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An American National Standard

Standard Specification for Coextruded Composite Drain, Waste, and Vent Pipe (DWV)[1]

This standard is issued under the fixed designation F1499; 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 coextruded composite drain, waste, and vent pipe (DWV). The pipe is produced in Schedule 40 IPS sizes by a coextrusion die system, in which the concentric layers are formed and combined before exiting the die.

1.1.1 Coextruded composite drain, waste, and vent pipe, DWV, by definition, is permitted to be produced with two or more layers. The outer layer shall be ABS. The middle layer is permitted to be thermally foamed PVC or solid PVC or a blend of rework material, as specified in the rework material section. The inner layer is permitted to be solid PVC or ABS, or a blend of rework material as specified in the rework material section.

1.1.2 The function of this specification is to provide standardization of product, technical data, and serve as a purchasing guide.

1.2 DWV is permitted to be produced utilizing a two layer or three layer coextrusion die.

1.3 Materials that do not meet the requirements of the material section are excluded.

1.4 Pipe produced to this specification is permitted to be joined using molded fittings meeting the requirements of Specification D2661 or Specification F628. The fitting patterns must comply with Specification D3311.

1.5 Pipe produced to this specification is permitted to be perforated in accordance with any specified standard or by agreement between the purchaser and the supplier.

1.6 Pipe produced to this specification is permitted to be belled for joining by solvent cementing or belled for joining by an elastomeric seal (gasket), in accordance with any specified standard or by agreement between the purchaser and the supplier.

1.7 Recommendations for storage, joining, and installation are provided in Appendix X1, Appendix X2, and Appendix X3, respectively.

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

1.9 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 this specification.

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

NOTE 1—Specifications related to this specification are as follows: Specifications D2661, D2665, F628, and F891.

1.10 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.

1.11 *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.*

1.12 *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 The following standards contain provisions that, though referenced in this specification, constitute provisions of this specification. All standards are subject to revision and parties using this specification, shall reference the most recent edition of the standards listed as follows:

2.2 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing
D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer
D883 Terminology Relating to Plastics
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
D2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic 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)
D2661 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
D2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
D3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
D3965 Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings
D4000 Classification System for Specifying Plastic Materials
E105 Guide for Probability Sampling of Materials
E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process
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
F628 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core
F891 Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

2.3 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)[3]

2.4 *Military Standard:*

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

2.5 *ANSI Standard:*

ANSI Z 34.1 American National Standard for Certification-Third-Party Program[4]
ANSI Z 34.2 American National Standard for Certification-Self-Certification by Producer or Supplier[4]

[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] Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.
[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

~~2.6 *Uniform Classification Committee Standards:*~~
~~Uniform Freight Classification[5]~~

~~2.7 *National Motor Freight Traffic Association Standard:*~~
~~National Motor Freight Classification[6]~~

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions are in accordance with Terminology D883 and F412. Abbreviations are in accordance with Terminology D1600. Plastic materials are classified in accordance with Classification D4000.

3.1.2 *coextruded pipe*—pipe consisting of two or more concentric layers of material bonded together in processing by any combination of temperature, pressure, grafting, crosslinking, or adhesion.

3.1.3 *compound*—a mixture of a polymer with other ingredients such as inert fillers, stabilizers, catalysts, processing aids, lubricants, impact modifiers, pigments, or curing agents.

3.1.4 *out-of-roundness*—the allowed difference between the maximum measured diameter and the minimum measured diameter (stated as an absolute deviation).

3.1.5 *thermally foamed plastic*—a cellular plastic produced by applying heat to effect gaseous decomposition or volatilize of a constituent. (1985)

3.1.6 *virgin plastic, (adj)*—materials in the form of pellets, granules, powder, floc, or liquid that has not been subjected to use or processing other than that required for its initial manufacture. (1985)

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *ABS/PVC*—an acronym for a blend of acrylonitrile-butadiene-styrene and poly vinyl chloride.

3.2.2 *lot*—a lot shall consist of all pipe produced, of one size, from one extrusion line, during one designated 24-h period.

