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An American National Standard

Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems[1]

This standard is issued under the fixed designation F1673; 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 nonpressure-polyvinylidene fluoride drainage systems for corrosive applications. Requirements for material, pipe and fittings are included. Polyvinylidene fluoride includes emulsion/suspension polymerization and copolymers of vinylidene fluoride/hexafluoropropylene produced by either method.

1.2 These requirements apply to Schedule 40 and 80 IPS, SDR 32.5, and SDR 21 pipe sizes. Pipe and fittings are to be joined by heat fusion or mechanical methods using the equipment supplied by the manufacturers.

1.3 This specification is not intended to provide for interchangeability between plastic pipe and fittings from different manufacturers, but it does allow for transition fittings for joining one manufacturer's product to another's product, provided the joining technique used is other than heat fusion.

1.4 This specification is not for polyvinylidene pressure systems.

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 Notes and appendixes are not a mandatory part of this specification.

1.7 The following safety hazard caveat pertains only to the test method portion, 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:*[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
D883 Terminology Relating to Plastics
D1600 Terminology for Abbreviated Terms Relating to Plastics
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 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
D3222 Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
D3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
D5575 Classification System for Copolymers of Vinylidene Fluoride (VDF) with Other Fluorinated Monomers
F412 Terminology Relating to Plastic Piping Systems
F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment[3]

2.3 *Military Standard:*

MIL-STD 129 Marking for Shipment and Storage[3]

[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.

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[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 Standard:*
Uniform Plumbing Code[4]

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions used in this specification are in accordance with the definitions given in Terminologies D883 and F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

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

4. Classification

4.1 *General*—This specification covers PVDF pipe and fittings made from PVDF or VF/HFP copolymers in Schedule 40 and 80 and SDR 32.5 and SDR 21 IPS sizes.

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

5. Materials and Manufacture

5.1 Polyvinylidene fluoride (PVDF) material for pipe or fittings shall conform to the requirements of Type I Grade 1, Type I Grade 2, or Type II PVDF as defined in Specification D3222 or copolymers as defined in Specification D5575.

5.2 The PVDF material may contain pigment and fillers not detrimental to the pipe and fittings, provided the pipe and fittings produced meet the requirements of this specification.

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

6. Requirements

6.1 *Dimensions and Tolerances—Pipe and Fittings:*

6.1.1 *Pipe:*

6.1.1.1 Dimensions and tolerances for pipe shown in Table 1 and Table 2 shall be measured in accordance with Method D2122. The tolerance for out-of-roundness shall apply only to pipe prior to shipment.

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

TABLE 1 Outside Diameters and Tolerances for PVDF Pipe Schedules 40 and 80 and SDR 21, in. (mm)

Nominal Pipe Size	Average Outside Diameter	Tolerance	Out-of-Roundness (Maximum Diameter Minus Minimum Diameter)
1¼	1.660 (42.16)	±0.005 (±0.13)	0.050 (1.28)
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 (2.04)
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 (3.80)
10	10.750 (273.05)	±0.015 (±0.38)	0.150 (3.80)
12	12.750 (323.85)	±0.015 (±0.38)	0.150 (3.80)

6.1.1.2 *Toe-In*—The outside diameter, when measured in accordance with Method D2122, shall meet the requirements of Table 1 and Table 2 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.

6.1.2 *Fittings:*

6.1.2.1 The minimum wall thickness of the body all fittings shall not be less than the corresponding Schedule 40 pipe size and shall be measured in accordance with Method D2122.

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

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

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

6.1.2.5 Taper pipe threads in any fittings shall be as specified in Specification F1498. The tolerance shall be 1½ large or small turns from the basic thread dimension and gaged in accordance with 8.7.

6.1.2.6 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 allow a smooth transition of fluid flow from one direction to another.

6.1.2.7 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.

6.1.2.8 *Traps*—All traps shall have a minimum water seal of 2 in.

