Designation: D 1784 – 02

Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds [1]

This standard is issued under the fixed designation D 1784; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This specification covers rigid PVC and CPVC compounds intended for general purpose use in extruded or molded form, including piping applications involving special chemical and acid resistance or heat resistance, composed of poly(vinyl chloride), chlorinated poly(vinyl chloride), or vinyl chloride copolymers containing at least 80 % vinyl chloride, and the necessary compounding ingredients. The compounding ingredients may consist of lubricants, stabilizers, non-poly(vinyl chloride) resin modifiers, pigments, and inorganic fillers.

NOTE 1—Selection of specific compounds for particular end uses or applications requires consideration of other characteristics such as thermal properties, optical properties, weather resistance, etc. Specific requirements and test methods for these properties shall be by mutual agreement between the purchaser and the seller.

1.2 Rigid PVC compounds intended for pipe, fittings, and other piping appurtenances are covered in Specifications D 3915 and D 4396.

1.3 Rigid PVC compounds for exterior building product applications are covered in Specification D 4216.

1.4 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.

1.5 Rigid PVC recycle plastics meeting the requirements of this specification may be used in some applications. Refer to the specific requirements in the materials and manufacture section of the applicable product standard.

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

1.7 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 2—This specification is similar in content (but not technically equivalent) to ISO 1163-1: 1985 and ISO 1163-2: 1980.

2. Referenced Documents

2.1 *ASTM Standards:*

D 256 Test Method for Determining the Izod Pendulum Impact Resistance of Plastics[2]

D 618 Practice for Conditioning Plastics 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 1898 Practice for Sampling of Plastics[2]

D 3892 Practice for Packaging/Packing of Plastics[3]

D 3915 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications[3]

D 4216 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related Plastic Building Products Compounds[3]

D 4396 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications[4]

D 4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets[4]

D 5260 Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds[4]

[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.

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

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

2.2 *ISO Standards:*[5]
ISO 1163-1: 1985
ISO 1163-2: 1980

3. Terminology

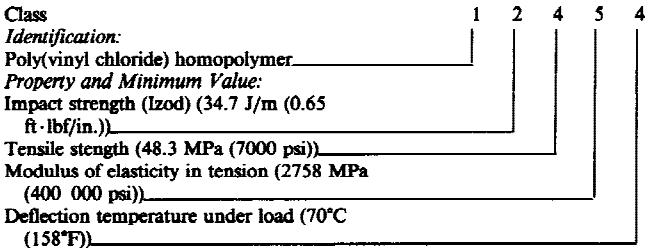
3.1 *Definitions*—Definitions are in accordance with Terminology D 883 and abbreviations with Terminology D 1600 unless otherwise indicated.

4. Classification

4.1 Means for selecting and identifying rigid PVC and CPVC compounds are provided in Table 1. The properties enumerated in Table 1 and the tests defined are expected to provide identification of the compounds selected. They are not necessarily suitable for direct application in design because of differences in shape of part, size, loading, environmental conditions, etc.

4.2 Classes are designated by the cell number for each property in the order in which they are listed in Table 1 including a suffix letter specifying the requirements for chemical resistance.

NOTE 3—The manner in which selected materials are identified by this classification system is illustrated by a Class 12454 rigid PVC compound having the following requirements (see Table 1). The two-digit cell limits 10 and 11 are rarely used, only for special high-temperature grades of CPVC compound:



NOTE 4—The cell-type format provides the means for identification and close characterization and specification of material properties, alone or in combination, for a broad range of materials. 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 materials. The manufacturer should be consulted.

4.3 Product application chemical resistance when specified shall be classified according to the classification section of Classification D 5260.

5. Ordering Information

5.1 The purchase order, or inquiry, for these materials shall state the specification number and identify the class selected, for example, D 1784, Class 12454.

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 and particle size (see 6.1),
5.2.2 Contamination level (see 6.2),
5.2.3 Color (see 6.3),
5.2.4 Other supplementary definition if necessary, and
5.2.5 Inspection (see 12.1).

6. Materials and Manufacture

6.1 Materials supplied under this specification shall be PVC and CPVC compounds in the form of cubes, granules, free-flowing powder blends, or compacted powder blends.

6.2 Materials shall be of uniform composition and size and shall be free of foreign matter to such level of contamination as may be agreed upon between the purchaser and the seller.

6.3 Color and transparency or opacity of molded or extruded articles formed under the conditions recommended by the seller shall be comparable within commercial match tolerances to the color and transparency or opacity of standard molded or extruded samples of the same thickness supplied in advance by the seller of the material.

