



**Designation: D4000 – 16**

## **Standard Classification System for Specifying Plastic Materials<sup>1</sup>**

This standard is issued under the fixed designation D4000; 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.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### **1. Scope\***

1.1 This standard provides a classification system for tabulating the properties of unfilled, filled, and reinforced plastic materials suitable for processing into parts.

NOTE 1—The classification system serves many of the needs of industries using plastic materials. The standard is subject to revision as the need requires; therefore, the latest revision should always be used.

1.2 The classification system and subsequent line call-out (specification) is intended to be a means of identifying 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 plastics field 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 inherent properties of the material not covered in this document, and the economic factors.

1.3 This classification system is based on the premise that plastic materials can be arranged into broad generic families using basic properties to arrange the materials into groups, classes, and grades. A system is thus established which, together with values describing additional requirements, permits as complete a description as desired of the selected material.

1.4 In all cases where the provisions of this classification system would conflict with the referenced ASTM specification for a particular material, the latter shall take precedence.

NOTE 2—When using this classification system the two-letter, three-digit suffix system applies.

NOTE 3—When a material is used to fabricate a part where the requirements are too specific for a broad material call-out, it is advisable for the user to consult the supplier to secure a call-out of the properties to suit the actual conditions to which the part is to be subjected.

1.5 *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.*

1.6 *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:<sup>2</sup>

[D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies](#)

[D150 Test Methods for AC Loss Characteristics and Permittivity \(Dielectric Constant\) of Solid Electrical Insulation](#)

[D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics](#)

[D257 Test Methods for DC Resistance or Conductance of Insulating Materials](#)

[D395 Test Methods for Rubber Property—Compression Set](#)

[D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension](#)

[D471 Test Method for Rubber Property—Effect of Liquids](#)

[D495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation](#)

[D569 Method for Measuring the Flow Properties of Thermoplastic Molding Materials \(Withdrawn 1995\)<sup>3</sup>](#)

[D570 Test Method for Water Absorption of Plastics](#)

[D573 Test Method for Rubber—Deterioration in an Air Oven](#)

[D575 Test Methods for Rubber Properties in Compression](#)

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

[D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers](#)

<sup>1</sup> This classification system 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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<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.

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

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

- D635** Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- D638** Test Method for Tensile Properties of Plastics
- D648** Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
- D695** Test Method for Compressive Properties of Rigid Plastics
- D706** Classification System and Basis for Specifications for Cellulose Acetate Molding and Extrusion Compounds (CA)
- D707** Classification System and Basis for Specification for Cellulose Acetate Butyrate Molding and Extrusion Compounds (CAB)
- D747** Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam (Withdrawn 2019)<sup>3</sup>
- D785** Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
- D787** Specification for Ethyl Cellulose Molding and Extrusion Compounds
- D788** Classification System for Poly(Methyl Methacrylate) (PMMA) Molding and Extrusion Compounds
- D789** Test Method for Determination of Relative Viscosity of Concentrated Polyamide (PA) Solutions
- 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
- D955** Test Method of Measuring Shrinkage from Mold Dimensions of Thermoplastics
- D1003** Test Method for Haze and Luminous Transmittance of Transparent Plastics
- D1149** Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment
- D1203** Test Methods for Volatile Loss From Plastics Using Activated Carbon Methods
- D1238** Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
- D1248** Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
- D1430** Classification System for Polychlorotrifluoroethylene (PCTFE) Plastics
- D1434** Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheet
- D1435** Practice for Outdoor Weathering of Plastics
- D1499** Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics
- D1505** Test Method for Density of Plastics by the Density-Gradient Technique
- D1525** Test Method for Vicat Softening Temperature of Plastics
- D1562** Classification System and Basis for Specification for Cellulose Acetate Propionate Molding and Extrusion Compounds (CAP)
- D1600** Terminology for Abbreviated Terms Relating to Plastics
- D1693** Test Method for Environmental Stress-Cracking of Ethylene Plastics
- D1784** Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
- D1822** Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials
- D1929** Test Method for Determining Ignition Temperature of Plastics
- D2116** Specification for FEP Resin Molding and Extrusion Materials
- D2137** Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
- D2240** Test Method for Rubber Property—Durometer Hardness
- D2287** Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
- D2288** Test Method for Weight Loss of Plasticizers on Heating (Withdrawn 2010)<sup>3</sup>
- D2565** Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
- D2583** Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- D2584** Test Method for Ignition Loss of Cured Reinforced Resins
- D2632** Test Method for Rubber Property—Resilience by Vertical Rebound
- D2843** Test Method for Density of Smoke from the Burning or Decomposition of Plastics
- D2863** Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
- D2951** Test Method for Resistance of Types III and IV Polyethylene Plastics to Thermal Stress-Cracking (Withdrawn 2006)<sup>3</sup>
- D3012** Test Method for Thermal-Oxidative Stability of Polypropylene Using a Specimen Rotator Within an Oven
- D3159** Specification for Modified ETFE Fluoropolymer Molding and Extrusion Materials
- D3222** Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
- D3275** Classification System for E-CTFE-Fluoroplastic Molding, Extrusion, and Coating Materials
- D3307** Specification for Perfluoroalkoxy (PFA) Resin Molding and Extrusion Materials
- D3350** Specification for Polyethylene Plastics Pipe and Fittings Materials
- D3418** Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
- D3638** Test Method for Comparative Tracking Index of Electrical Insulating Materials
- D3713** Test Method for Measuring Response of Solid Plastics to Ignition by a Small Flame (Withdrawn 2000)<sup>3</sup>
- D3763** Test Method for High Speed Puncture Properties of Plastics Using Load and Displacement Sensors
- D3801** Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position

