



# Standard Specification for Ethyl Cellulose Molding and Extrusion Compounds<sup>1</sup>

This standard is issued under the fixed designation D 787; 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 requirements for plasticized ethyl cellulose thermoplastic compounds suitable for injection molding and extrusion. It does not include special materials compounded for special applications.

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

1.3 The following precautionary statement 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 equivalent or similar ISO standard.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 256 Test Methods for Determining the Pendum Impact Resistance of Notched Specimens of Plastics<sup>2</sup>
- D 569 Test Method for Measuring the Flow Properties of Thermoplastic Molding Materials<sup>2</sup>
- D 570 Test Method for Water Absorption of Plastics<sup>2</sup>
- D 618 Practice for Conditioning Plastics for Testing<sup>2</sup>
- D 638 Test Method for Tensile Properties of Plastics<sup>2</sup>
- D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load<sup>2</sup>
- D 759 Practice for Conducting Physical Property Tests of Plastics at Subnormal and Supernormal Temperatures<sup>3</sup>
- D 785 Test Method for Rockwell Hardness of Plastics and

<sup>1</sup> 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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This edition includes the addition of an ISO equivalency statement and a Keywords section, the elimination of superfluous references to user/seller agreements, and the removal of specific requirements relating to Federal/Military procurement. Some references to *specimens* were changed to *samples* in keeping with normal usage within ASTM materials standards.

<sup>2</sup> Annual Book of ASTM Standards, Vol 08.01.

<sup>3</sup> Discontinued, see 1982 Annual Book of ASTM Standards, Vol 08.01.

Electrical Insulating Materials<sup>2</sup>

D 792 Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement<sup>2</sup>

D 883 Terminology Relating to Plastics<sup>2</sup>

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique<sup>2</sup>

D 1897 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials<sup>2</sup>

D 1898 Practice for Sampling of Plastics<sup>2</sup>

D 3892 Practice for Packaging/Packing of Plastics<sup>4</sup>

## 3. Terminology

3.1 Terms in this specification are in accordance with Terminology D 883.

## 4. Classification

4.1 This specification covers two types and eleven grades of ethyl cellulose molding and extrusion compounds as classified in accordance with Table 1. Type I materials are general purpose and Type II are characterized by improved resistance to impact, especially at low temperatures. The grades are classified in accordance with their physical properties as specified in Table 1.

## 5. Ordering Information

5.1 Purchase orders for, or inquiries about, the materials described in this specification shall identify the following:

5.1.1 The number of this specification and the required type and grade chosen from Table 1, for example, D 787 Type 1, Grade 1.

5.1.2 Supplementary requirements in accordance with this specification if necessary.

5.1.3 Color and opacity within the limits defined in 6.4.

5.1.4 Particle form and size if choice is available.

5.1.5 Such other requirements as may be agreed between the seller and the purchaser.

## 6. Materials and Manufacture

6.1 Materials supplied under this specification shall be ethyl cellulose plastics in the form of pellets unless otherwise specified.

<sup>4</sup> Annual Book of ASTM Standards, Vol 08.02.



TABLE 1 Detailed Requirements for Molded Test Specimens

NOTE 1—ft-lbf/in.  $\times$  53.3378660 = joules per metre. Megapascals (MPa) = newtons  $\times$  10<sup>6</sup> per metre squared.

Property	Type I						Type II						Test Methods
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11		
Specific gravity, unpigmented, max at 23/23°C [73.4/73.4°F]	1.13	1.13	1.12	1.12	1.11	1.10	1.12	1.12	1.11	1.11	1.10	D 792	
Hardness (Rockwell) R scale, min	110	110	105	105	100	95	105	80	75	75	50	D 785	
Tensile strength at 23°C, min:													
MPa	44.8	41.4	38.1	33.0	31.0	24.2	27.6	24.1	20.7	20.0	15.9	D 638	
psi	6500	6000	5400	4800	4500	3800	4000	3500	3000	3300	2900		
Impact strength (Izod), min at 23°C [73.4°F]:													
J/m of notch	90.7	90.7	106.7	106.7	117.3	149.5	186.7	213.5	293.4	213.5	320.3	D 256	
ft-lbf/in. of notch	1.7	1.7	2.0	2.0	2.2	2.8	3.5	4.0	5.5	4.0	6.0		
at –40°C [–40°F]:													
J/m of notch	26.7	26.7	26.7	26.7	26.7	26.7	53.4	64.1	80.1	53.4	80.1	D 758	
ft-lbf/in. of notch	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.2	1.5	1.0	1.5		
Deflection temperature, min:													
at 1820-kPa [264-psi] fiber stress:													
°C	82	77	71	66	60	49	66	77	71	60	49	D 648	
°F	180	170	160	150	140	120	150	170	160	140	120		
at 455-kPa [66-psi] fiber stress:													
°C	94	88	82	77	71	66	82	82	82	77	–		
°F	200	190	180	170	160	150	180	180	180	170	–		
Water absorption (24-h immersion), max %	1.7	1.5	1.4	1.2	1.1	1.0	1.3	1.5	1.5	1.5	1.5	D 570	
Weight loss on heating (72 h at 82°C), max %	0.3	0.4	0.6	0.8	1.5	1.8	2.0	1.2	2.0	2.0	2.0	D 787	

6.2 Material supplied in these forms shall be as uniform in composition and size and as free of contamination as can be achieved by good manufacturing practice.