7. Physical Requirements

7.1 Test values for specimens of the material prepared as specified in Section 9 and tested in accordance with Section 10 shall conform to the requirements given in Table 1 for the class selected.

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 material.

8.2 Unless otherwise agreed upon between the seller and the purchaser, the material shall be sampled in accordance with the procedure described in the General and Specific Sampling Procedures, 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 tests 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 determined 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 test specimens for Izod impact resistance, tensile strength, tensile modulus of elasticity, deflection temperature under load, and flammability. Specimens cut from laminates of compression-molded or extruded sections (see Practice D 4703) 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.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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

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

Designation Order No.	Property and Unit	Cell Limits											
		0	1	2	3	4	5	6	7	8	9	10	11
1	Base resin	unspecified	poly(vinyl chloride) homopolymer	chlorinated poly (vinyl chloride)	vinyl copolymer								
2	Impact resistance (Izod), min:												
	J/m of notch	unspecified	<34.7	34.7	80.1	266.9	533.8	800.7					
	ft·lb/in. of notch		<0.65	0.65	1.5	5.0	10.0	15.0					
3	Tensile strength, min:												
	MPa	unspecified	<34.5	34.5	41.4	48.3	55.2						
	psi		<5 000	5 000	6 000	7 000	8 000						
4	Modulus of elasticity in tension, min:												
	MPa	unspecified	<1930	1930	2206	2482	2758	3034					
	psi		<280 000	280 000	320 000	360 000	400 000	440 000					
5	Deflection temperature under load, min, 1.82 MPa (264 psi):												
	°C	unspecified	<55	55	60	70	80	90	100	110	120	130	140
	°F		<131	131	140	158	176	194	212	230	251	266	284
	Flammability	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]

[A] All compounds covered by this specification, when tested in accordance with Test Method D 635, shall yield the following results: average extent of burning of <25 mm; average time of burning of <10 s.

11. Test Methods

11.1 *Conditioning*—The test specimen for deflection temperature (Test Method D 648) shall be conditioned in accordance with Procedure B of Practice D 618, except that the minimum conditioning time in the circulating air oven shall be 24 h. All other molded test specimens shall be conditioned 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 test methods or in this specification, tests shall be conducted in the standard laboratory atmosphere of 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5 % relative humidity. In cases of disagreement, the tolerances shall be ±1°C (±1.8°F) 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 %. Report tensile strength at the yield point if the material yields, otherwise at break.

11.4 *Impact Resistance (Izod)*—Method A of Test Method 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 there shall be no evidence of fraying or delamination at the break.

11.5 *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 50°C (122°F) for 24 h or at the manufacturer's recommendation. Specimens shall be cooled in accordance with Procedure B of Practice D 618 or at the manufacturer's recommendation. The test report for annealed specimens shall include the time and temperature of annealing used.

11.6 *Flammability*—Test Method D 635. All compounds covered by this specification, when tested in accordance with Test Method D 635, shall yield the following results: average extent of burning of <25 mm; average time of burning of <10 s.

12. Inspection

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

13. Packaging and Package Marking

13.1 *Packaging*—The material 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, unless otherwise specified in the contract or order.

13.2 *Marking*—Unless otherwise agreed upon between the purchaser and the seller, shipping containers shall be marked with the name of the material and the name of the manufacturer; 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.

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

14. Keywords

14.1 chlorinated poly(vinyl chloride) (CPVC); CPVC compounds; poly(vinyl chloride) (PVC); PVC compounds; recycle plastics; rigid PVC

SUMMARY OF CHANGES

This section identifies the location of selected changes to this specification. For the convenience of the user, Committee D20 has highlighted those changes that may impact the use of this specification. This section may also include descriptions of the changes or reasons for the changes, or both.

D 1784 – 02:

(*1*) Revised 11.6 to include cooling language.

(*2*) Revised 11.3 to include point of tensile strength measurement.

(*3*) Made several suggested editorial changes throughout standard.

D 1784 – 99a:

(*1*) 11.5—Revised minimum HDT specimen annealing temperature.

(*2*) 1.2—Added reference to CPVC compounds.

(*3*) 2.1—Corrected Specification D 3915 and Specification D 4396 titles.

(*4*) 4.1—Added reference to CPVC compounds.

(*5*) 6.1—Added reference to CPVC compounds.

D 1784 – 99:

(*1*) Thickness of impact strength (Izod) test specimens in 11.4 was changed to 3.2 mm (0.125 in.).

D 1784 – 97:

(*1*) 1.3—Corrected Specification D 4216 reference.

(*2*) 1.3, 2.1, 4.1, 4.2, 4.3, 10.1, 11.8, and Tables 2, X1.1, and X2.1—Deleted sulfuric acid test.

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