- D3892** Practice for Packaging/Packing of Plastics
- D3895** Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D3915** Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications (Withdrawn 2015)<sup>3</sup>
- D3935** Classification System and Basis for Specification for Polycarbonate (PC) Unfilled and Reinforced Material
- D3965** Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings
- D3985** Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor
- D4020** Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
- D4066** Classification System for Nylon Injection and Extrusion Materials (PA)
- D4067** Classification System and Basis for Specification for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASTM Methods
- D4101** Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- D4181** Classification for Acetal (POM) Molding and Extrusion Materials (Withdrawn 2005)<sup>3</sup>
- D4203** Specification for and Basis for Specifications for Styrene-Acrylonitrile (SAN) Injection and Extrusion Materials
- D4216** Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly(Vinyl Chloride) (CPVC) Building Products Compounds
- D4329** Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics
- D4349** Classification System and Basis for Specification for Polyphenylene Ether (PPE) Materials
- D4364** Practice for Performing Outdoor Accelerated Weathering Tests of Plastics Using Concentrated Sunlight
- D4396** Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications
- D4474** Classification System for Styrenic Thermoplastic Elastomer Injection Molding and Extrusion Materials (TES) (Withdrawn 2008)<sup>3</sup>
- D4507** Specification for Thermoplastic Polyester (TPES) Materials (Withdrawn 1999)<sup>3</sup>
- D4549** Classification System and Basis for Specification for Polystyrene and Rubber-Modified Polystyrene Molding and Extrusion Materials (PS)
- D4617** Classification System for Phenolic Compounds (PF) (Withdrawn 2012)<sup>3</sup>
- D4634** Classification System and Basis for Specification for Styrene-Maleic Anhydride Molding and Extrusion Materials (S/MA)
- D4673** Classification System and Basis for Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastics and Alloys Molding and Extrusion Materials
- D4745** Classification System and Basis for Specification for Filled Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials Using ASTM Methods
- D4804** Test Method for Determining the Flammability Characteristics of Nonrigid Solid Plastics
- D4812** Test Method for Unnotched Cantilever Beam Impact Resistance of Plastics
- D4894** Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials
- D4895** Specification for Polytetrafluoroethylene (PTFE) Resin Produced From Dispersion
- D4976** Specification for Polyethylene Plastics Molding and Extrusion Materials
- D4986** Test Method for Horizontal Burning Characteristics of Cellular Polymeric Materials
- D5021** Specification for Thermoplastic Elastomer-Chlorinated Ethylene Alloy (TECEA) (Withdrawn 2007)<sup>3</sup>
- D5046** Classification for Fully Crosslinked Elastomeric Alloys (FCEAs) (Withdrawn 2000)<sup>3</sup>
- D5048** Test Method for Measuring the Comparative Burning Characteristics and Resistance to Burn-Through of Solid Plastics Using a 125-mm Flame
- D5132** Test Method for Horizontal Burning Rate of Polymeric Materials Used in Occupant Compartments of Motor Vehicles
- D5138** Classification System and Basis for Specification for Liquid Crystal Polymers Molding and Extrusion Materials (LCP)
- D5203** Specification for Polyethylene Plastics Molding and Extrusion Materials from Recycled Post-Consumer (HDPE) Sources (Withdrawn 2016)<sup>3</sup>
- D5204** Classification System and Basis for Specification for Polyamide-Imide (PAI) Molding and Extrusion Materials
- D5205** Classification System and Basis for Specification for Polyetherimide (PEI) Materials
- D5279** Test Method for Plastics: Dynamic Mechanical Properties: In Torsion
- D5336** Classification System and Basis for Specification for Polyphthalamide (PPA) Injection Molding Materials
- D5420** Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
- D5476** Classification System for Thermoplastic Polyurethane Materials (TPU) (Withdrawn 2005)<sup>3</sup>
- D5575** Classification System for Copolymers of Vinylidene Fluoride (VDF) with Other Fluorinated Monomers
- D5593** Classification for Thermoplastic Elastomers—Olefinic (TEO) (Withdrawn 2005)<sup>3</sup>
- D5628** Test Method for Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Falling Dart (Tup or Falling Mass)
- D5630** Test Method for Ash Content in Plastics
- D5676** Specification for Recycled Polystyrene Molding and Extrusion Materials (Withdrawn 2004)<sup>3</sup>

