Designation: D4396 – 15

Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications[1]

This standard is issued under the fixed designation D4396; 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 the classification and identification of rigid plastic compounds intended for use in making nonpressure piping products composed of *(1)* poly(vinyl chloride) polymer, *(2)* chlorinated poly(vinyl chloride) polymer, or *(3)* vinyl chloride copolymers, and the necessary compound ingredients. Compounding ingredients consist of lubricants; stabilizers; non-poly(vinyl chloride) resin modifiers; colorants or pigments, or both; fibrous or nonfibrous reinforcements; or fillers.

1.2 The requirements in this specification are intended for the quality control of compounds used to manufacture pipe or fittings intended for nonpressure use. They are not applicable to finished pipe and finished fittings. See the applicable ASTM standards or requirements for finished products.

1.3 In special cases, specific compounds for unusual piping applications that require consideration of other properties not covered in this specification, such as service temperature, sag resistance, special chemical resistance, weather resistance, bending forces, and electrical properties, shall be considered.

1.4 Rigid PVC-type compounds for building applications other than piping are covered in Specification D4216.

1.5 Rigid PVC compounds for general purpose extrusion, molding, fitting, and pipe are covered in Specification D1784.

1.6 The rate of burning test, Test Method D635, is used in this specification as a test for identification of certain properties of the compound.

1.7 It is acceptable for rigid PVC and CPVC recycle plastics meeting the requirements of this specification to be used in some applications. Refer to the specific requirements in the Material and Manufacture section of the applicable product standard.

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

1.9 The following safety hazards caveat pertains only to the test methods portion, Section 10, 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.*

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
D618 Practice for Conditioning Plastics for Testing
D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
D638 Test Method for Tensile Properties of Plastics
D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
D883 Terminology Relating to Plastics
D1600 Terminology for Abbreviated Terms Relating to Plastics
D1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D3892 Practice for Packaging/Packing of Plastics
D4216 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly(Vinyl Chloride) (CPVC) Building Products Compounds
D5260 Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

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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**

F412 Terminology Relating to Plastic Piping Systems

3. Terminology

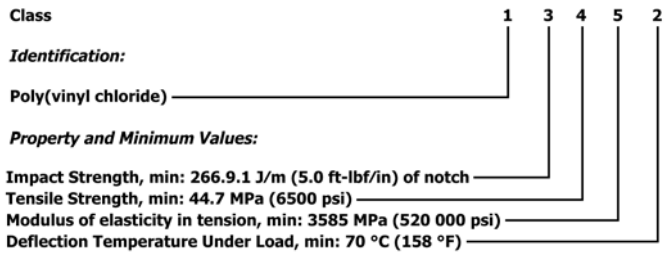
3.1 *Definitions*—General definitions are in accordance with Terminologies D883, F412, and D1600, unless otherwise noted.

4. Classification

4.1 The means for classifying and identifying PVC pipe compounds are provided in Table 1. The properties enumerated in this table and the tests defined provide identification of the compounds selected. They are not necessarily suitable for direct application in design because of differences in shape or part, size, loading, environmental conditions, method of processing, etc.

4.2 Classes are designated by the cell number for each property in the order in which they are listed in Table 1.

NOTE 2—The manner in which selected materials are identified by this classification system is illustrated by a cell Class 13452 PVC nonpressure pipe compound having the following requirements (see Table 1):



NOTE 3—The cell-type format provides the means for classification and close characterization and specification of compound properties, alone or in combination, for a broad range of compounds. This type format, however, is subject to possible misapplication since unobtainable property combinations can be selected if the user is not familiar with commercially available compounds. The manufacturer should be consulted.

4.3 Product application chemical resistance when specified shall be classified in accordance with the Classification Section of Classification D5260.

5. Materials and Manufacture

5.1 *Resin (Polymer) Requirements:*

5.1.1 Poly(vinyl chloride) (PVC) resin (polymer) meeting Cell 1 in Designation Order 1 shall have a vinyl chloride homopolymer content not less than 99.0 %.

