



Designation: D1593 – 09

# Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting<sup>1</sup>

This standard is issued under the fixed designation D1593; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification covers nonrigid, unsupported vinyl chloride plastic film and sheeting in which the resin portion of the composition contains at least 90 % vinyl chloride. The remaining 10 % may include one or more monomers copolymerized with vinyl chloride, or consist of other resins mechanically blended together with poly(vinyl chloride) or copolymers thereof.

1.2 The vinyl chloride plastic film and sheeting covered herein shall be 0.075 to 0.25 mm (3 to 10 mils) in thickness for film and greater than 0.25 mm in thickness for sheet. The film and sheeting shall include the stabilizers and plasticizers necessary to meet the requirements of this specification. The material may be transparent, translucent, or opaque, and may be plain, printed, embossed, or otherwise surface treated.

1.3 The values stated in SI units are to be regarded as the standard.

1.4 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 ISO equivalent for this specification.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

D618 Practice for Conditioning Plastics for Testing

D689 Test Method for Internal Tearing Resistance of Paper (Withdrawn 2009)<sup>3</sup>

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D1004 Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting

D1203 Test Methods for Volatile Loss From Plastics Using Activated Carbon Methods

D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D1239 Test Method for Resistance of Plastic Films to Extraction by Chemicals

D1433 Test Method for Rate of Burning and/or Extent and Time of Burning of Flexible Thin Plastic Sheeting Supported on a 45-Deg Incline (Withdrawn 1986)<sup>3</sup>

D1505 Test Method for Density of Plastics by the Density-Gradient Technique

D1898 Practice for Sampling of Plastics (Withdrawn 1998)<sup>3</sup>

D3892 Practice for Packaging/Packing of Plastics

2.2 *Military Standard*:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes<sup>4</sup>

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 *vinyl chloride plastics*—plastics based on polymers of vinyl chloride or copolymers of vinyl chloride with other monomers, the vinyl chloride being in greatest amount by mass.

## 4. Significance and Use

4.1 This specification designates three general-purpose types of vinyl chloride film and sheeting. The tests involved are expected to provide information to identify the type of material and to ensure a minimum of good workmanship and quality.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film, Sheeting, and Molded Products.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

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

The test data are not necessarily suitable for direct application in design because of differences encountered in the shape of the part, loading, size, environmental conditions, and so forth. The test results can be used for inspection and quality control tests, provided similar test equipment and proper methods are used.

4.2 Films and sheets are available, compounded differently, where special properties are required. Special types of film and sheeting will be added to the specification as their inclusion becomes generally desirable and the necessary data and methods become available.

### 5. Classification

5.1 This specification covers three types of nonrigid vinyl chloride plastic film and sheeting, designated in accordance with the method of manufacture as follows:

- 5.1.1 *Type I*—Calendered film and sheeting,
- 5.1.2 *Type II*—Extruded film and sheeting, and
- 5.1.3 *Type III*—Cast film and sheeting.

### 6. General Requirements

6.1 The material shall be of uniform composition and so compounded as to conform to the requirements of this specification.

6.2 The color, transparency or opacity, and surface finish shall be as specified by the purchaser in the contract or order.

6.3 The material shall be reasonably free from pinholes, particles of foreign matter, undispersed raw materials, and visual defects. Edges should be smooth and free from cuts. The extent of the above defects permissible shall be as agreed upon between the purchaser and the seller.

### 7. Dimensional Tolerances

7.1 *Thickness*—The average thickness of the film and sheeting determined from five uniformly spaced readings taken across the width of the sheet shall be within the following limits:

- 7.1.1 *Type I*— $\pm 10\%$  of the specified thickness.
- 7.1.2 *Type II*— $\pm 15\%$  of the specified thickness.
- 7.1.3 *Type III*— $\pm 10\%$  of the specified thickness.

7.2 *Average Thickness Based on Yield per Roll*—The average thickness based on yield shall be determined in accordance with 10.1.3 and shall be within the following limits:

- 7.2.1 *Type I*— $\pm 5\%$  of the specified thickness.
- 7.2.2 *Type II*— $\pm 10\%$  of the specified thickness.
- 7.2.3 *Type III*— $\pm 5\%$  of the specified thickness.

7.3 *Width*—The film and sheeting shall be held to a tolerance of  $\pm 12$  or  $-0$  mm ( $+\frac{1}{2}$  or  $-0$  in.) for Types I and II, and  $+19$  or  $-0$  mm ( $+\frac{3}{4}$  or  $-0$  in.) for Type III, of the width specified by the purchaser on the contract or order. This tolerance shall apply when the material is in roll form on the core.

7.4 *Length*—The length of material for Types I and II, excluding that which has been subjected to embossing, printing, and so forth, shall be continuous in any one roll. Four heat-sealed splices shall be allowed for Type III sheeting. The total length in a roll shall be as specified by the purchaser in the contract or order.

### 8. Requirements

8.1 Test specimens shall conform to the requirements prescribed in Table 1.

### 9. Sampling

9.1 A sample shall be selected at random from each lot of material sufficient to determine the conformance of the material to this specification. In addition, selected samples of the film or sheeting may be subjected to individual visual inspection.

### 10. Test Methods

10.1 Determine the properties enumerated in this specification in accordance with the following methods:

10.1.1 *Conditioning*—Condition the test specimens as  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) and  $50 \pm 5\%$  relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D618, for those tests where conditioning is required. In cases of disagreement, the tolerances shall be  $1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ) and  $\pm 2\%$  relative humidity.

TABLE 1 Detail Requirements for Nonrigid Vinyl Chloride Plastic Film and Sheetting

Property	Requirement		
	Type I	Type II	Type III
Tensile strength, <sup>A</sup> min, MPa (psi):			
D882, Method A	15.9 (2300)	20.7 (3000)	20.0 (2900)
D882, Method B	14.5 (2100)	17.2 (2500)	17.9 (2600)
Elongation at rupture, min, %	150	125	150
Tear resistance, min, N/mm (lbf/in.)	35 (200)	not applicable	not applicable
Internal tear resistance, min:			
Over 0.076 mm (0.003 in.) thick, g/μm (g/mil)	2.36 (60)	3.94 (100) for all thicknesses	5.91 (150) for all thicknesses
0.076 (0.003 in.) or less, g/sheet	180		
Volatile loss, max, %	see Fig. 1		
Water extraction, max, %	1	1	1
Low-temperature impact, max:			
°C	-18 to -20	-18 to -20	-10 to -12
°F	0 to -2	0 to -2	+14 to +12
Burning rate, max, mm/s (in./s)	30.5 (1.2)	not applicable	not applicable
Croaking	no croaking	no croaking	no croaking
Shrinkage at elevated temperature, max, %	7	8	5

<sup>A</sup>If the sheeting meets the requirement by either method, it shall be considered as passed.