- D5857** Specification for Polypropylene Injection and Extrusion Materials Using ISO Protocol and Methodology
- D5927** Classification System for and Basis for Specifications for Thermoplastic Polyester (TPES) Injection and Extrusion Materials Based on ISO Test Methods
- D5990** Classification System for Polyketone Injection Molding and Extrusion Materials (PK) (Withdrawn 2007)<sup>3</sup>
- D6314** Specification for Fluorocarbon Perfluoromethoxy (MFA) Resin Molding and Extrusion Materials (Withdrawn 2002)<sup>3</sup>
- D6338** Classification System for Highly Crosslinked Thermoplastic Vulcanizates (HCTPV) Based on ASTM Standard Test Methods
- D6339** Classification System for and Basis for Specifications for Syndiotactic Polystyrene Molding and Extrusion (SPS)
- D6358** Classification System and Basis for Specification for Poly (Phenylene Sulfide) (PPS) Injection Molding, Extrusion and Blow Molding Materials Using ISO Methods
- D6360** Practice for Enclosed Carbon-Arc Exposures of Plastics
- D6394** Specification for Sulfone Plastics (SP)
- D6778** Classification System and Basis for Specification for Polyoxymethylene Molding and Extrusion Materials (POM)
- D6779** Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)
- D6835** Classification System for Thermoplastic Elastomer-Ether-Ester Molding and Extrusion Materials (TEEE)
- 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)<sup>3</sup>
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E84** Test Method for Surface Burning Characteristics of Building Materials
- E96/E96M** Test Methods for Water Vapor Transmission of Materials
- E104** Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions
- E119** Test Methods for Fire Tests of Building Construction and Materials
- E162** Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
- E662** Test Method for Specific Optical Density of Smoke Generated by Solid Materials
- E1354** Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
- F372** Test Method for Water Vapor Transmission Rate of Flexible Barrier Materials Using an Infrared Detection Technique (Withdrawn 2009)<sup>3</sup>
- 2.2 *Federal Standard*:<sup>4</sup>  
**Department of Transportation** Federal Motor Vehicle Safety Standard No. 302
- 2.3 *Underwriters Laboratories*:<sup>5</sup>  
**UL94** Standards for Tests for Flammability for Parts in Devices and Appliances
- 2.4 *IEC and ISO Standards*:<sup>6</sup>  
**IEC 600093** Recommended Methods of Tests for Volume and Surface Resistivities of Electrical Insulation Materials  
**IEC 600112** Recommended Method for Determining the Comparative Tracking Index of Solid Insulation Materials Under Moist Conditions  
**IEC 600243** Recommended Methods of Test for Electrical Strength of Solid Insulating Materials at Power Frequencies  
**IEC 600250** Recommended Methods for the Determination of the Permittivity and Dielectric Dissipation Factor of Electrical Insulation Materials at Power, Audio, and Radio Frequencies Including Metre Wavelengths  
**IEC 60695-2-12** Fire Hazard Testing—Part 2-12: Glowing/Hot-Wire Based Test Methods—Glow-Wire Flammability Test Method for Materials  
**IEC 60695-11-10** Fire Hazard Testing—Part 11-10: Test Flames—50 W Horizontal and Vertical Flame Tests  
**IEC 60695-11-20** Fire Hazard Testing—Part 11-20: Test Flames—500 W Flame Test Methods  
**ISO 62** Plastics—Determination of Water Absorption  
**ISO 75-1** Plastics—Determination of Temperature of Deflection Under Load—Part 1: General Principles  
**ISO 75-2** Plastics—Determination of Temperature of Deflection Under Load—Part 2: Plastics and Ebonite  
**ISO 178** Plastics—Determination of Flexural Properties of Rigid Plastics  
**ISO 179** Plastics—Determination of Charpy Impact Strength of Rigid Materials  
**ISO 180** Plastics—Determination of Izod Impact Strength of Rigid Materials  
**ISO 294-4** Plastics—Injection Moulding of Test Specimens of Thermoplastic Materials—Part 4: Determination of Moulding Shrinkage  
**ISO 527-1** Plastics—Determination of Tensile Properties—Part 1: General Principles  
**ISO 527-2** Plastics—Determination of Tensile Properties—Part 2: Test Conditions for Moulding and Extrusion Plastics  
**ISO 604** Plastics—Determination of Compressive Properties  
**ISO 868** Plastics—Determination of Indentation Hardness by Means of a Durometer (Shore Hardness)

<sup>4</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

<sup>5</sup> Available from Underwriters Laboratories (UL), 333 Pfingsten Rd., Northbrook, IL 60062-2096, <http://www.ul.com>.

