



Standard Classification System for Specifying Plastic Materials¹

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 (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the 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 appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

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
- 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 Materials³
- 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
- 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

¹ This classification system is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.94 on Government/Industry Standardization (Section D20.94.01).

Current edition approved May 1, 2012. Published June 2012. Originally approved in 1982. Last previous edition approved in 2011 as D4000 - 11. DOI: 10.1520/D4000-12.

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.

³ Withdrawn. 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.

- D706** Classification System and Basis for Specifications for Cellulose Acetate Molding and Extrusion Compounds
- D707** Classification System and Basis for Specification for Cellulose Acetate Butyrate Molding and Extrusion Compounds
- D747** Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
- 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 Methods for Determination of Solution Viscosities of Polyamide (PA)
- 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
- 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-Fluorocarbon 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 Heating³
- 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-Cracking³
- 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)-Fluorocarbon 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 Flame³
- 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
- D3935** 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 for and Basis for Specification for Reinforced and Filled Poly(Phenylene Sulfide) (PPS) Injection Molding and Extrusion Materials Using ASTM Methods
- D4101** Specification for Polypropylene Injection and Extrusion Materials
- D4181** Classification for Acetal (POM) Molding and Extrusion Materials³
- D4203** Specification 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 UV 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)³
- D4507** Specification for Thermoplastic Polyester (TPES) Materials³
- 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)³
- D4634** Classification System and Basis for Specification for Styrene-Maleic Anhydride Molding and Extrusion Materials (S/MA)
- D4673** Classification System for Acrylonitrile-Butadiene-Styrene (ABS) Plastics and Alloys Molding and Extrusion Materials
- D4745** Specification for Filled Compounds of Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials
- 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)³
- D5046** Classification for Fully Crosslinked Elastomeric Alloys (FCEAs)³
- 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
- D5204** Classification System 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** 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)³
- D5575** Classification System for Copolymers of Vinylidene Fluoride (VDF) with Other Fluorinated Monomers
- D5593** Classification for Thermoplastic Elastomers—Olefinic (TEO)³
- 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 Materials³
- D5857** Specification for Polypropylene Injection and Extrusion Materials Using ISO Protocol and Methodology
- D5927** Classification System for Thermoplastic Polyester (TPES) Injection and Extrusion Materials Based on ISO Test Methods
- D5990** Classification System for Polyketone Injection Molding and Extrusion Materials (PK)³
- D6314** Specification for Fluorocarbon Perfluoromethoxy (MFA) Resin Molding and Extrusion Materials³
- D6338** Classification System for Highly Crosslinked Thermoplastic Vulcanizates (HCTPVs) 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 and Extrusion 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
- 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 Technique³
- 2.2 Federal Standard:**⁴
Department of Transportation Federal Motor Vehicle Safety Standard No. 302
- 2.3 Underwriters Laboratories:**⁵
UL94 Standards for Tests for Flammability for Parts in Devices and Appliances
- 2.4 IEC and ISO Standards:**⁶
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 Indention Hardness by Means of a Durometer (Shore Hardness)
- 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

⁴ 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>.

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

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

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 ^A Standard	Suggested Reference Cell Tables for Materials Without an ASTM Standard ^B	
			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		
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			

TABLE 1 *Continued*

Standard Symbol	Plastic Family Name	ASTM ^A Standard	Suggested Reference Cell Tables for Materials Without an ASTM Standard ^B	
			Unfilled	Filled
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		G	G
PIB	polyisobutylene		F	
PK	polyketone	D5990		
PMMA	Poly(methyl methacrylate)	D788		D
PMP	poly(4-methylpentene-1)		F	
POM	polyoxymethylene (acetal)	D4181, D6778		
POP	polyphenylene oxide	(see PPE)		
PP	polypropylene	D4101, D5857		
PPA	polyphthalamide	D5336, D6779		
PPE	polyphenylene ether	D4349		
PPH	polyphenylene		G	H
PPOX	poly(propylene oxide)			
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		

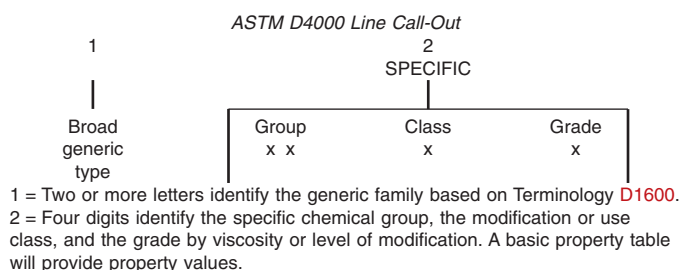
^AThe standards listed are those in accordance with this classification.

