Designation: D 4396 – 99a$^{\epsilon 1}$

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 D 4396; 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.

ϵ[1] NOTE—Editorially corrected 11.4 in April 2002.

1. Scope *

1.1 This specification covers 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. The compounding ingredients may 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 It may be necessary, in special cases, to select 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.

1.4 Rigid PVC compounds for pressure applications are covered in Specification D 3915.

1.5 Rigid PVC-type compounds for building applications other than piping are covered in Specification D 4216.

1.6 Rigid PVC compounds for general purpose extrusion and molding use are covered in Specification D 1784.

1.7 The rate of burning test, Test Method D 635, is used in this specification as a test for identification of certain properties of the compound.

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

1.9 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this specification.

1.10 Rigid PVC and CPVC recycle plastics meeting the requirements of this specification may be used in some applications. Refer to the specific requirements in the Material and Manufacture Section of the applicable product standard.

1.11 The following safety hazards caveat pertains only to the test methods portion, Section 11, 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 are no ISO standards covering the primary subject matter of this specification.

2. Referenced Documents

2.1 *ASTM Standards:*

D 256 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials[2]

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing[2]

D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position[2]

D 638 Test Method for Tensile Properties of Plastics[2]

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load[2]

D 883 Terminology Relating to Plastics[2]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds[3]

D 1898 Practice for Sampling of Plastics[3]

D 3010 Practice for Preparing Compression-Molded Test

[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] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.02.

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

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

NOTE 1—The minimum property value will determine the cell number, although the maximum expected value may fall within the next higher cell.

Designation Order No.	Property and Unit	Cell Limits								
		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, ft·lbf/in. (J/m) of notch	unspecified	0.65 (40.0)	1.5 (80.1)	5.0 (266.9)					
3	Tensile strength, min, psi (MPa)	unspecified	3000 (21)	4000 (27.5)	5000 (34.4)	6500 (44.7)	8000 (55.0)			
4	Modulus of elasticity in tension, min, psi (MPa)	unspecified	280 000 (1930)	340 000 (2344)	380 000 (2620)	460 000 (3171)	520 000 (3585)	620 000 (4275)		
5	Deflection temperature under load, 264 psi (1.82 MPa), min, °F (°C)	unspecified	140 (60)	158 (70)	176 (80)	212 (100)	230 (110)	248 (120)	266 (130)	284 (140)

Sample Plaques of Rigid Poly(Vinyl Chloride) Compounds[4]

D 3892 Practice for Packaging/Packing of Plastics[5]

D 3915 Specification for Poly(Vinyl Chloride) (PVC) and Related Plastic Pipe and Fittings Compounds for Pressure Applications[6]

D 4216 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related Plastic Building Products Compounds[6]

D 5260 Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds[5]

F 412 Terminology Relating to Plastic Piping Systems[6]

3. Terminology

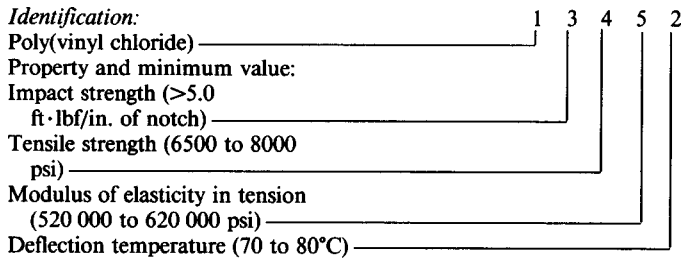
3.1 *Definitions:* General definitions are in accordance with Terminologies D 883, F 412, and D 1600, unless otherwise noted.

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 D 5260.

5. Ordering Information

5.1 The purchase order, or inquiry for these compounds, shall state this specification number and identify the cell class selected, for example: D 4396, Cell Class _____.

5.2 Further definition, as may be required for the following, shall be on the basis of agreement between the purchaser and the seller:

5.2.1 Physical form, bulk density, and particle size (see 6.2 and 6.3).

5.2.2 Contamination level (see 6.5).

5.2.2.1 Residual vinyl chloride or other monomers.

5.2.3 Color (see 6.4).

5.2.4 Other supplementary information, if necessary.

5.2.5 Inspection (see 12.1).

5.2.6 Any special chemical resistance, special heat resistance, or electrical properties.

6. Materials and Manufacture

6.1 *Resin (Polymer) Requirements*:

[4] Discontinued—See *1992 Annual Book of ASTM Standards*, Vol 08.02.