<sup>6</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

- ISO 877 Plastics—Determination of Resistance to Change Upon Exposure Under Glass to Daylight
- ISO 974 Plastics—Determination of the Brittleness Temperature by Impact
- ISO 1133 Plastics—Determination of the Melt Mass-Flow Rate (MFR) and the Melt Volume-Flow Rate (MVR) of Thermoplastics
- ISO 1183 Plastics—Methods for Determining the Density and Relative Density of Non-Cellular Plastics
- ISO 2039-2 Plastics—Determination of Hardness—Part 2: Rockwell Hardness
- ISO 3795 Road Vehicles, Tractors, and Machinery for Agriculture and Forestry—Determination of Burning Behavior of Interior Materials
- ISO 4577 Plastics—Polypropylene and Propylene—Copolymers—Determination of Thermal Oxidative Stability in Air-Oven Method
- ISO 4589 Plastics—Determination of Flammability by Oxygen Index
- ISO 4607 Plastics—Method of Exposure to Natural Weathering
- ISO 4892 Plastics—Methods of Exposure to Laboratory Light Sources
- ISO 4892-4 Plastics—Methods of Exposure to Laboratory Light Sources—Part 4: Open-flame Carbon-arc
- ISO 5659 Plastics—Smoke Regeneration—Part 2: Determination of Optical Density by a Single-Chamber Test
- ISO 6603-1 Plastics—Determination of Multiaxial Impact Behavior of Rigid Plastics—Part 1: Falling Dart Method

- ISO 6721-1 Plastics—Determination of Dynamic Mechanical Properties—Part 1: General Principles
- ISO 6721-2 Plastics—Determination of Dynamic Mechanical Properties—Part 2: Torsion-Pendulum Method
- ISO 9772 Cellular Plastics—Determination of Horizontal Burning Characteristics of Small Specimens Subjected to a Small Flame
- ISO 9773 Plastics—Determination of Burning Behaviour of Thin Flexible Vertical Specimens in Contact with a Small-Flame Ignition Source
- ISO 11357-1 Plastics—Differential Scanning Calorimetry—Part 1: General principles
- ISO 11357-3 Plastics—Differential Scanning Calorimetry—Part 3: Determination of Temperature and Enthalpy of Melting and Crystallization

**3. Terminology**

3.1 *Definitions*—The definitions used in this classification system are in accordance with Terminology D883.

**4. Significance and Use**

4.1 The purpose of this classification system is to provide a method of adequately identifying plastic materials in order to give industry a system that can be used universally for plastic materials. It further provides a means for specifying these materials by the use of a simple line call-out designation.

4.2 This classification system was developed to permit the addition of property values for future plastics.

**5. Classification**

**TABLE 1 Standard Symbols for Generic Families With Referenced Standards and Cell Tables**

Standard Symbol	Plastic Family Name	ASTM <sup>A</sup> Standard	Suggested Reference Cell Tables for Materials Without an ASTM Standard <sup>B</sup>	
			Unfilled	Filled
ABA	acrylonitrile-butadiene-acrylate		E	
ABS	acrylonitrile-butadiene-styrene	D3965, D4673		
AMMA	acrylonitrile-methyl methacrylate		E	
ARP	aromatic polyester	(see LCP)		
ASA	acrylonitrile-styrene-acrylate		E	
CA	cellulose acetate	D706		
CAB	cellulose acetate butyrate	D707		
CAP	cellulose acetate propionate		E	D
CE	cellulose plastics, general		E	D
CF	cresol formaldehyde		H	H
CMC	carboxymethyl cellulose		E	
CN	cellulose nitrate		E	D
CP	cellulose propionate	D1562		
CPE	chlorinated polyethylene		F	
CPVC	chlorinated poly(vinyl chloride)	D4396, D1784, D3915, D4216		
CS	casein		H	H
CTA	cellulose triacetate		E	D
EC	ethyl cellulose	D787	E	D
E-CTFE	ethylene-chlorotrifluoroethylene copolymer	D3275		
EEA	ethylene-ethyl acrylate		F	
EMA	ethylene-methacrylic acid		F	
EP	epoxy, epoxide		H	H
EPD	ethylene-propylene-diene			
EPM	ethylene-propylene polymer		F	D
ETFE	ethylene-tetrafluoroethylene copolymer	D3159		
EVA	ethylene-vinyl acetate		F	
FCEA	fully crosslinked elastomeric alloy	D5046		
FEP	perfluoro (ethylene-propylene) copolymer	D2116		
FF	furan formaldehyde		H	H
HCTPV	highly crosslinked thermoplastic vulcanizates	D6338		
IPS	impact polystyrene	(see PS)		
LCP	liquid crystal polymer	D5138		