^BCell 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.

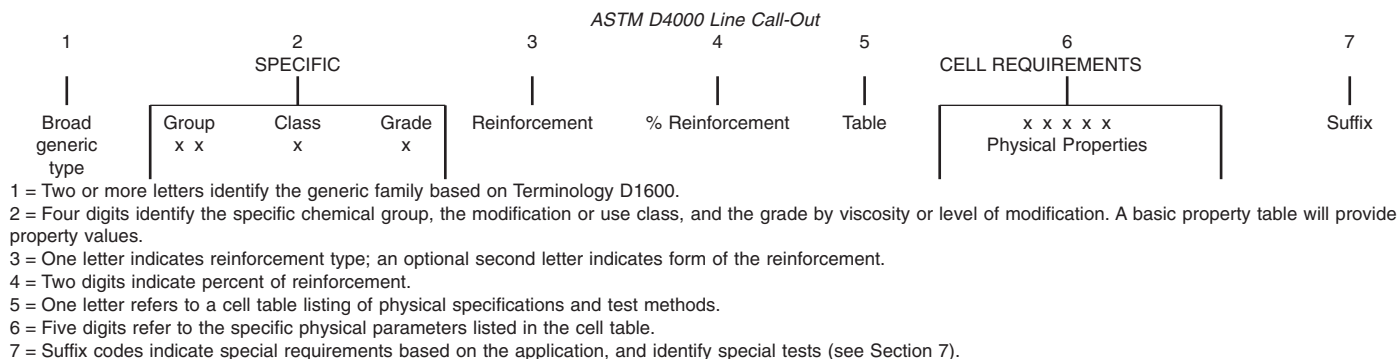


TABLE 2 Reinforcement-Filler^A Symbols^B and Tolerance

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

^AAsh content of filled or reinforced materials, or both may be determined using either Test Method D5630 or ISO 3451–1 where applicable.

^BAdditional 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

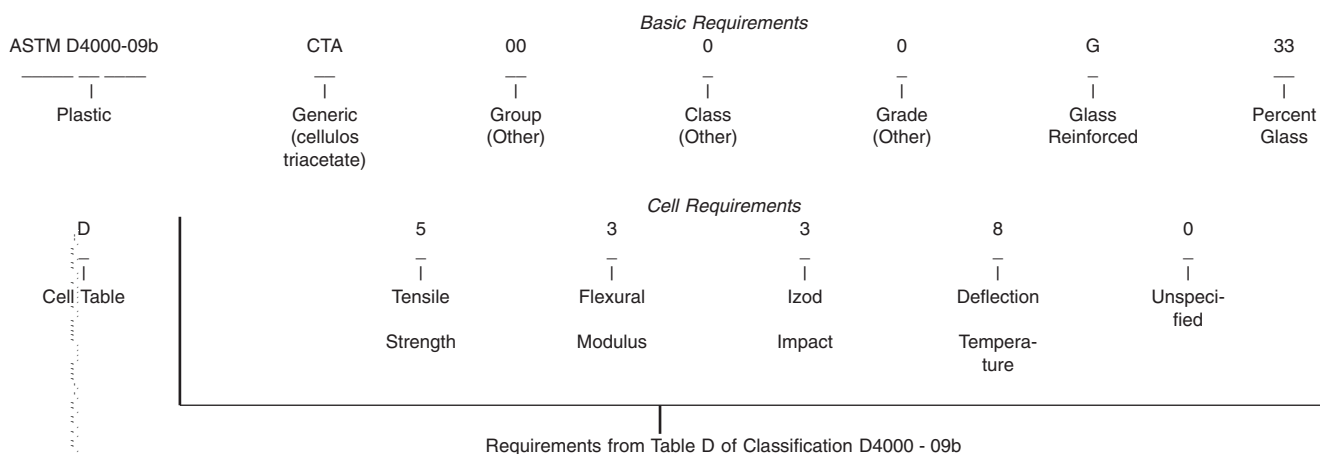
5.2.2 The requirements for special or reinforced materials will use the classification system as described by the addition of a single letter that indicates the proper cell table in which the properties are listed. A specific value is designated by the cell number for each property in the order in which 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.

