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An American National Standard

Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent (DWV) Pipe and Fittings Having Post-Industrial Recycle Content[1]

This standard is issued under the fixed designation F2390; 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 and test methods for materials, dimensions and tolerances, pipe stiffness, crush resistance, impact resistance, hydrostatic burst resistance, and solvent cement for poly(vinyl chloride) plastic drain, waste, and vent (DWV) pipe and fittings.

1.2 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.

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

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 7, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety hazards should a system fail for any reason.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1784 Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

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)

D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

F2135 Specification for Molded Drain, Waste, and Vent (DWV) Short-Pattern Plastic Fittings

D3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings

F1866 Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings

[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 Aug. 1, 2021. Published August 2021. Originally approved in 2007. Last previous edition approved in 2017 as F2390–12(2017). DOI: 10.1520/F2390-21.

[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.

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

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology in F412, and abbreviations are in accordance with Terminology in D1600, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *certificate of composition disclosure, n*—a certificate describing certain properties of an external recycled material, its formulation and source, and the specific material shipment to which it applies.

3.2.1.1 *Discussion*—Examples include polymer(s), molecular weight, percentage (and type) of inorganic material, tensile strength, modulus of elasticity, and izod impact; code or designation identifying the formulation and source information.

3.2.2 *post-industrial recycle, n*—recycled PVC material generated by a company or manufacturing plant that is different than the location producing products to this specification.

3.2.2.1 *Discussion*—Material used for a different product produced by the same manufacturer shall be considered as post-industrial recycle material for the product of this standard, unless the different product is made from the same compound.

3.2.3 *post-consumer recycle, n*—PVC plastic material used in products that have proceeded into the chain of commerce beyond the control of the original manufacturer.

3.2.3.1 *Discussion*—These materials are generally recycled by the users or consumers of the product, and have no specific identity or specificity of the compound.

3.2.3.2 *Discussion*—Post-consumer recycled material is NOT post-industrial recycle and is prohibited from use in products within this specification (see 5.4.1)

4. Significance and Use

4.1 The requirements of this specification are intended to provide pipe and fittings suitable for the drainage and venting of sewage and certain other liquid wastes.

NOTE 2—This standard specifies dimensional, performance and test requirements for plumbing and fluid handling, but does not address venting of combustion gases.

NOTE 3—Industrial waste disposal lines should be installed only with the specific approval of the cognizant building code authority since chemicals not commonly found in drains and sewers and temperatures in excess of 180 °F (82.2 °C) may be encountered.

5. Materials

5.1 *Basic Materials*—The pipe and fittings shall be made from a uniform blend containing virgin PVC compound and between 10 % by weight and 50 % by weight of post-industrial recycle material. The finished compound shall meet or exceed the minimum cell classification material requirements specified in 5.2, Virgin PVC Compounds.

5.2 *Virgin PVC Compounds*—Virgin PVC pipe compounds shall meet or exceed the requirements of Class 12454 as defined in Specification D1784. Virgin PVC fitting compounds shall meet or exceed the requirements of Class 12344 as defined in Specification D1784, but with a tensile strength of not less than 6 500 psi and a modulus of elasticity of not less than 380 000 psi. These plastics contain stabilizers, lubricants, and pigments.

5.3 *Rework Material*—The manufacturer is permitted to use his own clean pipe or fitting rework material, except as specified in 5.4, provided that the pipe or fittings produced shall meet all the requirements of this specification.

5.4 *Post-Industrial Recycled Materials*—The pipe or fittings manufacturer shall use post-industrial recycle material, as defined in 3.2.3 at a level of at least 10 % by weight or volume, but not exceeding 50 % by weight or volume.

5.4.1 *Post-Industrial Recycle Source*—The post-industrial recycle shall be clean, of a known source, and each shipment shall be provided with a certificate of composition disclosure. Post-consumer recycled materials shall not be used.

5.4.1.1 When blending with the manufacturer's own internal rework, the total post-industrial recycle level in the finished compound shall not exceed 50 %, by weight or volume.