5.1.2 Chlorinated Poly(vinyl chloride) (CPVC) resin (polymer) meeting Cell 2 in Designation Order 1 shall have a chlorine content not less than 63 %.

5.1.3 Vinyl chloride copolymer resin (polymer) meeting Cell 3 in Designation Order 1 shall contain not less than 80 % vinyl chloride content.

5.2 Compounds supplied under this specification shall be in the form of cubes, granules, pellets, free-flowing powder blends, or compacted powder blends.

5.3 Compounds shall be of uniform composition and size. Color and transparency or opacity shall be within applicable commercial tolerances.

5.4 Compounds shall be free of foreign matter to a level that will not affect processability, serviceability, or finished product appearance adversely.

6. Physical Requirements

6.1 Test values for specimens of the compound prepared as specified in Section 9 and tested in accordance with Section 11, shall conform to the requirements given in Table 1 for the cell class selected.

6.2 The compound, when tested in accordance with Test Method D635, shall not exceed an average extent of burn of 4 in. (100 mm) nor an average time of burn to exceed 10 s.

7. Sampling

7.1 A batch or lot shall be considered as a unit of manufacture and is permitted to consist of a blend of two or more production runs of compound.

7.2 Adequate statistically significant samples of the lot or batch shall be obtained prior to packaging.

TABLE 1 Class Requirements for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Pipe Compounds for Nonpressure Piping Products

Designation Order No.	Property and Unit	Cell Limits[A]								
		0	1	2	3	4	5	6	7	8
1	Kind of resin in compound	...	poly(vinyl chloride) (PVC)	chlorinated poly (vinyl chloride) (CPVC)	vinyl chloride copolymer					
2	Impact resistance, min, (J/m) of notch (ft·lbf/in.)	Unspecified	40.0 (0.65)	80.1 (1.5)	266.9 (5.0)	533.8 (10.0)	800.7 (15.0)			
3	Tensile strength, min, (MPa) psi	Unspecified	21 (3000)	27.5 (4000)	34.4 (5000)	44.7 (6500)	48.3 (7000)	55.2 (8000)		
4	Modulus of elasticity in tension, min, (MPa) psi	Unspecified	1930 (280 000)	2344 (340 000)	2620 (380 000)	2758 (400 000)	3034 (440 000)	3171 (460 000)	3585 (520 000)	4275 (620 000)
5	Deflection temperature under load, 264 psi (1.82 MPa), min, °C (°F)	Unspecified	60 (140)	70 (158)	80 (176)	100 (212)	110 (230)	120 (248)	130 (266)	140 (284)

[A]The property value per Section 8 determines the cell number.

8. Conformance Testing

8.1 The minimum properties identified by the class designations in Table 1 shall be verified by the test methods described in Section 10.

8.2 Conformance with this specification shall be determined by the results of one test or the average of multiple tests.

8.3 If the average test value produces values below the minimum property values of the class designation in Table 1, the material does not conform to this specification.

9. Specimen Preparation

9.1 Compliance with the cell requirements from Table 1 shall be determined with compression-molded, extruded, or injection-molded specimens for Izod impact resistance, tensile strength, tensile modulus of elasticity, and deflection temperature under load. Specimens cut from laminates of compression-molded or extruded sections shall not be used unless it can be shown by test that complete fusion is obtained. It is understood that a material shall not be tested without also specifying the method of specimen preparation. When comparative tests of materials are desired, the greatest care shall be taken to ensure that all specimens are prepared in exactly the same way used to certify the cell class of the compound. Procedures used in preparing the test specimens shall be as recommended by the seller for each specific compound.

NOTE 4—It is possible that a specimen taken from a finished product will not produce the same results as a specimen prepared by the method used for purposes of cell class testing and certification.