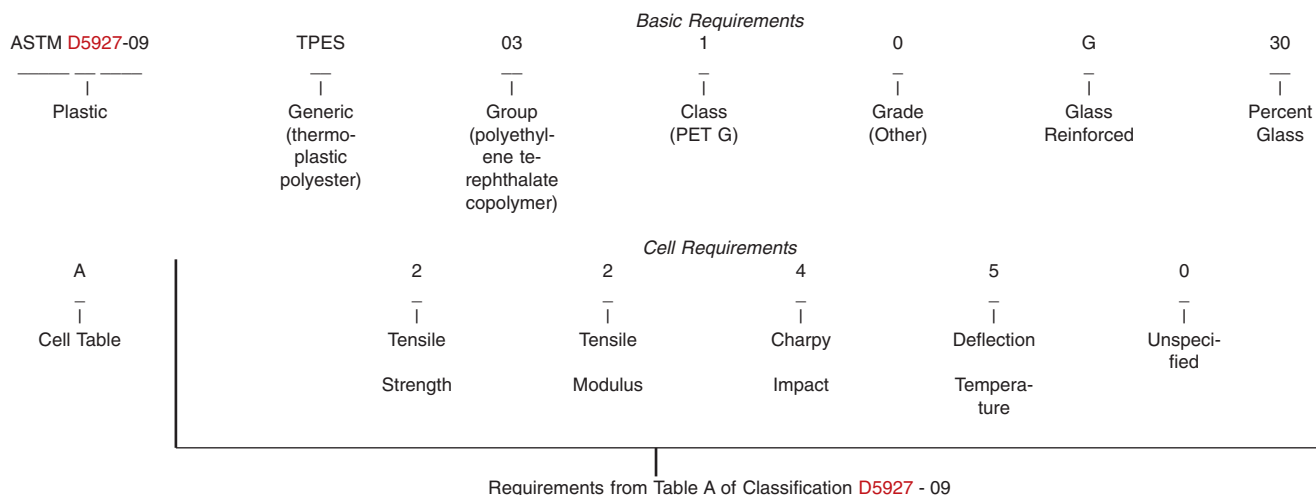
The first example is for a cellulose triacetate containing 33 percent glass reinforcement and with the property requirements shown in Table D of ASTM D4000.

ASTM D4000-09b CTA0000 G33 D53380



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



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 incorporated 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

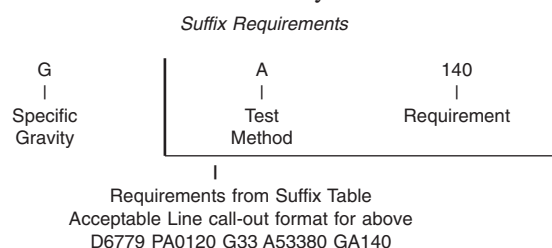
7.1 When requirements are needed that supersede or supplement the property table or cell table requirements, they shall be specified through the use of suffixes. In general, the first suffix letter indicates the special requirement needed and the second letter indicates the condition or test method, 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:



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 referenced 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 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 $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ 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 $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ 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.

15.2 Lot-acceptance inspection shall be the basis on which acceptance or rejection of the lot is made. The lot-acceptance inspection shall consist of those tests which ensure process control during manufacture as well as those necessary to ensure certifiability in accordance with 15.4.

15.3 Periodic check inspection shall consist of the tests specified for all requirements of the material under this classification system. Inspection frequency shall be adequate to ensure the material is certifiable in accordance with 15.4.

15.4 Certification shall be that the material was manufactured by a process in statistical control, sampled, tested, and inspected in accordance with this classification system, and that average values for the lot meet the requirements of the specification (line call-out).

15.5 A report of the test results shall be furnished when requested. The report shall consist of results of the lot-acceptance inspection for the shipment and the results of the most recent periodic-check inspection.

NOTE 10—If recycled plastics are allowed in the standard, insert the following phrase after the word “shipment” in the last sentence of 15.5: “and the percent by weight of recycled plastic, as defined in 3.1 of Guide D7209, if requested.”