5.4.1.2 Composition of the post-industrial recycle shall be known by the industrial source of the material.

5.4.1.3 The material shall not be purchased from a 3rd-party (for example, grinding, re-packaging facility, broker, etc.) unless there is a documented system in place to ensure that the material is clean, free of contamination and is of a single source and single material compound.

6. Requirements

6.1 *General*—The pipe and fittings shall be free of visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.1.1 The requirements in this section are intended only for characteristic minimum properties, not as simulated service tests.

6.2 *Dimensions and Tolerances:*

6.2.1 *Method*—All dimensions shall be determined in accordance with Test Method D2122.

6.2.2 *Dimensions:*

6.2.2.1 The outside diameter and wall thicknesses of pipe shall meet the requirements of Table 1. The pipe shall be in either 10 ft or 20 ft (3.05 m or 6.1 m) lengths, unless otherwise specified, with an allowable tolerance of +½, -0 in. (+13, -0 mm).

6.2.2.2 The patterns, dimensions, and laying lengths of fittings, including adaptors, shall meet the requirements of Specification D3311 and Table 2.

6.2.2.3 The patterns, dimensions, and laying lengths of Short-Pattern fittings shall meet the requirements of Specification F2135.

6.2.2.4 The spigot dimensions of fittings shall meet the requirements of Table 1.

6.2.2.5 For all fittings having taper pipe threads, threads shall conform to Specification F1498 and be gauged in accordance with 7.5. Fittings of nominal sizes not given in Specification F1498 shall not have threads.

6.2.2.6 Fabricated DWV fittings shall comply with F1866.

6.3 *Pipe Stiffness, Deflection Load and Flattening:*

6.3.1 *Pipe*—The minimum pipe stiffness at 5 % deflection shall be in accordance with Table 3. The pipe shall deflect by 60 % of the nominal outside diameter (flattening) without

TABLE 1 Dimensions and Tolerances for Outside Diameters and Thicknesses of PVC Plastic Drain, Waste, and Vent Pipe

Nominal Pipe Size	Outside Diameter			Wall Thickness	
	Average	Tolerance on Average	Out-of-Roundness (maximum minus minimum)	Minimum	Tolerance
			in. (mm)		
1¼	1.660 (42.16)	±0.005 (0.13)	0.024 (0.61)	0.140 (3.56)	+0.020 (0.51) -0.000
1½	1.900 (48.26)	±0.006 (0.15)	0.024 (0.61)	0.145 (3.68)	+0.020 (0.51) -0.000
2	2.375 (60.33)	±0.006 (0.15)	0.024 (0.61)	0.154 (3.91)	+0.020 (0.51) -0.000
3	3.500 (88.90)	±0.008 (0.20)	0.030 (0.76)	0.216 (5.49)	+0.026 (0.66) -0.000
4	4.500 (114.30)	±0.009 (0.23)	0.100(2.54)	0.237 (6.02)	+0.028 (0.71) -0.000
6	6.625 (168.28)	±0.011 (0.28)	0.100 (2.54)	0.280 (7.11)	+0.034 (0.86) -0.000
8	8.625 (219.08)	±0.015 (0.38)	0.150 (3.81)	0.322 (8.18)	+0.039 (0.99) -0.000
10	10.750 (273.05)	±0.015 (0.38)	0.150 (3.81)	0.365 (9.27)	+0.044 (1.12) -0.000
12	12.750 (323.85)	±0.015 (0.38)	0.150 (3.81)	0.406 (10.31)	+0.049 (1.24) -0.000
14	14.000 (355.6)	±0.015 (±0.38)	0.200 (5.08)	0.437 (11.1)	+0.053 (1.35) -0.000
16	16.000 (406.4)	±0.019 (±0.48)	0.320 (8.13)	0.500 (12.7)	+0.060 (1.52) -0.000

TABLE 2 Dimensions and Tolerances for Fitting Sockets for PVC Plastic Drain, Waste and Vent Pipe Fittings