[5] *Annual Book of ASTM Standards*, Vol 08.03.

[6] *Annual Book of ASTM Standards*, Vol 08.04.

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

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

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

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

6.3 Compounds shall be of uniform composition and size as agreed upon between the purchaser and the seller.

6.4 Color and transparency or opacity of extruded articles formed under the conditions recommended by the seller shall be comparable within commercial tolerances.

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

7. Physical Requirements

7.1 Test values for specimens of the compound prepared as specified in Section 10 and tested in accordance with Section 11, shall conform to the requirements given in Table 1 for the cell class selected.

7.2 The compound, when tested in accordance with Test Method D 635, shall not exceed an average extent of burn of 4 in. (100 mm) nor an average time of burn to exceed 10 s.

8. Sampling

8.1 A batch or lot shall be considered as a unit of manufacture and may consist of a blend of two or more production runs of compound.

8.2 Unless otherwise agreed upon between the seller and the purchaser, the compound shall be sampled in accordance with the procedure described in Sections 9-12, as applicable, of Practice D 1898. Adequate statistical sampling prior to packaging shall be considered an acceptable alternative.

9. Conformance Testing

9.1 The minimum properties identified by the class designations in Table 1 specified in the purchase order (see 5.1) shall be verified by the test methods described in Section 11.

9.2 Conformance with this specification shall be determined with one set of test results. If there are multiple test results, the average value for all test samples shall be used to determine conformance.

9.3 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.

10. Specimen Preparation

10.1 Compliance with the designated requirements chosen 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 (see Practice D 3010) shall not be used unless it can be shown by test that complete fusion is obtained. Procedures used in preparing the test specimens shall be as recommended by the seller for each specific compound.

11. Test Methods

11.1 *Conditioning*—Condition the test specimen for deflection temperature (Test Method D 648) in accordance with Procedure B of Practice D 618, except that the minimum conditioning time shall be 24 h. Condition all other test specimens in accordance with Procedure A of Practice D 618. The minimum conditioning time shall be 24 h.

11.2 *Test Conditions*—Unless otherwise specified in the testing methods or in this specification, conduct tests in the standard laboratory atmosphere of 73.4 ± 3.6°F (23 ± 2°C) and 50 ± 5 % relative humidity. In cases of disagreement, the tolerances shall be ±1.8°F (±1°C) and ±2 % relative humidity.

11.3 *Tensile Strength and Modulus of Elasticity*—Test Method D 638, using Type I specimens of 3.2 ± 0.4-mm (0.13 ± 0.02-in.) thickness and testing speed of 5.1 mm (0.20 in.)/min ± 25 %.

11.4 *Deflection Temperature*—Test Method D 648–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 90°C (194°F) unless a higher annealing temperature is required. The test report for all high-temperature annealed specimens shall include the time and temperature of annealing used.

11.5 *Impact Resistance (Izod)*—Method A of Test Methods D 256 using 3.2-mm (0.125-in.) thick specimens. The specimens may 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, shall be acceptable. Complete fusion means that there shall be no evidence of fraying or delamination at the break.

12. Inspection

12.1 Inspection of the compound shall be made as agreed upon between the purchaser and the seller as part of the purchase contract.

13. Packaging and Marking

13.1 *Packaging*—Unless otherwise specified in the contract or order. The compound shall be packaged in standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the point of delivery.

13.2 All packing, packaging, and marking provisions of Practice D 3892 shall apply to this specification.

13.3 *Marking*—If agreed upon between the purchaser and the seller, shipping containers shall be marked with the name of the compounds, the name of the manufacturer, cell class, batch or lot number, quantity contained therein as defined by the contract or order under which shipment is made, the name of the seller, and the number of the contract or order.

14. Keywords

14.1 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 edition of this standard since the last issue that may impact the use of this standard.

D 4396 – 97:

(*1*) Paragraphs 1.8, 2.1, and 7.3—Deleted sulfuric acid test.

(*2*) Section 9—Detailed conformance tests.

(*3*) Table 1—Changed property ranges to minimums.

D 4396 – 99:

(*1*) In 11.5, impact resistance (Izod) test specimen thickness was changed to 3.2 mm (0.125 in.).

D 4396 – 99a:

(*1*) Section 3—Deleted polymer definitions specific to this standard.

(*2*) Section 6—Added resin requirements.

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