16. Packaging, Packing, and Marking

16.1 Provisions of Practice D3892 apply for packaging, packing, and marking of plastic materials.

TABLE 3 Suffix Symbols and Requirements^A

Symbol	Characteristic
A	Color (unless otherwise shown by suffix, color is understood to be natural)
	Second letter A = does not have to match a standard B = must match standard
	Three-digit number 001 = color and standard number on drawing

TABLE *Continued*

Symbol	Characteristic
	002 = color on drawing
B	Fluid resistance
Second letter	A = reference fuel A, ASTM D471 , aged 70 h at $23 \pm 2^{\circ}\text{C}$ B = reference fuel C, ASTM D471 , aged 70 h at $23 \pm 2^{\circ}\text{C}$ C = ASTM #1 oil, ASTM D471 , aged 70 h at $100 \pm 2^{\circ}\text{C}$ D = IRM 902 oil, ASTM D471 , aged 96 h at $100 \pm 2^{\circ}\text{C}$ E = IRM 903 oil, ASTM D471 , aged 70 h at $100 \pm 2^{\circ}\text{C}$ F = Distilled water, ASTM D471 , aged 70 h at $100 \pm 2^{\circ}\text{C}$
	Three digit number is obtained from Suffix Table 1. It indicates change in hardness, tensile strength, elongation, and volume. Example: BC 132 specifies that material, after aging in ASTM #1 oil for 70 h at 100°C , can have changed no more than 2 Shore D points, 5 % tensile strength, 15 % elongation, and 5 % in volume.
C	Melting point—softening point
Second letter	B = ASTM D1525 , load 10 N, Rate A (Vicat) C = ASTM D1525 , load 10 N, Rate B (Vicat) D = ASTM D3418 (Transition temperature DSC/DTA) (ISO 11357-1 and ISO 11357-3) G = ISO 306, load 10 N, heating rate 50°C/h (Vicat) H = ISO 306, load 10 N, heating rate 120°C/h (Vicat) I = ISO 306, load 50 N, heating rate 50°C/h (Vicat) J = ISO 306, load 50 N, heating rate 120°C/h (Vicat) K = ASTM D1525 , load 50 N, Rate A (Vicat) L = ASTM D1525 , load 50 N, Rate B (Vicat)
	Three-digit number = minimum value $^{\circ}\text{C}$
E	Electrical
Second letter	A = dielectric strength (short-time), ASTM D149 (IEC 600243)
Three-digit number $\times$ factor of 0.1 = kV/mm, min	B = dielectric strength (step by step), ASTM D149 (IEC 600243)
Three-digit number $\times$ factor of 0.1 = kV/mm, min	C = insulation resistance, ASTM D257 (IEC 600093)
Three-digit number $\times$ factor of $10^{14} = \Omega$, min	D = dielectric constant at 1 MHz, ASTM D150 , max (IEC 600250)
Three-digit number $\times$ factor of 0.1 = value	E = dissipation factor at 1 MHz, ASTM D150 , max (IEC 600250)
Three-digit number $\times$ factor of 0.0001 = value	F = arc resistance, ASTM D495 , min
Three-digit number = value	G = volume resistivity, ASTM D257 (IEC 600093)
Three-digit number $\times$ factor of $10^{14} = \Omega\text{-cm}$, min	H = comparative tracking index, ASTM D3638 , ac frequency, 50 Hz, 0.1 % ammonium chloride (IEC 600112)
Three-digit number = V, min	J = volume resistivity, ASTM D257 (IEC 600093), $\Omega\text{-cm}$ K = surface resistivity, ASTM D257 (IEC 600093), Ω (per square)
First digit indicates:	1 = minimum requirement 2 = maximum requirement
Final two digits indicate the exponential value of the base 10	Example: EJ206 specifies a maximum volume resistivity of $10^6\Omega\text{-cm}$
F	Flammability
Second Letter	A = Horizontal Burning Rate ASTM D635 , UL94 HB, IEC 60695-11-10, Method A
Report as:	(First three digits equal burn rate in mm/min), next three significant digits are thickness of sample tested in mm $\times$ factor of 0.1. If sample burns beyond the 100 mm mark, the samples are considered to have no rating.
B = Oxygen Index	ASTM D2863 , ISO 4589
Report as:	Value % O_2 to three significant figures
C = Flash Ignition	ASTM D1929 , Procedure A
Report as:	Value, $^{\circ}\text{C}$ min to three significant digits rounded to nearest whole number.
D = Self Ignition	ASTM D1929 , Procedure B
Report as:	Value, $^{\circ}\text{C}$ min to three significant digits rounded to nearest whole number.
E = Ignition by a Small Flame	ASTM D3713
	Letter retired, standard withdrawn without replacement in 2000.
F = Vertical Burn Rating	ASTM D3801 , UL94 V, IEC 60695-11-10, Method B
Report as:	(First digit = rating), next three significant digits are thickness of sample tested in mm $\times$ factor of 0.1.
Rating designations:	0 = V-0 1 = V-1 2 = V-2 if no rating, do not use "F"
000 = to be specified by user	
G = Radiant Panel Test	ASTM E162
Report as:	Flame Spread
First two digits indicate minimum specimen thickness	
00 to be specified	05 3.00 mm
01 0.25 mm	06 6.00 mm
02 0.40 mm	07 9.00 mm
03 0.80 mm	08 12.70 mm