3.2.3 *rework material*—a blend of the different materials generated from coextruded composite drain, waste, and vent pipe (DWV).

4. Classification

4.1 Coextruded composite drain, waste, and vent pipe, DWV, produced in compliance this specification will provide pipe suitable for the drainage and venting of sewage and certain other liquid wastes.

NOTE 2—Before installing coextruded composite pipe in an industrial waste disposal system, the approval of the cognizant building code authority should be obtained as conditions not commonly found in normal use may be encountered and temperatures in excess of ~~180°F (82°C)~~180 °F (82 °C) may be encountered.

5. Ordering Information

5.1 Orders for coextruded composite drain, waste, and vent pipe, DWV, produced in compliance with this specification should include the following:

5.1.1 This ASTM designation number, and the year of issue,

5.1.2 Pipe size,

5.1.3 Footage required of each size, and

5.1.4 Materials.

6. Materials and Manufacture

6.1 *Basic Compound*—Virgin compound for use in the outer layer of coextruded composite drain, waste, and vent pipe, DWV, shall contain pigments or screening agents to provide protection against UV radiation.

6.2 *ABS Compound Specification*—The ABS compound shall be virgin ABS compound conforming to the requirements of Specification D3965 and shall meet all of the requirements for Cell Class 4-2-2-2-2.

6.2.1 The color and form of the material shall be ~~by agreement between the purchaser and the supplier,~~ in accordance with Specification D3965.

6.3 *PVC Compound Specification*—The PVC compound shall be virgin PVC compound conforming to the requirements of Specification D1784 and shall meet all of the requirements for Cell Class 12344 except that the tensile strength shall not be less than 6500 psi and the modulus of elasticity shall not be less than 380,000.

6.3.1 The color and form of the material shall be ~~by agreement between the purchaser and the supplier~~ in accordance with Specification D1784.

6.3.2 Individual cell class values are permitted to be greater than those listed.

6.4 *Rework Material*—A blend of clean rework materials generated from the manufacturers own pipe production is permitted to be used by the same manufacturer, provided the pipe produced meets all of the requirements of this specification.

6.4.1 Rework material generated from composite pipe shall not be used in the outer layer.

6.4.2 Thermally foamed layer shall not be used in the inner or outer layer.

7. Requirements

7.1 *General*—The inside and outside surfaces of pipe produced in accordance with this specification shall be free of chalking, sticky, or tacky material. The surfaces shall be free of excessive bloom. Bloom or chalking may develop in pipe exposed to direct rays of the sun (ultraviolet radiant energy) for extended periods and consequently, these requirements do not apply to pipe after extended exposure to direct rays of the sun. The inside and outside surfaces of pipe shall be free of foreign inclusion or other defects that are visible to the naked eye, and may affect the wall integrity.

7.1.1 The requirements in this section are intended only for use as quality control tests, not as simulated service tests.

7.2 *Dimensions and Tolerances:*

7.2.1 *Outside Diameter*—The outside diameter and tolerances shall meet the requirements of Table 1 when measured in accordance with Method D2122. The tolerances for out-of-roundness shall apply to the pipe at the time of manufacture.

TABLE 1 Outside Diameter and Tolerance

Outside Diameter, in. (mm)			
Nominal Pip Sizes	Average	Tolerance on Average Outside Diameter	Out-of-Roundness Maximum Diameter Minus Minimum Diameter[A]
1¼	1.660 (42.16)	+0.010, –0.000 (+0.25, –0.00)	0.024 (0.60)
1½	1.900 (48.26)	+0.010, –0.000 (+0.25, –0.00)	0.024 (0.60)
2	2.375 (60.32)	+0.010, –0.000 (+0.25, –0.00)	0.024 (0.60)
3	3.500 (88.90)	+0.015, –0.000 (+0.38, –0.00)	0.060 (1.52)
4	4.500 (114.30)	+0.015, –0.000 (+0.38, –0.00)	0.100 (2.54)
6	6.625 (168.28)	+0.016, –0.006 (+0.41, –0.15)	0.100 (2.54)
8	8.625 (219.07)	+0.022, –0.008 (+0.56, –0.20)	0.150 (3.81)

[A] Measured at time of manufacturing.