6.3 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.

6.4 The color and transparency or opacity of items fabricated under the conditions recommended by the manufacturer of the material shall be comparable within commercial match tolerances to the color and transparency or opacity of samples submitted in advance by the manufacturer and approved by the purchaser.

## 7. Physical Requirements

7.1 Test specimens of the material shall conform to the requirements prescribed in Table 1.

7.2 Molded specimens for those tests requiring them shall be prepared as described in Section 10.

7.3 Flow temperature of a given compound shall be within  $\pm 5^\circ\text{C}$  of the flow temperature designated in the contract or order.

7.4 Conformance to the requirements of this specification shall be determined by means of the tests identified in Section 11 unless otherwise specified.

## 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 1 of this specification.

9.2 One set of samples for those tests that are designated (Section 11), shall be considered sufficient for testing the batch or lot. The average results of those samples shall comply with the requirements prescribed in this specification.

## 10. Specimen Preparation

10.1 Requirements in Table 1 are based on injection molded specimens 3.2 mm [ $1/8$  in.] thick. Machined specimens 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 ethyl cellulose, the material should be dried to a moisture content of 0.2 % or less. Material spread in a tray to a maximum depth of 51 mm [2 in.] and exposed in a circulating-air oven at 76.5 to 88°C [170 to 190°F] for 3 h should be satisfactory. Control the injection molding condition on cycle in accordance with Practice D 1897, using a material temperature of 10 to 25°C [13 to 45°F] below the level that causes discoloration of the plastic. Mold temperatures of 48 to 71°C [120 to 160°F] have been found desirable. As a rule, thin section molding and the higher flow temperature compounds require the higher mold temperature.



## 11. Test Methods

11.1 Determine the properties defined by this specification in accordance with the following methods:

11.1.1 Unless otherwise specified, all tests shall be performed in the standard laboratory atmosphere as defined by Practice D 618.

11.1.2 Unless otherwise specified, molded test specimens shall be conditioned in accordance with Procedure A of Practice D 618.

11.1.3 *Flow Temperature*—Procedure A of Test Method D 569.

11.1.4 *Rockwell Hardness*—Procedure A of Test Method D 785.

11.1.5 *Specific Gravity*—Method A of Test Methods D 792, or Test Method D 1505.

11.1.6 *Tensile Strength*—Test Method D 638, Type I test specimen, 5.0-mm [0.2-in.]/min testing speed.

11.1.7 *Impact Strength (Izod)*—Method A of Test Methods D 256, and Practice D 759. Specimen size: 63.5 mm [2½ in.] long, by 12.7 mm [½ in.] wide, by 3.2 mm [⅛ in.] thick.

11.1.8 *Deflection Temperature*—Test Method D 648. Condition test specimens in accordance with Procedure B of Practice D 618.

11.1.9 *Water Absorption*—Test Method D 570, 2424-h immersion. Condition in accordance with Test Method D 570.

11.1.10 *Weight Loss on Heating*—Condition test specimens, 50.8 mm [2 in.] in diameter or 50.8 mm wide by 63.5 mm [2½ in.] long by 3.2 mm [⅛ in.] thick, for 48 h over anhydrous calcium chloride at  $23 \pm 1^\circ\text{C}$  [ $73.4 \pm 1.8^\circ\text{F}$ ]. Weigh three

specimens and then place them in a circulating-air oven for 72 h at  $82 \pm 1^\circ\text{C}$  [ $180 \pm 1.8^\circ\text{F}$ ]. Support the specimens flatwise on a screen in the oven. Upon removal from the oven, cool the specimens in a desiccator over anhydrous calcium chloride to  $23 \pm 1^\circ\text{C}$  [ $73.4 \pm 1.8^\circ\text{F}$ ]. Then weigh the specimens and calculate the percentage weight loss on heating on the basis of the conditioned weight.

## 12. Inspection

12.1 Inspection of the material shall be as described in Sections 7 and 8.

## 13. Rejection

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

## 14. Packaging and Package Marking

14.1 *Packaging*—The material shall be packaged in standard commercial containers, so constructed as to ensure acceptance by common or other carriers for safe transportation to the point of delivery.

14.2 *Package Marking*—Shipping containers shall identify the material and its supplier, the batch or lot number, its type, and the quantity contained.

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

## 15. Keywords

15.1 cellulose; ethylcellulose; extrusion; molding; plasticized; specification

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