



Standard Specification for Poly(Vinyl Chloride) (PVC) Schedule 40 Drain, Waste, and Vent Pipe with a Cellular Core¹

This standard is issued under the fixed designation F3128; 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 poly(vinyl chloride) (PVC) plastic drain, waste and vent pipe made to Schedule 40 iron pipe sizes (IPS) and produced by the coextrusion process with concentric inner and outer solid PVC layers and the core consisting of closed-cell cellular PVC. Plastic which does not meet the material requirements specified in Section 5 is excluded from single layer and all coextruded layers.

1.2 Fittings meeting the requirements of Specification D2665 and D3311 are suitable for use with pipe meeting the requirements of this specification.

1.3 Poly(vinyl chloride) plastic which does not meet the definitions of virgin PVC plastic as given in 5.1 is excluded, as performance of plastic other than those defined as virgin was not determined. PVC rework plastic which meets the requirements of rework plastic as given in 5.2 is acceptable.

1.4 Reprocessed plastic or recycled plastic as defined in Terminology D883 is excluded.

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

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

1.7 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.

1.8 *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.

1.9 *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

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2152 Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion

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)

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

D2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855 Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets

D3311 Specification for Drain, Waste, and Vent (DWV)

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.

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

Plastic Fittings Patterns

D4396 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications

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

F656 Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

2.2 *Federal Standard*.³

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

2.3 *Military Standard*.³

MIL-STD-129 Marking for Shipment and Storage

2.4 *Plastic Pipe Institute*⁴

PPI-TR-7 Recommended Method For Calculation of Nominal Weight of Plastic Pipe

4. Classification

4.1 Pipe produced in accordance with this specification is intended to provide pipe suitable for the drainage and venting of sewage and certain other liquid wastes.

NOTE 1—Before installing pipe for waste disposal use, 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 140°F (60°C) may be encountered.

NOTE 2—This specification does not include requirements for pipe intended to be used to vent combustion gases.

5. Materials

5.1 *Material Specification*—The PVC material shall conform to the requirements prescribed in Specification **D4396** with a cell classification of 11432. PVC material which has a higher cell class than that listed is acceptable.

5.2 *Rework Material*—The manufacturer shall use only his own clean rework pipe material conforming with these cell class requirements. It shall be used only in the core layer if it contains any residual blowing agent. The pipe produced shall meet all requirements of this specification.

5.3 *Cellular Material*—Cellular PVC used in the core layer shall be of a closed cell structure when tested in accordance with **6.3.6**.

6. Requirements

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

6.2 *Dimensions and Tolerances*:

6.2.1 *Outside Diameter*—the outside diameter and tolerances shall meet the requirements of **Table 1** when measured in accordance with Test Method **D2122**. The tolerances for out-of-roundness shall apply to pipe prior to shipment.

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

6.2.3 *Length*—The pipe length may be 7 ft, 10 ft, 12 ft, or 20 ft with a tolerance on length of +½, -0 in., unless otherwise specified.

6.3 *Performance Requirements*:

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology **F412** and abbreviations are in accordance with Terminology **D1600**, unless otherwise specified. The abbreviations for poly(vinyl chloride) plastic is PVC.

3.2 *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.

3.3 *Definitions of Terms Specific to This Standard*:

3.3.1 *IPS schedule 40 series*—Pipe pipe produced to an iron pipe outside diameter with a Schedule 40 wall thickness.

3.3.2 *recycled plastic*—a plastic prepared from discarded articles that have been cleaned and reground.

³ DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 <http://quicksearch.dla.mil/>

⁴ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.

TABLE 1 Outside Diameter and Tolerances

Nominal Pipe Size,	Outside Diameter,		Tolerance on Average Outside Diameter,	Out-of-Roundness
	in.	in. (mm)		
1¼		1.660 (42.16)	±0.005 (0.13)	0.060 (1.52)
1½		1.900 (48.26)	±0.006 (0.15)	0.060 (1.52)
2		2.375 (60.32)	±0.006 (0.15)	0.060 (1.52)
3		3.500 (88.90)	±0.008 (0.20)	0.060 (1.52)
3 ½		4.000 (101.60)	±0.008 (0.20)	0.100 (2.54)
4		4.500 (114.30)	±0.009 (0.23)	0.100 (2.54)
5		5.563 (141.30)	±0.010 (0.25)	0.100 (2.54)
6		6.625 (168.28)	±0.011 (0.28)	0.100 (2.54)
8		8.625 (219.08)	±0.015 (0.38)	0.150 (3.81)
10		10.750 (273.05)	±0.015 (0.38)	0.150 (3.81)
12		12.750 (323.85)	±0.015 (0.38)	0.150 (3.81)

