1.8^\circ\text{F}$ ($23 \pm 1^\circ\text{C}$) for $24\text{h} + \frac{1}{2}\text{--}0\text{h}$, in accordance with Test Method D 570. Remove the specimens, wipe dry with a clear, dry cloth, and reweigh immediately. Calculate the average percent gain in weight to the nearest 0.01 % on the basis of the initial weight.

7.5 Hydrostatic Pressure Test:

7.5.1 Fused Joint (Including Butt-Fused and ElectroFused) 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 $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) 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.

7.5.2 Mechanical Joint Pressure Test—Perform the pressure test on mechanical joints on test specimens prepared in a manner similar to that described in 7.5.1, except use appropriate pipe specimens where 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 $24\text{h} + 15\text{--}0.0\text{min}$ and inspect for signs of leakage. Apply this test to each size and type of joint being considered.

7.6 Mechanical-Joint Pullout Test:

7.6.1 Join two sections of pipe by a coupling. 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.

7.6.2 Using the set-up described in 7.6.1, 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.

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

7.7 Threads—All taper pipe threads shall be gaged in accordance with Specification F 1498.

7.8 Flattening—Using Test Method D 2412, flatten three specimens of pipe 6-in. (152-mm) long, between parallel plates in a suitable press until the distance between parallel plates is 40 % of the original 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.

7.9 Impact Resistance:

7.9.1 Polyethylene Pipe and Fittings—Determine and test polyethylene pipe and fitting impact values in accordance with Test Method D 2444, 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 polyethylene compound used by that manufacturer. Test ten specimens. When nine or ten specimens pass, accept the lot. When four or more specimens fail, reject the lot. When two or three specimens of ten fail, test ten additional specimens. When 17 of 20 specimens tested pass, accept the lot. When seven or more of 20 fail, reject the lot. When four, five, or six of 20 fail, test 20 additional specimens. When 32 of 40 specimens pass, accept the lot. When nine 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 4—This test is intended only for use as a quality control test, not as a simulated service test.

8. Retest and Rejection

8.1 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 requirements of this specification.

9. Product Marking

9.1 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.

9.2 Content of Marking:

9.2.1 Fittings shall be marked with the following:

9.2.1.1 Manufacturer's name or trademark.

9.2.1.2 Raw material designation and type in accordance with 5.1 or 5.2.

9.2.1.3 Size, clearly noting SI or inch-pound units.

9.2.1.4 The letters ASTM followed by the designation number of this specification, F 1901, with which the fitting complies.

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

9.2.2.1 Manufacturer's name or trademark.

9.2.2.2 Raw material designation and type in accordance with 5.1 or 5.2.

9.2.2.3 Nominal pipe size in accordance with Table 1 or Table 2 in the designated measurement unit (millimeters or inches).

9.2.2.4 The letters ASTM followed by the designation number of this specification, F 1901, with which the pipe complies.

NOTE 5—Pressure pipe may be used for drain, waste, and vent.

10. Quality Assurance

10.1 When the product is marked with ASTM designation F 1901, 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.

11. Keywords

11.1 DWV; pipe fittings; pipes; plastic pipes; polyethylene; recycle; waste disposal (building)

SUPPLEMENTARY REQUIREMENTS

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use one's own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

S2. *Packaging and Marking*:

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the suppli-

er's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packaging shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.⁹

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

⁹ Available from the Uniform Classification Committee, Suite 1106, 222 South Riverside Plaza, Chicago, IL 60606 and the National Motor Freight Traffic Association, American Trucking Associations, Inc., 1616 P St., NW, Washington, DC 20036.

ANNEX

(Mandatory Information)

A1. INSTRUCTIONS

A1.1 The manufacturer shall ensure that equipment and instructions needed for joining the pipe and fittings are readily obtainable by the installer.

A1.2 Polyethylene drain, waste, and vent systems shall be installed and supported in accordance with the manufacturer's recommendations.

APPENDIXES

(Nonmandatory Information)

X1. STORAGE

X1.1 *Outside Storage*—Plastic pipe should be stored on a flat surface or supported in a manner that will prevent sagging or bending. Do not store pipe in direct sunlight for long periods.

X1.2 Inventories of plastic pipe should be used first-in first-out basis.

X2. JOINING

X2.1 *Field Inspection*—Prior to use, all pipes should be inspected carefully for cuts, gouges, deep scratches, damaged ends, or other major imperfections. Defective pipe should be rejected or the damaged sections should be cut out.

X2.2 *Pipe Fit*—Pipe is manufactured to close tolerances to ensure satisfactory fit between pipe and the fittings socket during assembly. Use only combinations of pipe and fittings that yield manufacturer recommended fits.

X2.3 Caution must be taken if there is an excess amount of toe-in. This could result in excess clearance, and not cut off, result in a poorly fused joint.

X2.4 *Cutting*—Pipe can be cut easily with ordinary saws. The pipe should be cut square and all burrs removed with a sharp knife, fine tooth file, or other suitable tool such as chamfering tool or reamer. A miter box is recommended to ensure square cut ends. The use of specially designed plastic pipe cutters with extra wide rollers and thin cutting wheels is recommended.

X2.5 *Cleaning*—Remove burrs from inside and outside pipe edges. Wipe off all dust, dirt, and moisture from surfaces to be joined with a clean dry rag or a paper towel. Pipe and fittings must be dry before assembly to obtain good joints.

X3. INSTALLATION

X3.1 *Installation Under Freezing Conditions*—Plastic pipe has decreased resistance to impact under freezing conditions. Increased care should be exercised if installation is likely to occur under these conditions, particularly during handling, transportation, installation, and backfilling. When possible, installation should be avoided during freezing conditions. Allowance shall be made for expansion that will occur when the temperature of the pipe is raised.

X3.2 *Alignment and Grade*—Align all piping system components properly without strain. Do not bend or pull pipe into position after being joined. The grade of horizontal drainage and vent piping shall be as specified in the application code.

X3.3 *Supports and Spacing*—Hangers and straps should not compress, distort, cut, or abrade the piping and should allow free movement of pipe. Support horizontal piping in accordance with the manufacturer's recommendations. Supports should allow free movement. Maintain vertical piping in straight alignment with supports at each floor level or at 10-ft (3.1-m) intervals, whichever is less.

X3.4 *Threaded Connections*—Do not cut threads on pipe.

Molded threads on adapter fittings for transition to threaded construction are necessary except in the case of cleanout plugs. Only approved thread tape or thread lubricant specifically intended for use with plastic pipe should be used.

X3.5 *Threaded Tightness*—Maximum thread tightness is hand tight plus one full turn.

X3.6 *Connection to Nonplastic Pipe*—When connecting plastic pipe to other types of piping, use only approved types of fittings and adapters designed for the specific transition.

X3.7 *Thermal Expansion*—Allow for thermal expansion and movement in all piping installations by the use of approved methods. Support, but do not rigidly restrain piping at branches or changes in direction. Do not anchor pipe rigidly in wall. For thermal expansion consult the manufacturer.

X3.8 *Chemical Resistance*—Before installing a polyethylene DWV piping system, chemical resistance data for the piping in question should be consulted. If there is a chemical resistance question, consult the manufacturer.

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