6.2 *Chemical Resistance*—Pipe and fittings material shall be evaluated in accordance with Practice D543, Procedures I and II, using the chemicals listed in 8.3. The weight change shall not exceed 2 %, nor shall the 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 there is a minimum of 50 % recovery of tensile strength after 72 h, and that figure is within ±10 % of the original tensile strength, the specimen shall be considered acceptable.

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

6.4 *System Integrity:*

6.4.1 Fused joints and associated pipe shall withstand a pressure of 50 psi (345 kPa) without leaking when tested in accordance with 8.5.1.

6.4.2 Mechanical joints shall withstand a pressure of 14.5 psi (100 kPa) without leaking when tested in accordance with 8.5.2.

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

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

TABLE 2 Wall Thicknesses and Tolerances for PVDF Pipe Schedules 40 and 80 and SDR 21, 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 thickness' shall equal or exceed the value shown in the Schedule 40 table.

Nominal Pipe Sizes	Schedule 40		Schedule 80		SDR 21		SDR 32.5	
	Minimum	Tolerance	Minimum	Tolerance	Minimum	Tolerance	Minimum	Tolerance
1¼	0.140 (3.56)	+0.020 (+0.51)	0.191 (4.85)	+0.023 (+0.58)	0.079 (2.01)	+0.020 (+0.51)	0.062 (1.57)	+0.020 (0.51)
1½	0.145 (3.68)	+0.020 (+0.51)	0.200 (5.08)	+0.024 (+0.61)	0.090 (2.28)	+0.020 (+0.51)	0.062 (1.57)	+0.020 (0.51)
2	0.154 (3.91)	+0.020 (+0.51)	0.218 (5.54)	+0.026 (+0.66)	0.113 (2.87)	+0.020 (+0.51)	0.073 (1.85)	+0.020 (0.51)
3	0.216 (5.49)	+0.026 (+0.66)	0.300 (7.62)	+0.036 (+0.91)	0.167 (4.22)	+0.020 (+0.51)	0.108 (2.74)	+0.020 (0.51)
4	0.237 (6.02)	+0.028 (+0.71)	0.337 (8.56)	+0.040 (+1.02)	0.214 (5.44)	+0.026 (+0.66)	0.138 (3.51)	+0.020 (0.51)
6	0.280 (7.11)	+0.034 (+0.86)	0.432 (10.97)	+0.052 (+1.32)	0.315 (8.00)	+0.038 (+0.97)	0.204 (5.18)	+0.0241 (0.61)
8	0.322 (8.18)	+0.039 (+0.99)	0.500 (12.70)	+0.060 (+1.52)	0.411 (10.44)	+0.049 (+1.24)	0.265 (6.73)	+0.032 (0.81)
10	0.365 (9.27)	+0.044 (+1.12)	0.593 (15.06)	+0.071 (+1.80)	0.512 (13.00)	+0.061 (+1.55)	0.331 (8.41)	+0.040 (1.02)
12	0.406 (10.31)	+0.049 (+1.24)	0.687 (17.45)	+0.082 (+2.08)	0.607 (15.42)	+0.073 (+1.85)	0.392 (9.96)	+0.047 (+1.19)

TABLE 3 Average Waterway Diameter, in. (mm)

Nominal Pipe Size	Unthreaded Fittings	Under Half Thread of Male Adapters	
	Minimum	Minimum	Maximum
1¼	1.227 (31.17)	1.220 (30.99)	1.280 (32.51)
1½	1.446 (36.73)	1.458 (37.03)	1.501 (38.13)
2	1.881 (47.78)	1.915 (48.64)	1.946 (49.43)
3	2.820 (71.63)	2.849 (72.36)	2.983 (75.77)
4	3.737 (94.92)	3.806 (96.67)	3.972 (100.89)
6	5.646 (143.41)	5.851 (148.62)	6.008 (152.53)
8	7.490 (190.25)	. . .	. . .
10	9.407 (238.94)	. . .	. . .
12	11.197 (284.40)	. . .	. . .

6.4.4 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.

6.5 All stainless steel parts shall be made of corrosion-resistant steel, containing not less than 16 % chromium and not less than 6 % nickel by weight.

