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Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting¹

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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:²

D 618 ~~Practice for Conditioning Plastics and Electrical Insulating Materials for Testing~~ Practice for Conditioning Plastics for Testing

D 689 Test Method for Internal Tearing Resistance of Paper

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D 882 ~~Test Methods~~ Method for Tensile Properties of Thin Plastic Sheeting

D 1004 Test Method for ~~Initial~~-Tear Resistance (Graves Tear) of Plastic Film and Sheeting

D 1203 Test Methods for Volatile Loss ~~from~~From Plastics Using Activated Carbon Methods

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D 1239 Test Method for Resistance of Plastic Films to Extraction by Chemicals

D 1433 Test Method for Rate of Burning and/or Extent and Time of Burning of Flexible Thin Plastic Sheeting Supported on a 45° Incline³

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique

D 1898 Practice for Sampling of Plastics⁰

D 3892 Practice for Packaging/Packing of Plastics

2.2 Military Standard:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes⁴

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

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³ 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*, Vol 08.01, volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ Withdrawn.

⁰ Discontinued—See 1987 *Annual Book of ASTM Standards*, Vol 08.01. Replaced by Specification D 4549.

⁵ 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.

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. 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 ± 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 D 618, for those tests where conditioning is required. In cases of disagreement, the tolerances shall be 1°C ($\pm 1.8^\circ\text{F}$) and $\pm 2\%$ relative humidity.

10.1.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreements, the tolerances shall be $\pm 1^\circ\text{C}$ ($\pm 1.8^\circ\text{F}$) and $\pm 2\%$ relative humidity.

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

Property	Requirement		
	Type I	Type II	Type III
Tensile strength, ^A min, MPa (psi):			
D 882, Method A	15.9 (2300)	20.7 (3000)	20.0 (2900)
D 882, 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

^AIf the sheeting meets the requirement by either method, it shall be considered as passed.

10.1.3 *Thickness*—This method for thickness is to be used as a referee method and must be used for embossed sheeting. For routine testing, standard dead weight methods may be used.

10.1.3.1 *Apparatus*—The apparatus shall consist of the following:

- (1) *Analytical Balance*, equipped with pan straddle or other stationary support, sensitive to 0.005 g,
- (2) *Class S Weights*,
- (3) *Beaker*, 250-mL,
- (4) *Fine Thread or Wire*, nonabsorbent,
- (5) *Thermometer*, 0 to 100°C, graduated in 1°C divisions,
- (6) *Die or Template*, for cutting test specimens, 10 by 10 cm, with dimensional tolerance of ±0.01 cm/side, and
- (7) *Sharp Knife or Razor*.

10.1.3.2 *Test Specimens*—Test five 10 by 10-cm specimens taken uniformly across the width of the sheet.

10.1.3.3 *Procedure*—By means of the die or template and the sharp knife or razor, cut five specimens from the sample of material. Weigh each specimen to the nearest 0.5 mg on the analytical balance. Record the weight as *W*. Determine the specific gravity of each specimen in accordance with Method A of Test Methods D 792, or Test Method D 1505, and record as *D*. Use of a wetting agent is recommended.

10.1.3.4 *Calculation*—Calculate the average thickness of each test specimen, using the following formula, and average the five values:

$$T = 394W/100D = 3.94W/D \quad (1)$$

where:

- T* = average thickness of test specimen, mils,
W = weight of test specimen, g,
D = density of test specimen, g/cm³,
 394 = conversion factor, cm to mils, and
 100 = area of specimen, cm².

10.1.4 *Average Thickness Based on Yield per Roll*—Calculate the average thickness based on yield per roll as follows:

$$\text{average thickness, mils} = \frac{768.9 \times \text{net weight (lb)}}{\text{specific gravity} \times \text{length (yd)} \times \text{width (in.)}} \quad (2)$$

10.1.5 *Tensile Strength and Elongation at Rupture*—Either Test Method A or Test Method B of Test Methods D 882 may be used. In either case, test specimens shall be 25.4 mm (1 in.) wide. The test method used shall be stated in the report.

10.1.6 *Tear Resistance*—Test Method D 1004, using pendulum or constant elongation type of machine.

10.1.7 *Internal Tear Resistance*—Test Method D 689, except that readings obtained where the tear deviates more than 10 mm (3/8 in.) from the line of the initial slit shall not be rejected when obtained with embossed sheeting. Determine the average from measuring five samples taken each direction across the width of the film or sheet and two samples of each direction taken directly adjacent to the longitudinal edges of the film or sheet, the remaining three being equally spaced between these two. Report the tear tests for each machine. Report the cross-directional averages of these five tests in each direction.

10.1.8 *Volatile Loss*—Measure volatile loss by Procedure A of Test Methods D 1203. (See also Fig. 1 of this specification.)

10.1.9 *Water Extraction*—Test Method D 1239, except that the specimens shall be preconditioned for 3 h at 50 ± 3°C (122 ± 5°F), removed from the oven, placed in the desiccator, and allowed to cool to room temperature before weighing. Also, the immersion test shall be made for 24 h at 50 ± 3°C (122 ± 5°F) in distilled water only.