



Designation: **D6713—14 D6713 – 19**

## Standard Specification for Extruded and Compression Molded Shapes Made from Poly(Vinylidene Fluoride) (PVDF)<sup>1</sup>

This standard is issued under the fixed designation D6713; 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 the requirements and test methods for the material, dimensions, and workmanship, and the properties of extruded sheet, rod and tubular bar manufactured from PVDF.

1.2 The properties included in this specification are those required for the compositions covered. Requirements necessary to identify particular characteristics important to specialized applications are described by using the classification system given in Section 4.

~~1.3 This specification allows for the use of recycled plastics (as defined in Guide [D7209](#)).~~

1.3 The values stated in English units are to be regarded as the standard in all property and dimensional tables. For reference purposes, SI units are also included in Tables X and S-PVDF only.

1.4 The following ~~precautionary safety hazards~~ caveat pertains only to the test method ~~portions of or test methods described in~~ 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, health, and ~~health~~ environmental practices and determine the applicability of regulatory ~~requirements/limitations~~ prior to use.*

NOTE 1—There is no ~~similar or equivalent ISO known~~ ISO equivalent to this standard. ISO 12086-1 and ISO 12086-2 have pertinent information.

1.5 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

### 2. Referenced Documents

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

[D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics](#) [602baba809c/astm-d6713-19](#)

[D618 Practice for Conditioning Plastics for Testing](#)

[D638 Test Method for Tensile Properties of Plastics](#)

[D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials](#)

[D883 Terminology Relating to Plastics](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D3222 Specification for Unmodified Poly\(Vinylidene Fluoride\) \(PVDF\) Molding Extrusion and Coating Materials](#)

[D3892 Practice for Packaging/Packing of Plastics](#)

[D4000 Classification System for Specifying Plastic Materials](#)

~~[D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products \(Withdrawn 2015\)](#)~~<sup>3</sup>

### 3. Terminology

3.1 *Definitions:*

3.1.1 *regrind (plastic), n*—a product or scrap such as sprues and runners that have been reclaimed by shredding and granulating for use in-house.

<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. Current edition approved ~~May 1, 2014~~ Oct. 1, 2019. Published ~~May 2014~~ October 2019. Originally approved in 2001. Last previous edition approved in ~~2009~~ 2014 as [D6713 – 01](#) [D6713 - 14](#) ([2009](#)). DOI: [10.1520/D6713-14](#); [10.1520/D6713-19](#).

<sup>2</sup> 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* volume information, refer to the standard's Document Summary page on the ASTM website.

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

3.1.2 For definitions of other technical terms pertaining to plastics terms used in this specification, see Terminology specification and associated ~~D883~~ or Guide with plastics issues refer to the terminology contained in ~~D7209~~ D883.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *recycled-plastic shape, n*—a product made from up to 100 % post-consumer material.

3.2.2 *rod, n*—an extruded solid cylindrical shape with a minimum diameter of 1/16 in.

3.2.3 *sheet, n*—flat stock greater than and including 0.010 in. thickness.

3.2.4 *tubular bar, n*—extruded annular shapes with minimum inside diameter of 1/16 in., and a minimum wall of 1/4 in.

3.2.5 *unmodified virgin plastic shape, n*—a product produced from virgin plastic, as furnished by a manufacturer, with no additives or processing aids.

4. Classification and Material

4.1 Product shape and size as defined in the applicable purchase order.

4.2 This specification covers product extruded and compression molded as listed in Table S-PVDF. Products included in the designations reference Specification ~~D3222~~ callouts where applicable.

4.2.1 The type of PVDF shape product shall be categorized by type, grade and class depending on resin and filler compositions as defined in Table S-PVDF.

4.2.2 Each type of shape shall be categorized into one of several grades as follows:

4.2.2.1 *Grade 1—Unmodified Virgin*—Extruded or compression molded product made using only 100 % virgin PVDF material.

4.2.2.2 *Grade 2—General Purpose*—Extruded or compression molded product made using up to 20 % PVDF regrind developed during internal processing steps is allowed.

4.2.2.3 *Grade 3—Recycled*—Extruded or compression molded product made using up to 100 % recycled PVDF resin.

4.3 The type, class and grade is further differentiated based on dimensional stability (elevated temperature excursion test), Table S-PVDF, and dimensional requirements, Tables A and B.

4.4 Property Tables:

4.4.1 Table S-PVDF (where S indicates this is a shape table) shall be used to describe both extruded or compression molded products.

4.4.2 Table X is intended to be used to describe both extruded or compression molded products not included in Table S-PVDF via a cell callout that includes the applicable Table S-PVDF type and specific properties (Designations 1-7).

4.4.3 To facilitate the incorporation of future or special materials not covered by Table S-PVDF, the “as specified” category (00) for type, class and grade is shown in the table with the basic properties to be obtained from Table X, as they apply.