Nominal Pipe Size	A			B			C	E	Internal Threads	
	Socket Entrance Diameter			Socket Bottom Diameter			Socket Depth, min	Wall thickness min.[A]	Outside Diameter of Hub, M. min.	Thread length min.
	Average	Tolerance on Avg.	Out-of - Roundness s	Average	Tolerance on Avg.	Out-of – Roundness s				
					in. (mm)					
1¼	1.675 (42.54)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	1.655 (42.04)	±0.005 (±0.13)	0.024 (0.61)	0.687 (17.44)	0.156 (3.96)	1.871 (47.52)	0.687 (17.44)
1½	1.915 (48.64)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	1.895 (48.13)	±0.005 (±0.13)	0.024 (0.61)	0.687 (17.44)	0.156 (3.96)	2.127 (54.03)	0.687 (17.44)
2	2.390 (60.71)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	2.370 (60.20)	±0.005 (±0.13)	0.024 (0.61)	0.750 (19.05)	0.156 (3.96)	2.634 (66.90)	0.750 (19.05)
3	3.520 (89.41)	+0.010/-0.005 (+0.25/-0.13)	0.030 (0.76)	3.495 (88.77)	+0.005/-0.010 (+0.13/-0.25)	0.030 (0.76)	1.500 (38.10)	0.219 (5.56)	3.841 (97.56)	1.187 (30.15)
4	4.520 (114.8)	+0.010/-0.005 (+0.25/-0.13)	0.030 (0.76)	4.495 (114.2)	+0.005/-0.010 (+0.13/-0.25)	0.030 (0.76)	1.750 (44.45)	0.250 (6.35)	4.907 (124.6)	1.28 (32.54)
6	6.647 (168.8)	+0.015/-0.010 (+0.38/-0.25)	0.060 (1.52)	6.614 (168.0)	±0.010 (±0.25)	0.060 (1.52)	3.000 (76.20)	0.281 (7.14)	7.203 (183.0)	1.500 (38.10)
8	8.655 (219.8)	+0.020/ -0.010 (+0.51/ -0.25)	0.090 (2.29)	8.610 (218.7)	+0.015/ -0.015 (+0.38/ -0.3800)	0.090 (2.29)	4.000 (101.6)	0.328 (8.33)	[B]	[B]
10	10.780 (273.8)	+0.025/-0.020 (+0.64/-0.51)	0.120 (3.05)	10.735 (272.7)	±0.020 (±0.51)	0.120 (3.04)	5.000 (127.0)	0.365 (9.28)	[B]	[B]
12	12.780 (324.6)	+0.030/-0.025 (+0.76/-0.64)	0.150 (3.81)	12.735 (323.5)	±0.020 (±0.51)	0.150 (3.81)	6.000 (152.4)	0.406 (10.3)	[B]	[B]

[A] The wall thickness is a minimum value except that a ±10 % variation resulting from core shift is allowable. In such case, the average of the two opposite wall thicknesses shall equal or exceed the value shown in the table.
[B] Not applicable for these nominal sizes.

TABLE 3 Pipe Stiffness Requirements for PVC DWV Pipe[A]

Nominal Pipe Size	Pipe Stiffness Factor, min, psi (kPa)
1¼	1400 (9650)
1½	1010 (6960)
2	600 (4140)
3	510 (3520)
4	310 (2140)
6	150 (1030)
8	100 (690)
10	78 (530)
12	63 (430)
14	60 (415)
16	60 (415)

[A]Measured at 5 % deflection.

cracking, rupture, or other visible evidence of failure when tested in accordance with 7.4.

6.3.1.1 *Pipe Stiffness (PS)*—Three specimens shall be tested. If all three meet the PS requirement, the sample meets the PS requirement. If one or two fail, additional testing shall be conducted in accordance with 6.3.1.2. If all three fail, the sample does not meet the PS requirement.

