



Designation: D 706 – 98

Standard Specification for Cellulose Acetate Molding and Extrusion Compounds¹

This standard is issued under the fixed designation D 706; 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 requirements for cellulose acetate thermoplastic compounds plasticized with either diethyl phthalate or dimethyl phthalate and are suitable for injection molding and extrusion. These compounds have an acetyl content between 39 and 40 %. It does not include materials compounded for special application. Cellulosic plastic materials, being thermoplastic, are reprocessible and recyclable. This specification allows for the use of those cellulosic materials, provided that all specific requirements of this specification are met.

1.2 The properties included in this specification are those required to identify the compositions covered. There may be other requirements necessary to identify particular characteristics important to specialized applications. These may be specified by using the suffixes as given in Section 5.

1.3 This classification system and subsequent line call out (specification) are intended to provide a means of calling out plastic materials used in the fabrication of end items or parts. It is not intended for the selection of materials. Material selection should be made by those having expertise in the plastic field after careful consideration of the design and performance required of the part, environment to which it will be exposed, fabrication process to be employed, costs involved, and inherent properties of the material other than those covered by this classification system.

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

1.5 The following safety hazards caveat pertains only to the test method 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 is no equivalent or similar ISO standard.

2. Referenced Documents

2.1 ASTM Standards:

¹ This specification is under the jurisdiction of Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

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D 256 Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics²

D 570 Test Method for Water Absorption of Plastics²

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²

D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position²

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

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement²

D 883 Terminology Relating to Plastics²

D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics²

D 1600 Terminology for Abbreviated Terms Relating to Plastics²

D 1729 Practice for Visual Evaluation of Color Differences of Opaque Materials³

D 1898 Practice for Sampling of Plastics²

D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials⁴

D 3892 Practice for Packaging/Packing of Plastics⁴

D 4000 Classification System for Specifying Plastic Materials⁴

D 5033 Guide for the Development of Standards Relating to the Proper Use of Recycled Plastics⁵

E 308 Practice for Computing the Colors of Objects by Using the CIE System³

3. Terminology

3.1 *Definitions*—The terminology used in this specification is in accordance with Terminologies D 883 and D 1600.

4. Classification

4.1 This specification covers the following groups, classes, and grades (see Table CA):

² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 06.01.

⁴ Annual Book of ASTM Standards, Vol 08.02.

⁵ Annual Book of ASTM Standards, Vol 08.03.

4.1.1 *Group 1*—High impact strength, diethyl phthalate plasticizer.

4.1.2 *Group 2*—High tensile strength, diethyl phthalate plasticizer.

4.1.3 *Group 3*—High impact strength, dimethyl phthalate plasticizer.

4.1.4 *Group 4*—High tensile strength, dimethyl phthalate plasticizer.

4.1.5 *Class*—According to plasticizer content and properties specified in Table CA.

4.1.6 *Grade 1*—For injection molding (general purpose).

4.1.7 *Grade 2*—For extrusion (see requirements in 6.4).

5. Suffixes

5.1 When requirements are needed that are not covered in Table CA, they shall be indicated through the use of suffixes.

5.2 A list of suffixes can be found in Classification System D 4000 (Table 3) and may be used for additional requirements as appropriate. Additional suffixes will be added to that classification system as test methods and requirements are developed and requested.

5.3 Color and opacity shall be within the limits defined in 6.3.

5.4 Commonly used suffixes for cellulose acetate are shown as follows:

F = flammability requirements as designated by the following digits:

First Digit

1 = rate of burning—Test Method D 635, specimen size: 125 mm long by 12.7 wide by 3.2 mm thick.

Second Digit

1 = burn rate 5 cm/min, max.

T = transmittance requirements as designated by the following digits:

First Digit

1 = total luminous transmittance determined in accordance with Procedure A of Test Method D 1003.

Second Digit

1 = total transmittance, 80 % min.

5.5 An example of this classification system for a high-impact cellulose acetate formulation would be as follows:

CA0122F11 (1)

CA = Table CA Property Requirements.

01 = Group 01—High Impact Strength, diethyl phthalate plasticizer.

2 = Class 2—Plasticizer Range from 35 to 40 % (see Table CA, Footnote 1).

2 = Grade 2—Extrusion Application.

F11 = Flammability requirement—Burn rate maximum of 5 cm/min when tested in accordance with Test Method D 635

NOTE 2—CA0122 corresponds to the following physical property requirements in Table CA:

Specific gravity: 1.25-1.28.

Tensile stress at yield: 18 MPa min.

Flexural modulus: 930 MPa min.

Izod impact strength: 200 J/m min.

Water absorption: 4.7 % max.

Weight loss on heating: 10.0 % max.

6. Materials and Manufacture

6.1 Materials supplied shall be as uniform in composition and size, and as free of contamination, as can be achieved by good manufacturing practice.

6.2 These materials may contain colorants in the nominal amounts ordinarily employed, but such additives shall not alter the ability of the materials to meet the specified properties.

6.3 The color of material supplied shall be comparable, within commercial match tolerances, to the color of standard samples prepared by the manufacturer.

6.4 Grade 2 materials shall be verified by the manufacturer to be of extrusion quality.

7. Physical Requirements

7.1 Test specimens of the material shall conform to the requirements prescribed in Table CA.

7.2 Molded specimens, for those tests requiring them, shall be prepared in accordance with Section 10.

7.3 Conformance to the requirements of this specification shall be determined in accordance with Section 11.

8. Sampling

8.1 The material shall be sampled in accordance with Sections 9 to 12 of Practice D 1898. Adequate statistical sampling prior to packaging shall be considered an acceptable alternative.

8.2 For sampling purposes, a batch or lot shall be considered a unit of manufacture as prepared for shipment and may consist of a blend of two or more production runs of material.

9. Number of Tests

9.1 Routine testing of each batch or lot shall be limited to properties designated in Table CA of this specification.

9.2 One set of samples for those tests that are designated (Section 12) shall be considered sufficient for testing the batch or lot. The average results from those samples shall comply with the requirements prescribed in this specification.

9.3 If any failure occurs, the materials may not be certified to this specification.

10. Specimen Preparation

10.1 Physical property requirements in Table CA are based on injection molded specimens 3.2 mm thick. Specimens machined from compression-molded blanks or extruded strips may be used, provided it can be shown that the results are comparable.

10.2 Prior to molding cellulose acetate, dry the material to a moisture content of 0.2 % or less. The primary reason for drying the material is to eliminate visual defects such as surface imperfections and bubbles. Material spread in a tray to a maximum depth of 50 mm and exposed in a circulating-air oven at 75 to 90°C for 3 h should be satisfactory. Formulations containing either very low or very high levels of plasticizer may require slightly higher or lower drying temperatures respectively. Control the injection molding cycles in accordance with Practice D 3641, using a melt temperature 25 to