**TABLE 1** *Continued*

Standard Symbol	Plastic Family Name	ASTM <sup>A</sup> Standard	Suggested Reference Cell Tables for Materials Without an ASTM Standard <sup>B</sup>	
			Unfilled	Filled
MF	melamine-formaldehyde		H	H
PA	polyamide (nylon)	D4066-94, D4066-01, D6779		
PAEK	polyaryletherketone			
PAI	polyamide-imide	D5204	G	G
PARA	polyacryl amide			
PB	polybutene-1		F	
PBT	poly(butylene terephthalate)	(see TPES)		
PC	polycarbonate	D3935		
PCTFE	polymonochlorotrifluoroethylene	D1430		
PDAP	poly(diallyl phthalate)		H	H
PE	polyethylene	D1248, D4976, D3350, D4020, D5203		
PEBA	polyether block amide			
PEEK	polyetheretherketone			
PEI	polyether-imide	D5205		
PEO	poly(ethylene oxide)			
PESU	polyether sulfone	D6394		
PET	poly(ethylene terephthalate), general	(see TPES)		
PETG	glycol modified polyethylene terephthalate comonomer	(see TPES)		
PF	phenol-formaldehyde	D4617		
PFA	perfluoro alkoxy alkane	D3307		
PI	polyimide			
PIB	polyisobutylene		G	G
PK	polyketone		F	
PMMA	Poly(methyl methacrylate)	D5990		
PMP	poly(4-methylpentene-1)	D788		D
POM	polyoxymethylene (acetal)		F	
POP	polyphenylene oxide	D4181, D6778		
PP	polypropylene	(see PPE)		
PPA	polyphthalamide	D4101, D5857		
PPE	polyphenylene ether	D5336, D6779		
PPH	polyphenylene	D4349		
PPOX	poly(propylene oxide)		G	H
PPS	poly(phenylene sulfide)	D4067, D6358		
PPSU	poly(phenyl sulfone)	D6394	G	G
PS	polystyrene	D4549, D5676		
PTFE	polytetrafluoroethylene	D1430, D3159, D3222, D3307, D4745, D4894, D4895, D6314		
PUR	polyurethane		F	D
PVAC	poly(vinyl acetate)		F	D
PVAL	poly(vinyl alcohol)		F	D
PVB	poly(vinyl butyral)		F	D
PVC	poly(vinyl chloride)	D2287	F	D
PVDC	poly(vinyl idene chloride)		F	D
PVDF	poly(vinyl idene fluoride)	D3222		
PVF	poly(vinyl fluoride)		F	D
PVFM	poly(vinyl formal)		F	D
PVK	poly(vinylcarbazole)		F	D
PVP	poly(vinyl pyrrolidone)		F	D
SAN	styrene-acrylonitrile	D4203		
SB	styrene-butadiene		E	D
SI	silicone plastics		G	G
S/MA	styrene-maleic anhydride	D4634		
SMS	styrene-methylstyrene		E	D
SP	polysulfone	D6394		
SPS	syndiotactic polystyrene	D6339		
TECEA	thermoplastic elastomer-chlorinated ethylene alloy	D5021		
TEEE	thermoplastic elastomer, ether-ester	D6835		
TEO	thermoplastic elastomer-olefinic	D5593		
TES	thermoplastic elastomer-stryenic	D4474		
TPE	thermoplastic elastomer	(see individual material)		
TPES	thermoplastic polyester (general)	D4507, D5927		
TPU	thermoplastic polyurethane	D5476		
UF	urea-formaldehyde		H	H
UP	unsaturated polyester			
VDF	vinylidene fluoride	D5575		

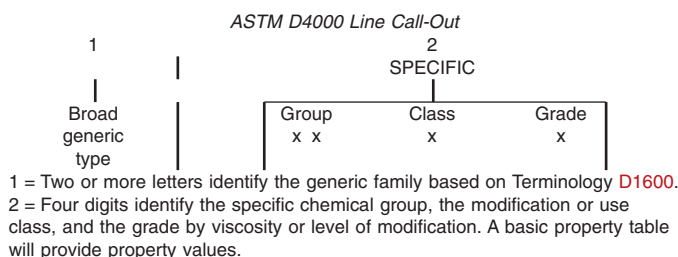
<sup>A</sup>The standards listed are those in accordance with this classification.