6.6 *Sealing Rings*—Sealing rings shall be made from a material with a chemical resistance similar to PVDF.

6.7 *Flattening*—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 8.8.1.

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

7. Workmanship, Finish, and Appearance

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

8. Test Methods

8.1 *Conditioning*—When required, condition the test specimens at 73.4 ± 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 D618.

8.2 *Test Conditions*—Conduct the test in a 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 material quantification method in Practice D543.

Chemical	Percent in Water
Acetic acid	5 by volume
Acetone	5 by volume
Methyl alcohol	100
Ammonia hydroxide	10 by volume
Nitric acid	40 by volume
Sodium hydroxide	10 by weight
Sulfuric acid	20 by volume
Hydrochloric acid	20 by volume

8.4 *Water Absorption*—Three cleanly cut specimens measuring approximately 2 by 3 in. (50 by 75 mm) and having smooth edges shall be weighed to the nearest 0.001 g and immersed in distilled water at 73.4 ± 1.8 °F (23 ± 1 °C) for 24 h + ½ −0 h, in accordance with Test Method D570. The specimens shall be removed, wiped dry with a clean, dry cloth, and reweighed immediately. The average percent gain in weight shall be calculated to the nearest 0.01 % on the basis of the initial mass. Weight change shall be less than 0.50 % (material qualification only).

8.5 *Joint Tests—Hydrostatic Pressure Tests:*

8.5.1 *Fused Joint Pressure Test*—Six specimens of pipe, each five times the nominal diameter or a maximum of 18 in. (450 mm) in length, shall be selected at random for each size of piping and each type of system being considered. Three suitable couplings shall also be selected at random. Three joined specimens shall be prepared by joining two pipe specimens with one coupling, using the 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 (345 kPa) for a minimum of 5 min and inspect for leaks. None of the three specimens shall leak.

8.5.1.1 This is a laboratory performance test only and is not for field use.

8.5.2 *Mechanical Joint Pressure Test*—The pressure test on mechanical joints shall be carried out 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 (100 kPa) 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.

8.5.2.1 This is a laboratory performance test only and is 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 setup described in 8.6.1, 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.

8.6.3 Remove the axial force and pressurize the complete joint assembly to 14.5-psi (100-kPa) hydrostatic pressure for a period of 1 h and inspect for leaks.

8.7 *Threads*—All molded taper threads shall have a blunt start with a pilot equal to ½ to ¾ turns. Include the pilot in the thread length measurement. Schedule 80 PVDF pipe may be threaded. Measure threads using taper pipe thread gages conforming to Specification F1498 dimensions and follow the method of gaging outlined:

8.7.1 *Gaging External Taper Threads*—In gaging external taper threads, screw the ring gage tight by hand on the external thread. The thread is within the permissible tolerance when the gaging face of the working ring gage is not more than 1½ large or small turns from being flush with the face of the fitting, after correction has been made for any variation in the gage from basic dimensions.

8.7.2 *Gaging Internal Taper Threads*—In gaging internal taper threads, screw the plug gage tight by hand into the fitting. The thread is within the permissible tolerance when the gaging notch of the working plug gage is not more than 1½ large or small turns from being flush with the face of the fitting, after correction has been made for any variation in the gage from basic dimensions.

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. Upon removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

8.9 *Impact Resistance for PVDF Pipe and Fittings*—Determine and test PVDF pipe and fitting impact values in accordance with Test Method D2444, using Tup A and Holder 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 PVDF compound 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.

8.9.1 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 requirements of this specification by such means as omitting tests that are a part of this 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 test.

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 Manufacturers name or trademark,

10.2.1.2 Raw material designation and type in accordance with 5.1,

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

10.2.1.4 Size.

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 designation and type in accordance with 5.1,

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, "F1673," with which the pipe complies, and

10.2.2.6 Schedule or SDR (Schedule 40, or SCH 40, or Schedule 80, or SCH 80, or SDR 32.5 or SDR 21), whichever is applicable.