10. Test Methods

10.1 *Conditioning*—Condition the test specimen for deflection temperature (Test Method D648) in accordance with Procedure B of Practice D618, except that the minimum conditioning time shall be 24 h. Condition all other test specimens in accordance with Procedure A of Practice D618. The minimum conditioning time shall be 24 h.

10.2 *Test Conditions*—Unless otherwise specified in the testing methods or in this specification, conduct tests in the standard laboratory atmosphere of 23 ± 2°C (73 ± 4°F) and 50 ± 10 % relative humidity. In cases of disagreement, the tolerances shall be ±1°C (±2°F) and ±5 % relative humidity.

10.3 *Tensile Strength and Modulus of Elasticity*—Test Method D638, using Type I specimens of 3.2 ± 0.4-mm (0.13 ± 0.02-in.) thickness and testing speed of 5.1 mm (0.2 in.)/min ± 25 %. Report tensile strength at the yield point if the material yields, otherwise at break.

10.4 *Deflection Temperature*—Test Method D648–Method A– using 127-mm (5-in.) long, 12.5-mm (0.5-in.) wide, and 3.2-mm (0.125-in.) thick specimens under 1.82-MPa (264-psi) fiber stress. Materials that require high-temperature annealing prior to testing shall be annealed at 50°C (122°F) for 24 h or at the manufacturer's recommendation. Specimens shall be cooled in accordance with Procedure B of Practice D618. The test report for all high-temperature annealed specimens shall include the time and temperature of annealing used.

10.5 *Impact Resistance (Izod)*—Method A of Test Methods D256 using 3.2-mm (0.125-in.) thick specimens. It is acceptable for the specimens to be compression-molded, extruded, or injection-molded with the provision that compression-molded or extruded specimens built-up as laminates, in which complete fusion is obtained. Complete fusion means that there shall be no evidence of fraying or delamination at the break.

11. Packaging and Marking

11.1 *Packaging*—The compound shall be packaged in standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation.

11.2 All packing, packaging, and marking provisions of Practice D3892 shall apply to this specification.

12. Keywords

12.1 chlorinated poly(vinyl chloride); nonpressure piping; poly(vinyl chloride) plastic; recycle plastics; rigid plastic; vinyl chloride copolymer

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D4396 – 06) that may impact the use of this standard. (October 1, 2015)

(1) Delete old 1.4 and 1.9.
(2) Subsection 1.8 reworded to state SI units as standard and moved to end of Scope.
(3) Reworded 1.1, 1.3, 1.5(renumber), 1.7(renumber), 5.1.1(renumber), 5.3(renumber), 7.1 & 7.2(renumber).
(4) Reworded 8.1, 8.2 & 9.1(renumber).
(5) Reworded ISO statement per D4968-09 (Note 1).
(6) Section 2, removed references to D1898, D3010, and D3915, which have been withdrawn.
(7) Note 2, new Cell Classification example, using SI units.
(8) Deleted Section 5, Ordering information (5.1 – 5.2.6) and renumbered all other sections.
(9) Reworded 5.1.1 and 5.3(renumber).
(10) Subsection 10.2(renumber), updated in accordance with D618-08.
(11) Subsections 10.3(renumber) and 10.4(renumber), updated in accordance with D1784-11 and arranged for SI units as standard.
(12) Subsection 10.5(renumber), arranged for SI units as standard and reworded.

(13) Deleted Section 12., Inspection.
(14) Reworded 11.1 and 11.2(renumber).
(15) Deleted 11.3(renumber).
(16) Table 1, Note 1 to table Footnote A, moved to bottom of table and reworded.
(17) Table 1, reorganized so SI units are standard, put 'inch-pound' units in parentheses.
(18) Table 1, added Impact Resistance for Cells 4 and 5.
(19) Table 1, added Tensile Strength 48.3 (7000) to Cell 5 and moved 55.2 (8000) to Cell 6.
(20) Table 1, added Modulus 2758 (400 000) to cell 4 and 3034 (440 000) to cell 5 moved other cells to 6, 7 and 8.