<sup>B</sup>Cell Tables A and B have been reserved for the referenced standards and will apply to unfilled and filled materials covered in those standards.

5.1 Plastic materials shall be classified on the basis of their broad generic family. The generic family is identified by letter designations as found in Table 1. These letters represent the standard abbreviations for plastics in accordance with Terminology D1600.

NOTE 4—For example: PA = polyamide (nylon), EMA = ethylene-methacrylic acid, and EVA = ethylene-vinyl acetate.

5.1.1 The generic family is classified into groups in accordance, in general, with the chemical composition. These groups are further subdivided into classes and grades as shown in the basic property table that applies. The letter designation applicable is followed by a four-digit number indicating group, class, and grade. The first two digits indicate the group, the third digit the class, and the fourth digit the grade.



The D4000 line call-out can be used only if the plastic is listed in Table 1 and has no more than one material standard referenced. If two or more standards are referenced for a material, a direct D4000 line call-out is ambiguous.

NOTE 5—An example using the group, class, and grade is as follows: PC0122 would indicate: PC = polycarbonate, 01 (group) = polycarbonate,

2 (class) = flame retarded, and 2 (grade) with requirements given in the (PC) basic property table of Classification D3935.

NOTE 6—A previous edition of this standard used three digits for group, class, and grade; 0122 is equivalent to what was 122.

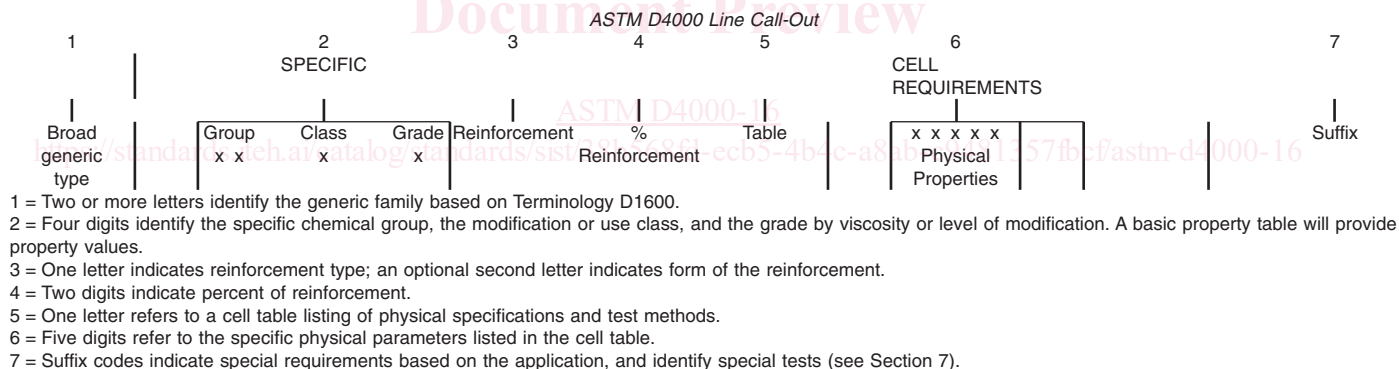
5.1.2 Basic property tables have been developed to sort the commercially available unreinforced plastics into groups, classes, and grades. These tables are found in the standards listed in Table 1.

5.1.2.1 Where a standard does not exist for this classification system the letter designation for the generic family will be followed by four 0's and the use of cell table that applies (see 5.3).

NOTE 7—Example—PI0000 would indicate a polyimide plastic (PI) from Table 1, and 0000 indicating no basic property table requirements.

5.2 Reinforced or filled versions, or both of the basic materials are identified by a single letter from Table 2 that indicates the reinforcement or filler, or both, used and two digits that indicate the nominal quantity in percent by weight. A second letter from Table 2A may be used to indicate the form or structure of the reinforcement or filler, or both, but is neither necessary nor functional for mixtures. Thus, a letter designation G for glass and 33 for percent by weight, G33, specifies a reinforced or filled material with 33 percent by weight of glass, and another letter designation E following the G (that is, GE33) specifies a filled material with 33 percent by weight of glass in the form of beads (or spheres or balls).

5.2.1 The generic family is based on the broad chemical makeup of the base polymer. By its designation, certain inherent properties are specified.