4.4.4 *Reinforcements and Additive Materials*—A symbol (single-letter) will be used for the major reinforcement or combination, or both, along with two numbers that indicate the percentage of addition by mass with the tolerance as tabulated below. This must be included in all Table X callouts.

Symbol	Material	Tolerance (Based on the Total Mass)
C	Carbon and graphite fiber reinforced	±2 %
G	Glass-reinforced <15 % glass content >15 % glass content	±2 % ±3 %
L	Lubricants (for example, PTFE, graphite, and silicone)	by agreement between the supplier and the user
M	Mineral	±2 %
R	Combinations of reinforcements or fillers, or both	±3 % for the total reinforcement

4.5 *Callout Designation*—A one-line system shall be used to specify PVDF materials covered by this specification. The system uses predefined cells to refer to specific aspects of this specification as illustrated below:

4.5.1 Examples:

4.5.1.1 *Example 1*—Product made from unfilled virgin PVDF:

CELL CALLOUT: S-PVDF0111

where:

S-PVDF01 = product made from PVDF in accordance with Table S-PVDF,

± = unfilled virgin class, and

1 = unfilled class, and

± = general purpose grade product.

1 = unmodified virgin grade product.

4.5.1.2 *Example 2*—Product made from 10 % carbon fiber blended with unmodified virgin PVDF resin:

CELL CALLOUT: S-PVDF0100C10X3454430

where:

S-PVDF0100	= product made from PVDF in accordance with Table S-PVDF, <u>unspecified</u> ,
C10	= 10 % carbon fiber,
X	= Table X properties,
3	= tensile strength (10,000 psi),
4	= elongation at break (10 %),
5	= tensile modulus (500,000 psi),
4	= dimensional stability (0.4 %),
4	= flexural modulus (550,000 psi),
3	= Izod impact (1.0 ft-lb/in of notch), and
0	= unspecified.

4.5.2 These two examples illustrate how an on-line, alphanumeric sequence identifies the product composition, commercial parameters and physical characteristics of extruded or compression molded product. A space must be used as a separator between the specification number and the type designation. No separators are needed between type, class and grade. When special notes are to be included, such information must be preceded by a comma. Special tolerances must be noted at the time of order and are inserted after the grade in parenthesis and preceded by a comma.

## 5. Property Requirements

5.1 The physical property values listed within this specification's tables are to be considered minimum specification values. Any requirement for specific test data for a given production lot must be specified at the time of order. Physical properties for products not yet included in Table S-PVDF shall be specified using Table X for extruded or compression molded products.

## 6. Dimensional Requirements

6.1 The type, class and grade is differentiated based on dimensional stability (elevated temperature excursion test), Table S-PVDF and dimensional requirements, Tables A and B. Products shall be produced within commercial tolerances and with the lowest stress levels for machined parts as delineated in Tables A and B for extruded and compression molded products.

6.2 Tubular bar dimensions shall be supplied in the unfinished condition, unless otherwise specified at time of order sufficient to finish to the nominal dimension ordered.

6.3 The maximum allowable camber or bow, or both, shall be within the limits referenced in Tables A and B.

## 7. Workmanship, Finish, and Appearance

7.1 *Appearance*—The color of products shall be as published by the shapes manufacturer. They shall be uniform in color throughout the thickness. Specific colors and color-matching only agreed to by order. It is possible for physical properties to be affected by colors.

7.2 *Finish*—All products shall be free of blisters, wrinkles, cracks, gouges and defects that restrict commercial use of the product. A special surface finish shall be supplied only when specified in the purchase order or contact.

7.3 *Defects*—All products shall be free of voids, dirt, foreign material and embedded particles exceeding  $\frac{1}{32}$  in. maximum diameter as defined in 7.3.1.

7.3.1 The criteria for determining internal cleanliness shall be external visual inspection. A maximum number of two internal defects per square foot of sheet and one foot length of rod and tubular bar shall be allowed. Clusters of defects less than  $\frac{1}{32}$  in. diameter are to be counted as a single defect.

## 8. Sampling

8.1 Sampling shall be statistically adequate to satisfy the requirements of this specification as applicable.

8.2 For purposes of sampling, an inspection lot for examination and tests shall consist of all material of the same type, class, grade, and nominal size submitted for inspection at one time.

## 9. Number of Tests

9.1 Routine lot inspection shall consist of all criteria specified in the applicable product tables.

9.2 The criteria listed in these product tables and definitions are sufficient to establish conformity of the sheet, rod or tubular bars to this specification. When the number of test specimens is not stated in the test method, a single determination is sufficient. If more than single determinations and separate portions of the same sample are made, the results shall be averaged. The final result shall conform to the requirements prescribed in this specification.