



Designation: D8033 – 22

Standard Classification System for Poly(Ether Ether Ketone) (PEEK) Molding and Extrusion Materials¹

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1. Scope*

1.1 This classification system covers poly(ether ether ketone) materials suitable for injection molding and extrusion. This classification system allows for the use of recycled materials provided that all specification requirements are met.

1.2 The properties included in this standard are those required to identify the compositions covered. Other requirements necessary to identify particular characteristics important to specialized applications are to be specified by using the suffixes in Section 5.

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

1.4 Poly(ether ether ketone), commonly referred to as PEEK, is a member of the poly (aryl ether ketone) or PAEK family. Specification D6262 covers properties of PAEK shapes and includes shapes produced from PEEK.

NOTE 1—This standard and ISO 23153 address the same subject matter, but differ in technical content.

1.5 The following precautionary caveat pertains only to the test method portion, Section 11, of this classification system: *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 environmental practices and determine the applicability of regulatory limitations prior to use.*

¹ This test method 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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1.6 *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:²

- D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
- D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
- D257 Test Methods for DC Resistance or Conductance of Insulating Materials
- D618 Practice for Conditioning Plastics for Testing
- D638 Test Method for Tensile Properties of Plastics
- D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D883 Terminology Relating to Plastics
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
- D3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials
- D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
- D3835 Test Method for Determination of Properties of Polymeric Materials by Means of a Capillary Rheometer

² 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

- D3892** Practice for Packaging/Packing of Plastics
D4000 Classification System for Specifying Plastic Materials
D4812 Test Method for Unnotched Cantilever Beam Impact Resistance of Plastics
D6262 Specification for Extruded, Compression Molded, and Injection Molded Basic Shapes of Poly(aryl ether ketone) (PAEK)
D6869 Test Method for Coulometric and Volumetric Determination of Moisture in Plastics Using the Karl Fischer Reaction (the Reaction of Iodine with Water)
D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)³
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
 2.2 *ISO Standards*:⁴
ISO 23153-1:2020 Plastics—Polyetheretherketone (PEEK) moulding and extrusion materials—Part 1: Designation system and basis for specifications
ISO 23153-2:2020 Plastics—Polyetheretherketone (PEEK) moulding and extrusion materials—Part 2: Preparation of test specimens and determination of properties
 2.3 *Underwriters' Laboratories Standards*:⁵
UL94 Standard for Tests for Flammability of Plastic Materials

3. Terminology

3.1 Except for terms defined below, the terminology used in this classification system is in accordance with Terminologies **D883** and **D1600**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *poly(ether ether ketone)*, *n*—a polymer in which the repeated structural unit contains an aromatic ketone and two aromatic ether linkages. (C₁₉H₁₂O₃)

4. Classification

4.1 Poly(ether ether ketone) materials are classified into groups that are subdivided into classes and grades as shown in the Basic Property Table (Table PEEK).

NOTE 2—An example of a specification based on this classification system is given below. The specification PEEK012GF30 indicates the following:

PEEK = Poly(ether ether Ketone) as found in Terminology **D1600**

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

01 (Group) = General Purpose
 2 (Class) = Low Flow
 GF30 (Grade) = 30 % Glass-Filled, with corresponding requirements shown in Table PEEK.

4.1.1 To facilitate incorporation of future or special materials the “Other” category for group (00), class (0), and grade (0) is shown in Table PEEK. The basic properties for these materials are obtained from Table A as they apply.

4.2 Table A shall be used to specify the physical property requirements that shall be shown by a six-character designation. The designation shall consist of the letter A and the five digits comprising the cell numbers for the property requirements in the order as they appear in Table A.

4.2.1 Reinforced filled and lubricated variations of the basic materials are identified by a single letter from Table 1 that indicates the filler and/or reinforcement used and two digits that indicate the nominal quantity in percent by weight. A second letter, from Table 1a, when desired, is used to indicate the form or structure of the reinforcement and/or filler, but is not used for functional mixtures. Thus, the letter designation G for glass, E for beads or spheres or balls, and 33 for percent by weight, specifies a reinforced or filled material with 33 percent by weight in the form of glass beads, spheres, or balls. The reinforcement letter designations and associated tolerance levels are shown in Table 1. Form and structure letter designations are shown in Table 1a.

NOTE 3—This part of the classification system uses the percent of reinforcements or additives, or both, in the callout of the modified basic material. The types and percentages of reinforcements and additives are often shown on the supplier's technical data sheet unless they are proprietary in nature. If necessary, additional callout of these reinforcement and additives is accomplished by use of the suffix part of the system (see Section 5).

4.2.2 Although the values listed in Table A are necessary to include the range of properties available in existing materials, this does not imply that every possible combination of the properties exists or can be obtained.

4.2.3 When the grade of the basic material is not known, or is not important, the “0” grade shall be used for the reinforced materials in this system.

NOTE 4—An example of the use of this classification system for specifying a special poly(ether ether ketone) plastics material is given as follows. The specification PEEK012GF30A43460 would have the following material requirements:

PEEK0120 = poly(ether ether ketone) from Table PEEK,
 GF30 = glass reinforced at the 30 % nominal level,
 A = Table A property requirements,
 4 = tensile strength, 130 MPa min,
 3 = flexural modulus, 4.5 GPa min,
 4 = Notched Izod impact, 60 J/m min,
 6 = deflection temperature, 275°C min, and
 0 = unspecified.

If no properties are specified, the designation would be: PEEK0120GF30A00000.