TABLE 2 Minimum Wall Thickness^A, Pipe Stiffness and Impact Requirements

Nominal Pipe Size in.	Minimum Wall Thickness in.	Minimum Pipe Stiffness lbf/in. ² (MPa)	Minimum Impact Energy ft.lbf, (J) at 32 °F (0 °C)
1 ¼	0.140 (3.56)	600 (4.13)	15 (20)
1 ½	0.145 (3.68)	600 (4.13)	20 (27)
2	0.154 (3.91)	300 (2.07)	30 (41)
3	0.216 (5.49)	300 (2.07)	40 (54)
3½	0.226 (5.74)	250 (1.72)	40 (54)
4	0.237 (6.02)	200 (1.38)	40 (54)
5	0.258 (6.55)	120 (0.83)	40 (54)
6	0.280 (7.11)	120 (0.83)	40 (54)
8	0.322 (8.18)	100 (0.69)	50 (68)
10	0.365 (9.27)	60 (0.41)	55 (75)
12	0.406 (10.31)	50 (0.34)	55 (75)

^A The maximum wall thickness shall not be greater than 1.25 times the minimum wall thickness.

6.3.1 *Pipe Stiffness*—The minimum pipe stiffness values at 5% deflection when measured in accordance with Test Method D2412 shall equal or exceed the values in Table 2. 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 6.3.1.1. If all three fail, the sample does not meet the requirement.

6.3.1.1 *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 requirement, the average pipe stiffness of 11 specimens shall meet or exceed the minimum requirement given in Table 2. 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 the applicable table but is not within 15 % of the average, the sample meets the requirements of the pipe stiffness testing. The 11 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.

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

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

where:

$$N = 11$$

$$avg PS = \frac{\sum (PS_i)}{11}$$

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

The 15 % requirement is calculated as follows:

$$(avg - LCL) / (avg) \times 100 \leq 15\%$$

NOTE 3—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 acceptable deflection limit.

NOTE 4—The strength and load-carrying capabilities of plastic pipe are measured and reported as pipe stiffness, which is determined in accordance with Test Method D2412. The term “crushing strength” is not applicable to plastic piping.

6.3.2 *Pipe Flattening*—There shall be no evidence of cracking, delamination or rupture when pipe is deflected 60 %

of the initial inside diameter, when tested in accordance with Test Method D2412. Three specimens shall be tested and all shall pass.

NOTE 5—This test is intended only for use as a quality control test and not as a simulated service test.

6.3.3 *Impact Resistance*—The minimum impact energy, when tested at the time of manufacture, shall comply with Table 2. Test in accordance with Practice D2444, using Tup A and Holder B. Use a 12-lb (5.4-kg) tup for testing pipe sizes 4 in. and smaller and a 20-lb (9.1-kg) tup for pipe sizes larger than 4 in.

6.3.3.1 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.

6.3.3.2 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.

6.3.4 *Bond*—The bond between layers shall be strong and uniform. It shall not be possible to separate any two layers with a probe or the point of a knife blade so that the layers separate cleanly, nor shall separation of the bond occur between layers during testing performed under the requirements of this specification.

6.3.5 *Extrusion Quality*—The pipe shall meet the requirements of Test Method D2152.

6.3.6 *Cellular Structure*—The core layer of cellular core pipe shall not allow the passage of water when tested at 10 psig ± 1 psig for a minimum of 30 minutes. The test sample shall be 18 in. ± 0.1 in. (457 mm ± 3 mm) long. Create a seal on the O.D. and the I.D. of the pipe near one end in a manner that permits the exposed core to be subjected to water pressure (Note 6). Any sign of water emanating from the core at the opposite end after 30 minutes is indication of an open cell structure and the specimen does not meet the requirements of this specification.

NOTE 6—The method of sealing against the I.D. and O.D. of the pipe is not specified, as several acceptable methods are available. One such method uses an elastomeric no-hub adapter clamped to the O.D. and

pneumatic or mechanical test plug to seal the I.D.

6.4 Other Requirements:

6.4.1 *Joining*—Coextruded poly(vinyl chloride) PVC Cellular Core DWV Pipe is joined using fittings meeting the requirements of Specification **D2665** and **D3311**

6.4.2 *Solvent Cement*—In the assembly of solvent cement joints, the safety requirements of Practice **F402** shall be followed and the joint shall be assembled following Practice **D2855**, using a cleaner or primer.

7. Sampling and Conditioning

7.1 *Sampling*—The selection of the sample or samples of pipe shall be as agreed upon by the purchaser and seller. In case of no prior agreement, any sample selected by the testing lab shall be deemed adequate.

7.2 Conditioning:

7.2.1 For referee testing at 73 °F (23 °C), condition the specimens prior to test at 73.4 °F ± 3.6 °F (23 °C ± 2 °C) and 50 ± 10% relative humidity in accordance with Practice **D618**, Procedure A.

7.2.2 For routine quality control testing at 73 °F (23 °C), 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.

7.2.3 For referee and routine quality control testing at 32 °F (0 °C), condition the specimens at 32 °F ± 3.6 °F (0 °C ± 2 °C) in air for at least 2 h, or in ice water for at least 1h.