7.2.2 *Wall Thickness*—The wall thickness and tolerances shall meet the requirements of Table 2 when measured in accordance with Method D2122.

7.2.3 *Length*—The pipe shall be in either 10 or 20-ft (3.05 or 6.1-m) lengths, unless otherwise specified. The allowable tolerance on the length shall be +½,–0 in.

7.3 *Pipe Stiffness*—The minimum pipe stiffness at 5 % deflection when measured in accordance with Test Method D2412 shall equal or exceed the value in Table 3. The rate of crosshead motion shall be 0.20 in./min to 0.25 in./min (5.1 mm/min to 6.3 mm/min). Three specimens shall be tested. If all three meet this requirement, the sample meets this requirement. If one or two fail, additional testing shall be conducted in accordance with 7.3.1. If all three fail, the sample does not meet the requirement.

7.3.1 *Pipe Stiffness and Lower Confidence Limit*—In the event that one or two of the specimens tested in 7.3 fail to meet the minimum 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 (11). 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 7.3, and an additional eight with rotation by 35°, as specified in D2412, continuing throughout the remaining specimens.

The LCL based on testing eleven specimens is calculated as follows (Note: $N = 11$):

$$\text{LCL} = (\text{Average PS}) - \{2.76\,(\text{Standard Deviation})/\sqrt{(N)}\} \tag{1}$$

where:

$$(\text{Average PS}) = \left[\sum(\text{PS}_i)\right]/(11) \tag{2}$$

$$(\text{Standard Deviation}) = \left[\frac{\sum \text{PS}^2 - (\sum \text{PS})^2/\text{N}}{N-1}\right]^{1/2} \tag{3}$$

The 15 % requirement is calculated as:

$$(\text{Average} - \text{LCL})/(\text{Average}) \times 100\,\% \leq 15\,\% \tag{4}$$

NOTE 3—This test is conducted at the time of manufacture.

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

NOTE 5—The strength and load-carrying capabilities of composite DWV pipe is measured and reported as pipe stiffness, that is determined in accordance with Test Method D2412. The term "crushing strength" is not applicable to thermoplastic piping.

7.4 *Pipe Flattening*—There shall be no evidence of rupture or cracking when deflected 25 % of the initial inside diameter when tested by Test Method D2412. Test three specimens. When all pass, accept the lot. When one fails, the lot does not meet the requirements of this specification. Failure shall be a crack or break extending entirely through the pipe wall visible to the unaided eye. Refer to 9.1 (see Note 3).

7.5 *Impact Resistance*—The minimum impact resistance, when tested at the time of manufacture, shall comply with the requirements of Table 4. Test in accordance with Test Method D2444 using Tup B and Holder B. Use a 20–lb (9.1 kg) tup for all sizes.

TABLE 2 Wall Thickness and Tolerance

	Wall Thickness, in. (mm)	
Nominal Pipe Sizes	Minimum Wall[A]	Tolerance
1¼	0.140 (3.56)	+0.020 (+0.50)
1½	0.145 (3.68)	+0.020 (+0.50)
2	0.154 (3.91)	+0.020 (+0.50)
3	0.216 (5.42)	+0.026 (+0.66)
4	0.237 (6.02)	+0.028 (+0.71)
6	0.280 (7.11)	+0.034 (+0.86)
8	0.322 (8.18)	+0.034 (+0.86)

[A] The minimum is the lowest wall thickness of the pipe at any cross section.

TABLE 3 Pipe Stiffness

Nominal Pipe Sizes	Minimum Pipe Stiffness at 5 % Deflection	
	psi	(MPa)
1¼	600	(4.13)
1½	535	(3.69)
2	300	(2.06)
3	280	(1.93)
4	175	(1.21)
6	75	(0.52)
8	75	(0.52)

TABLE 4 Impact Resistance

Nominal Pipe Sizes	Minimum Impact Resistance, ft lb3 lbf (J)
	At ~~32°F (0°C)~~32 °F (0 °C)
1¼	15 (20)
1½	20 (27)
2	30 (41)
3	40 (54)
4	40 (54)
6	40 (54)
8	40 (54)

7.5.1 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 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.