**TABLE 2 Reinforcement-Filler<sup>A</sup> Symbols<sup>B</sup> and Tolerance**

Symbol	Material	Tolerance
C	Carbon and graphite	±2 percentage points
D	Alumina trihydrate	±2 percentage points
E	Clay	±2 percentage points
F	Cellulose	±2 percentage points
G	Glass	±2 percentage points
H	Aramid	±2 percentage points
J	Boron	±2 percentage points
K	Calcium carbonate	±2 percentage points
L	Lubricants (for example, PTFE, graphite, and so forth)	Depends upon material and process—to be specified
M	Mineral	±2 percentage points
N	Natural organic (cotton, sisal, hemp, flax, and so forth)	±2 percentage points
P	Mica	±2 percentage points
Q	Silica	±2 percentage points
R	Combinations of reinforcements or fillers, or both	±3 percentage points
S	Synthetic organic	±2 percentage points
T	Talcum	±2 percentage points
V	Metal	±2 percentage points
W	Wood	±2 percentage points
X	Not specified	To be specified

<sup>A</sup>Ash content of filled or reinforced materials, or both may be determined using either Test Method **D5630** or ISO 3451–1 where applicable.

<sup>B</sup>Additional symbols may be added to this table as required.

**TABLE 2A Symbols for the Form or Structure of Fillers and Reinforcing Materials**

Symbol	Form or Structure
C	Chips, cuttings
D	Fines, powder
E	Beads, spheres, balls
F	Fiber
G	Ground
H	Whisker
K	Knitted fabric
L	Layer
M	Mat (fabric, thick)
N	Non-woven (fabric, thin)
P	Paper
R	Roving
S	Flake
T	Cord
V	Veneer
W	Woven fabric
X	Not specified
Y	Yarn

<https://standards.iteh.ai/catalog/standards/sist/38b568fd-ecb5-4b4c-a8ab-c9481357fbcf/astm-d4000-16>

5.2.2 The requirements for special or reinforced materials will use the classification system as described by the addition of a single letter that indicates the proper cell table in which the properties are listed. A specific value is designated by the cell number for each property in the order in which they are listed in the table. When a property is not to be specified, a zero is

entered as the cell number. Likewise, when an acceptable value is not available in the cell table, the number 9 should be used and a suffix used indicating the specific value (see 7.3). Thus, the letter designation “A” for cell table and 53380 for property values shall always be written A53380. The cell tables that may be used for each generic family are listed in Table 1.



The following three examples illustrate correct usage of the system. Note that the second example specifies one of two referenced standards shown in Table 1 of D4000-09b.

The first example is for a cellulose triacetate containing 33 percent glass reinforcement and with the property requirements shown in Table D of ASTM D4000.

ASTM D4000-09b CTA0000 G33 D53380

ASTM D4000-09b		Basic Requirements					
Plastic		CTA	00	0	0	G	33
		Generic (cellulos triacetate)	Group (Other)	Class (Other)	Grade (Other)	Glass Reinforced	Percent Glass
D		Cell Requirements					
Cell Table		5	3	3	8	0	
		Tensile Strength	Flexural Modulus	Izod Impact	Deflection Temperature	Unspecified	

Requirements from Table D of Classification D4000 - 09b

The second example is for a PET copolymer with 30 percent glass reinforcement with the properties requirements shown in Table A of ASTM D5927-09.

ASTM D5927-09 TPES0310 G30 A22450

ASTM D5927-09		Basic Requirements					
Plastic		TPES	03	1	0	G	30
		Generic (thermo-plastic polyester)	Group (polyethylene terephthalate copolymer)	Class (PET G)	Grade (Other)	Glass Reinforced	Percent Glass
A		Cell Requirements					
Cell Table		2	2	4	5	0	
		Tensile Strength	Tensile Modulus	Charpy Impact	Deflection Temperature	Unspecified	

Requirements from Table A of Classification D5927 - 09

The third example is for a reinforced plastic where the shape or form of the reinforcement is included. The designation D4066 - 94b PA0120G33A53380 indicates the following with the material requirements from Classification D4066 - 94b:

PA0120 = Nylon 66 heat stabilized from Table PA of Classification D4066 - 94b,

G33 = Glass reinforced with 33 % glass, nominal, no requirement for shape or form,

A = Table A (D4066) for property requirements,

5 = Tensile strength, 175 MPa, min,

3 = Flexural modulus, 7500 MPa, min,

3 = Izod impact, 75 J/m, min,

8 = Deflection temperature, 235°C, min, and

0 = Unspecified.

NOTE 8—The type and amount of reinforcement are sometimes shown on the supplier's technical data sheet. If necessary, additional control of these reinforcements shall be accomplished by the use of the suffix part of the system (Section 7).