11. Quality Assurance

11.1 When the product is marked with this designation, F1673, 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.

12. Keywords

12.1 acid waste; corrosion resistance; corrosive waste drainage; drain pipes; installation; joints; laboratory piped services; pipe fittings; pipes; plastic pipes; PVDF (polyvinylidene); traps (drainage); waste disposal (building)

SUPPLEMENTARY REQUIREMENTS

These requirements apply *only* to federal/military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for all inspection and test requirements specified herein. The producer may use his 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.

NOTE S1.1—In U.S. federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement:*

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier'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 packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

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.

NOTE S2.1—The inclusion of the U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this specification.

ANNEX

(Mandatory Information)

A1. INSTRUCTIONS

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

A1.2 The PVDF drainage 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 exceed manufacturers recommended exposure time to direct sunlight.

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

X2. JOINING

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

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

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

X2.4 *Cutting*—Pipe may be easily cut with ordinary saws. The pipe shall be cut square and the burrs should be removed with a sharp knife fine-tooth file or other suitable tool, such as a chamfering tool or reamer. If cut with a saw, a miter box should be used 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 the surfaces to be joined with a clean dry rag or a paper towel. Pipe and fittings shall be dry before assembly to obtain good pipe joints.

X3. INSTALLATION

X3.1 *Underground Installation*—Underground installation of pipe shall be in accordance with Practice D2321, except aggregate size shall be limited to ½ in. (13 mm) for angular and ¾ in. (19 mm) for rounded particles.

X3.2 *Above-Ground Installation*—The PVDF pipe and fittings are used in applications where the surface flame spread and the smoke density are an important consideration and in applications where high temperatures are required.

X3.3 *DWV Installation*—Pipe shall be installed in conformance with governing building codes. In areas not governed by codes, pipe shall be installed in accordance with accepted engineering practices.

X3.4 *Installation Under Freezing Conditions* —Plastic pipe has decreased resistance to impact under freezing conditions. Increased care shall 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.

X3.5 *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 the horizontal drainage and vent piping shall be as specified in the application code.

X3.6 *Supports and Spacing*—Hangers and straps shall not compress, distort, cut, or abrade the piping and shall allow free movement of the piping system. Support horizontal piping in accordance with the manufacturer's recommendations. Supports must allow for free movement of the pipe. Maintain vertical piping in straight alignment, with supports at each floor level or at 10-ft (3.1-m) intervals, whichever is less. Vertical supports shall allow the pipe to move freely.

X3.7 *Threaded Connections*—Do not cut threads on Schedule 40 or SDR 21 pipe. Schedule 80 pipe may be threaded with dies specifically designed for plastic pipe. Molded threads on adapter fittings for transition to threaded connections are necessary, except in the case of cleanout plugs. Only approved thread tape or thread lubricant specifically intended for use with plastic pipe shall be used.

X3.8 *Thread Tightness*—Maximum thread tightness is hand tight plus one full turn.

X3.9 *Connection to Nonplastic Pipe*—When connecting plastic pipe to other types of piping, use only approved type fittings and adapters designed for the specific transition.

X3.10 *Building Drains Under Floor Slabs*—Trench bottoms shall be smooth and of uniform grade with either undisturbed soil or a layer of selected and compacted backfill so that no settlement will occur. The bottom of the pipe shall rest on this material throughout the entire length.

X3.11 *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 of direction. Do not anchor pipe rigidly in walls or floors. For thermal expansion, consult the manufacturer.

X3.12 Chemical Resistance—Before installing a PVDF (polyvinylidene fluoride) corrosive waste piping system, chemical resistance data for the piping material shall be consulted. Take caution when mixing chemicals, as properties can change. If there is a chemical resistance question, consult the manufacturer.

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1673-04(2009)) that may impact the use of this standard.

(1) 1.1, 1.2, were revised.
(2) 4.3 was deleted
(3) 5.1 was revised.
(4) Note 2 was deleted.
(5) Table 2 was revised.