6.3.1.2 *Pipe Stiffness and Lower Confidence Limit*—In the event that one or two of the specimens tested in 6.3.1 fail to meet the minimum PS requirement, the average pipe stiffness of eleven specimens shall meet or exceed the minimum requirement given in Table 3. The 99 % lower confidence limit (LCL) shall be within 15 % of the average value. The LCL shall be calculated using the Student's "*t*" distribution, with *N*-1 degrees of freedom, where *N* is the number of specimens. The critical *t*-value shall be used to at least three significant digits. Alternatively, if the LCL exceeds the minimum PS requirement in Table 3, but is not within 15 % of the average, the sample meets the requirements of the pipe stiffness testing. The eleven specimens include the three tested under 6.3.1, and an additional eight with rotation by 35°, as specified in Test Method D2412, continuing throughout the remaining specimens.

6.3.1.3 The LCL based on testing eleven specimens is calculated as follows:

$$LCL = (avg\ PS) - \left\{2.76(std.\ dev.)/\sqrt{(N)}\right\} \quad (1)$$

where:

$$(avg\ PS) = \left[\sum(PS_i)\right]/ \quad (2)$$

$$(std.\ dev.) = \left[\frac{\sum PS^2 - \left(\sum PS\right)^2/N}{N-1}\right] 1/2$$

$N = 11$

6.3.1.4 The 15 % requirement is calculated as follows:

$$(Avg - LCL)/(Avg) \times 100 \leq 15\,\% \quad (3)$$

NOTE 4—The 5 % deflection criterion, which was arbitrarily selected for testing convenience, should not be considered as a limitation with respect to in-use deflection. The engineer is responsible for establishing the acceptable deflection.

6.3.2 *Fittings*—Individual fittings unassembled shall withstand a minimum load of 750 lbf/ft (11 kN/m) of centerline length without cracking or other visible evidence of failure when tested in accordance with 7.4.

6.4 *Minimum Hydrostatic Burst Pressure*—When tested at 73 °F (23 °C) in accordance with Test Method D1599, the minimum burst pressure of pipe shall be in accordance with Table 4, and the minimum burst pressure of fittings shall be 200 psi (1.4 MPa). Test three specimens of pipe or three fittings; all shall meet the requirements.

NOTE 5—The minimum burst pressure requirements for DWV fittings are lower than for pipe because of the fittings geometry.

6.5 *Impact Resistance*—The minimum impact resistance of pipe and fittings shall comply with Table 5. Test in accordance with Test Method D2444 using Tup C and Holder A for pipe and Tup A and Holder B for fittings. Use a 12 lb (5 kg) tup for testing pipe sizes 4 in. and smaller and a 20 lb (10 kg) tup for pipe larger than 4 in. Test fittings with a 12 lb (5 kg) Tup. Test couplings cemented to short pieces of pipe and allowed to dry for 24 h.

6.5.1 *Test 10 specimens.* When 9 or 10 specimens pass, accept the lot. When 2 or more specimens fail, test 10 additional specimens. When 17 of 20 specimens tested pass, accept the lot. When 4 or more of 20 specimens tested fail, test 20 additional specimens. When 32 of 40 specimens pass, accept the lot. When 9 or more of 40 specimens fail, the lot does not meet the requirements of this specification.

6.5.2 Failure in the test specimens shall be shattering or any crack or break extending entirely through the pipe wall and visible to the unaided eye.

7. Test Methods

7.1 *Sampling*—A sample of the pipe and fittings sufficient to determine conformance with this specification shall be taken at random from each lot or shipment. About 40 ft (12 m) of pipe are required to make the tests prescribed. The number of fittings required varies depending on the size and type of fitting.

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

7.2 *Conditioning:*

7.2.1 For referee purposes, condition the specimens prior to test at 73 °F ± 4 °F (23 °C ± 2 °C) and 50 % ± 5 % relative humidity in accordance with Practice D618, Procedure A.