5.3 To facilitate the identification of new, special, and reinforced materials where basic property tables are not provided in a material specification, cell tables have been incor-

porated in this standard (preceding Section 17). These tables should be used in the same manner as the cell tables that appear in the material specifications.

5.3.1 Although the values listed in cell tables include the range of properties available in existing materials, that does not imply that every possible combination of properties exists or can be obtained.

**6. Basic Requirements**

6.1 The main table or cell tables in the referenced ASTM classification standard found in **Table 1**, are to be used to develop a line call-out for each Plastic Family Name. A direct D4000 line call-out can be used only if the plastic is listed in Table 1 and has no more than one material standard referenced.

6.2 The cell tables included in this standard shall be used to develop a line call-out only for the materials not covered by a classification standard in **Table 1**. When the existing main or cell tables do not adequately describe the material, then suffixes are used in place of, or in addition to, a cell table designation.

6.3 A line call-out assembled using this classification system becomes a specification. The line call-out shall refer to the standard used and contain the broad and specific type of plastic, together with the appropriate identifiers followed by special suffix requirements, as they apply. The following summarizes the line call-out and the entire system as detailed in this standard.

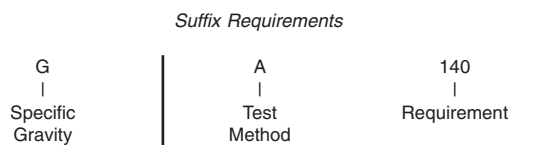
**7. Suffix Requirements**

7.1 When requirements are needed that supersede or supplement the property table or cell table requirements, they shall be specified through the use of suffixes. In general, the first suffix letter indicates the special requirement needed and the second letter indicates the condition or test method, or both, with a three-digit number indicating the specific requirement. The suffixes that may be used are listed in Table 3 (following 16.1).

7.2 Basic requirements from property or cell tables, as they apply, are always in effect unless these requirements are superseded by special suffix requirements in the line call-out.

NOTE 9—When using the suffixes for additional requirements of the material, the user must keep in mind that not all tests are routinely conducted by the supplier. When these requirements are necessary to identify particular characteristics important to specific applications they shall be specified.

7.3 The following is an example of a line call-out specification with suffix for a reinforced nylon:



Requirements from Suffix Table  
Acceptable Line call-out format for above  
D6779 PA0120 G33 A53380 GA140

ASTM D6779 Referenced Standard, latest issue  
PA0120G33 Plastic Material Basic Cell  
A53380 A Table Property Requirements  
GA140 Suffix Requirements

7.4 When a standard for a material is listed in **Table 1**, the requirements of the referenced standard apply and the refer-

enced standard is to be used. When the requirements for a material are included in this standard, the following sections are applicable.

**8. General Requirements**

8.1 The composition of the specified material shall be uniform and shall conform to the requirements specified herein.

**9. Detail Requirements**

9.1 The material shall conform to the requirements prescribed in the table (basic property, reinforced, cell, and suffix) as they apply.

9.2 For the purpose of determining conformance with this classification system, all specified limits, in this standard are absolute limits as defined in Practice E29.

9.3 With the absolute method, an observed value or a calculated value is not rounded, but is to be compared directly with the specified limiting value. Conformance or nonconformance with the specification is based on this comparison.

**10. Sampling**

10.1 Sampling shall be statistically adequate to satisfy the requirements of 15.4. A lot of material shall be considered as a unit of manufacture as prepared for shipment, and may consist of a blend of two or more “production runs” or batches.

**11. Numbers of Tests**

11.1 The number of tests conducted shall be consistent with the requirements of Sections 10.1 and 15.4.

**12. Specimen Preparation**

12.1 The test specimens shall be molded as specified for the specific materials under test in the ASTM standard specifications for the materials.

**13. Conditioning**

13.1 Condition the test specimens at 23 ± 2°C and 50 ± 10 % relative humidity for not less than 40 h prior to testing for those tests where conditioning is specified unless otherwise directed in the ASTM standard specification for the material.

13.2 Conduct tests in the standard laboratory atmosphere of 23 ± 2°C and 50 ± 10 % relative humidity unless otherwise directed in the ASTM standard specification for the material.

13.3 For materials sensitive to atmospheric exposure, special preparations for conditioning and test conditions should be adhered to as provided in the referenced standard for the material.

**14. Test Methods**

14.1 Determine the properties enumerated in this classification system by means of the test methods referenced.

**15. Inspection and Certification**

15.1 Inspection and certification of the material supplied under this classification system shall be for conformance to the requirements specified herein.