7.3 Test Conditions:

7.3.1 For referee testing at 73 °F (23 °C), conduct tests in the standard laboratory atmosphere of 73.4 °F ± 3.6 °F (23 °C ± 2 °C) and 50 ± 10% relative humidity.

7.3.2 For routine quality control testing at 73 °F (23 °C), conduct tests at the room temperature and humidity of the manufacturer's testing area.

7.3.3 For referee and routine quality control testing at 32 °F (0 °C), complete the test as soon as possible after removal from the conditioning atmosphere, but in any case within 15 s.

7.4 *Test Methods*—Only specified ASTM test methods shall be used.

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 in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirements of the specifications by such means as omitting test methods that are part of the specification, substitution, or modifying test methods, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods designated in 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. Marking

9.1 *Quality of Marking*—The marking shall be applied to the pipe for end-use application in such a manner that it remains legible (easily read) after installation and inspection.

9.2 *Content of Marking*—The pipe shall be marked at least every 5 ft (1.52 m) in letters not less than 3/16 in. (4.76 mm) high and in a color that contrasts with the color of the pipe, and shall contain the following information:

9.2.1 Manufacturer's name or trademark.

9.2.2 This designation, ASTM F3128.

9.2.3 The wording "COEXTRUDED CELLULAR CORE PVC DWV PIPE".

9.2.4 Nominal pipe size (for example: 2 in. IPS Schedule 40).

9.2.5 Manufacturer's code for identifying lot number, date and year of manufacture, or other information as needed.

10. Quality Assurance

10.1 When the product is marked with this designation, F3128, 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 cellular core; coextruded; DWV; PVC; Schedule 40; thermoplastic

SUPPLEMENTARY REQUIREMENTS

SUPPLEMENTARY REQUIREMENTS GOVERNMENT/MILITARY PROCUREMENT

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 the performance of 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.

S2.1 *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.

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.

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 pipe should be carefully inspected for cuts, gouges, deep scratches, damaged ends, and other major imperfections. Defective pipe should be rejected, and damaged sections should be cut out.

dissolve the joint surfaces prior to application of solvent cement for joining. Primers meeting the requirements of Specification F656 are acceptable.

X2.2 *Pipe Fit*—Pipe is manufactured to close tolerances to ensure satisfactory “interference” fit between the pipe and the fittings socket during assembly. Use only combinations of pipe and fittings that give interference fits. Pipe that is a loose fit in the socket may not properly bond. The allowable tolerance assures a forced fit and when solvent cement is applied, the pipe and fitting will readily mate, thus assuring a physical fusion. The pipe should enter the dry fitting socket to between one half and two thirds of the fitting socket depth.

X2.7 *Solvent Cement*—Use only solvent cement designated for PVC. A solvent cement meeting the requirements of Specification D2564, when used in accordance with the manufacturer’s recommendations, should provide satisfactory results; or follow Practice D2855.

X2.7.1 *Application of Cement*—Using the applicator supplied with the can of solvent cement, or a brush or roller with a width of about one half the pipe diameter for pipe sizes above 2 in., apply a moderate even coating of cement in the fitting socket to cover only the surfaces to be joined. Heavy or excessive application of solvent cement may become an obstruction in the pipe and prevent satisfactory joining. Quickly apply a heavy coat of solvent cement to the outside of the pipe. Make sure that the coated distance on the pipe is equal to the depth of the fitting socket.

X2.3 *Cutting*—Pipe can be easily cut with an ordinary hacksaw or carpenter’s saw. Fine-tooth blades with little or no set should be used for best results. The pipe should be cut square and all burrs removed with a sharp knife, a fine-tooth file, or other suitable device. A miter box is recommended to ensure square cut ends. Standard steel pipe or tubing cutters are not recommended for cutting PVC pipe since they may cause excessive heat and pressure, which can result in cracked or irregular pipe ends. There are special cutters available with extra wide rollers and thin cutting wheels that have been designed for cutting plastic pipe, and their use is recommended.

X2.8 *Assembly*—Make the joint as quickly as possible after application of the solvent cement and before the solvent cement dries. Should the solvent cement dry partially before the joint is made up, reapply solvent cement before assembling. Insert the pipe into the fitting socket, making sure that the pipe is inserted to the full depth of the fitting socket. Hold the joint together firmly for about 30 s for small diameter pipe and 60 s for diameters above 6 in. to avoid push out. Remove excessive solvent cement from the exterior of the joint with a clean, dry cloth.

X2.4 *Cleaning*—Chemical or mechanical cleaners should be used to clean the pipe after all burrs have been removed and prior to assembly.

X2.9 *Set Time*—Do not attempt to disturb the pipe and fitting joint until after the solvent cement has set or damage to the joint and loss of fit may result. Reasonable handling of the

X2.5 *Safety Requirements for Solvent Cement and Primers*—Practice F402 should be followed.

X2.6 *Primers*—Primers may be used to clean, soften, and