TABLE 4 Minimum Hydrostatic Burst Pressure at 73 °F (23 °C)

Nominal Pipe Size	Minimum Hydrostatic Burst Pressure[A] psi (kPa) Type I
1¼	1180 (8140)
1½	1060 (7310)
2	890 (6140)
3	840 (5790)
4	710 (4900)
6	560 (3680)
8	500 (3450)
10	450 (3100)
12	420 (2890)
14	410 (2830)
16	410 (2830)

[A]These burst pressures are calculated using a hoop stress of 6400 psi (44.1 MPa).

TABLE 5 Impact Resistance of PVC Plastic Drain, Waste and Vent Pipe and Fittings

Description	Impact Resistance, min., ft-lbf (J) 73 °F (23 °C)
All pipe sizes	60 (81)
All fitting sizes and types	15 (20)

7.2.2 For routine quality control testing, condition the specimens at the temperature and humidity of the manufacturer's testing facility for not less than 1 h or until the specimens are at the room temperature.

7.3 *Test Conditions:*

7.3.1 For referee purposes, conduct tests in the standard laboratory atmosphere of 73 °F ± 4 °F (23 °C ± 2 °C) and 50 % ± 10 % relative humidity.

7.3.2 For routine control testing, conduct tests at the room temperature and humidity of the manufacturers testing area.

7.4 *Pipe Stiffness, Deflection Load, and Flattening*—Measure the pipe stiffness, the flattening of pipe and the deflection load of fittings in accordance with Test Method D2412. In the test for pipe, note the load when the initial diameter is reduced 5 % (pipe stiffness). Continue test until the diameter is deflected by 60 % of its original value (flattening). The rate of head approach shall be 0.20 in./min to 0.25 in./min (5.1 in./min to 6.3 mm/min).

7.4.1 *Pipe*—Three specimens, each 6 in. ± ¼ in. (150 mm ± 3 mm) long, shall be tested. The ends shall be cut square and free of burrs and jagged edges. Each specimen shall meet the requirements of 6.3.1.

7.4.2 *Fittings*—Test three complete fittings. Each specimen shall meet the requirement of 6.3.2. Shim fittings to give full centerline contact with platens. Fittings having nonuniform diameters, such as reducers, shall be considered acceptable when the wall thickness at all points is equal to or greater than the wall thickness of pipe of the same material and diameter that meets the crush resistance requirements.

7.4.3 *Procedure*—Terminate the test when the diameter of pipe test specimens is reduced to 40 % of its original value or the pipe cracks or shows other evidence of visible failure. Terminate the test on fittings when the load reaches 750 lbf/ft (11 kN/m) of centerline length. Observe the load and deflection at the first evidence of cracking, if any. Record location and type of failure.

7.4.4 *Calculations*—For pipe, divide the load at failure (flattening) if such occurred, by the length of the pipe test specimen to obtain the flattening resistance. Express results in N/m or lbf/ft. Calculate the values for each specimen of pipe and fittings for conformance to the requirements of 6.3.1 and 6.3.2. For calculation of pipe stiffness, refer to the Calculation Section and the Appendix of Test Method D2412. Calculate the values for each specimen separately. Examine the results for each specimen of pipe for conformance to the requirements of Table 3.

7.5 *Threads*—All taper pipe threads shall be gauged in accordance with Specification F1498.

8. Retest and Rejection

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

9. Product Marking

9.1 *Pipe*—The pipe shall be marked in letters not less than 3⁄16 in. (5 mm) high, in a contrasting color, and shall at least consist of the manufacturer's name or trademark, the designation ASTM F2390, the nominal pipe size, the word RECYCLE, the symbol PVC, and the symbol DWV, spaced at intervals of not more than 5 ft (1.5 m).

9.2 *Fittings*—Fittings shall be marked on the body or hub with the manufacturer's name or trademark, the designation ASTM F2390, and the symbol PVC.

10. Quality Assurance

10.1 When the product is marked with this designation, F2390, 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; fittings; pipe; plastic; post-consumer recycle; post-industrial recycle; PVC; Schedule 40; thermoplastic