7.5.2 Failure of the test specimen shall be shattering or any crack or break extending entirely through the pipe wall and visible to the unaided eye.

7.6 *Bond*—The bond between layers shall be strong and uniform. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly, or the probe or knife blade moves freely between the layers; nor shall separation of bond occur between layers during testing performed under the requirements of this specification. Refer to 9.1 (see Note 3).

7.7 *Inspection*—Inspection shall be made prior to installation of all pipe. Pipe that does not meet the requirements of Section 8 shall be returned to the seller.

7.8 *Solvent Cement*—In the assembly of solvent cement joints, the solvent cement shall be compatible with the material in the outer layer, as marked on the pipe, and shall meet the requirements of Specification D2235.

7.8.1 The safety requirements of Practice F402 shall be followed.

7.9 *Qualification Test:*

7.9.1 *Joint Tightness*—Join two pieces of pipe together using molded fittings and solvent cement. Use solvent cement meeting the requirements of 7.8. Cure the solvent cement joints 24 h at room temperature, before testing. Joints shall not leak when tested at an internal water pressure of 25 psi (170 kPA), for 1 h using water at ~~73°F (23°C).~~73 °F (23 °C). Refer to 9.1.

NOTE 6—The qualification test is designed to qualify the thickness of the outer layer, to ensure that the thickness of the outer layer is sufficient to withstand the effect of the solvent cement, and thus ensure a good leak-free joint.

8. Sampling and Conditioning for Quality Control Testing

8.1 *Sampling*—The lot shall consist of all pipe produced of one size from one extrusion line during one designated 24-h period. Take the number of specimens for each test from pipe selected at random.

NOTE 7—Also see Practices E105 and E122.

8.2 *Conditioning:*

8.2.1 For referee testing at ~~73° F,~~ 73 °F, condition the specimens prior to the test at ~~73~~73 °F ± ~~4°F (23~~4 °F (23 °C ± ~~2°C)~~2 °C) and ~~50~~50 % ± 10 % relative humidity in accordance with Practice D618, Procedure A.

8.2.2 For routine quality control testing at ~~73°F,~~73 °F, condition the specimens at the temperature and humidity of the manufacturers testing facility for not less than 1 h or until the specimens are at room temperature.

8.2.3 For referee testing at ~~32°F,~~32 °F, condition the specimens at ~~32~~32 °F ± ~~4°F~~4 °F (0 ± 2°) for at least 16 h in air.

8.2.4 For quality control testing at ~~32°F,~~32 °F, condition the specimens at ~~32~~32 °F ± ~~4°F~~4 °F (0 ± ~~2°C)~~2 °C) for at least 12 h, or in ice water for at least 1 h.

8.3 *Test Conditions:*

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

8.3.2 For routine quality control testing, conduct tests at the temperature and humidity of the manufacturer's testing area.

8.3.3 For testing at ~~32°F,~~32 °F, complete the test as soon as possible after removal from the conditioning atmosphere, but in any case within 15 s.

8.4 *Frequency of Test*—The frequency of testing shall be established by the manufacturers, consistent with good quality control practices.

8.5 *Number of Tests*—The number of tests for quality control shall be under the manufacturer's established quality control program.

8.6 *Test Conditions For Quality Control Testing*—Conduct quality control testing at the temperature and humidity of the manufacturer's testing area in accordance with Practice D618.

8.7 *Quality Control Test*—The quality control program shall include testing for compliance with this specification of the following:

8.7.1 Outside diameter,

8.7.2 Wall thickness,

8.7.3 Length,

8.7.4 Pipe stiffness,

8.7.5 Pipe flattening,

8.7.6 Impact strength, and

8.7.7 Bond.

8.8 *Referee Testing:*

8.8.1 *Sampling*—Collect specimens in accordance with 8.1. The number of specimens shall be sufficient to obtain a complete set of test results for those properties to be measured. Prepare specimens in accordance with the applicable ASTM test method.