TABLE *Continued*

Symbol	Characteristic
04 1.60 mm	09 >12.70 mm
Third digit indicates the flame spread	
1 15 max	5 100 max
2 25 max	6 150 max
3 50 max	7 200 max
4 75 max	8 >200
H = Flame Spread Index	ASTM E84
Report as:	Flame Spread Index
NOTE 1:	Smoke Developed Index may also be reported.
NOTE 2:	Classifications may be used as per the International Building Code
Class I:	Flame Spread 0–25
Class II:	Flame Spread 26–77
Class III:	Flame Spread 76–200
J = Automotive Horizontal Burn Rate	ASTM D5132 , FMVSS 302, ISO 3795
Report as:	(First three digits = burn rate in mm/min), next three significant digits are thickness of sample tested in mm × factor of 0.1.
K =	ASTM D2843
Letter retired, method no longer in broad commercial use, replaced by ASTM E662 .	
L =	UL (IEC 60695-11-10)
Letter retired, see Appendix X1 for replacement procedures and references to the old requirements.	
M = Vertical Burn Rating; Film	ASTM D4804 , UL94 VTM, ISO 9773
Report as:	(First digit = rating), next three significant digits are thickness of sample tested in mm × factor of 0.01.
Rating designations:	0 = VTM0 1 = VTM1 2 = VTM2 if no rating, do not use “M”
N = Horizontal Burn Rate; Foam	ASTM D4986 , UL94 , ISO 9772
Report as:	(First digit = rating), next three significant digits are thickness of sample tested in mm × factor of 0.1.
Rating designations:	0 = HBF 1 = HF-1 2 = HF-2 if no rating, do not use “N”
P = Glow Wire Flammability Index	IEC 60695-2-12
Report as:	(First three digits are glow wire flammability index reported in °C). Following three significant digits are thickness of sample tested in mm × factor of 0.1.
R = Heat Release Rate	ASTM E1354
Report as:	Peak Heat Release Rate
Rating Designations:	(First three digits are peak heat release rate in kW/m ²), next three digits are incident heat flux in kW times ten (×10).
S = NBS Smoke (Flame or Smolder Mode)	ASTM E662 , ISO 5659-2
Report as:	(First digit = 1 for Flame mode or 2 for Smolder mode), final three digits = Specific Optical Density.
T = Fire Rating	ASTM E119
Report as:	(Fire resistance rating in hours, first two digits). Third digit = “1” for hose stream applied, “0” for no hose stream applied. Fourth digit is application from table below:
Rating designations:	0: No application designated 1: Bearing Walls and Partitions 2: Nonbearing Walls and Partitions 3: Columns 4: Floors and Roofs 6: Loaded Restrained Beams 7: Protective Membranes in Wall, Partition, Floor, or Roof Assemblies
U = Large Flame Vertical Burn Rating; Plaque	ASTM D5048 , UL94 5VA, IEC 60695-11-20
Report as:	(First three digits = burn time plus afterglow time in seconds after fifth flame application), the fourth digit “1” or “0” for flaming drips (1 = yes, 0 = no), next three significant digits are thickness of sample tested in mm × factor of 0.1. Last digit: “1” or “0” for holes burned through plaques (1 = yes, 0 = no).
V = Large Flame Vertical Burn Rating; Bar	ASTM D5048 , UL94 5VA, IEC 60695-11-20
Report as:	(First three digits = burn time plus afterglow time in seconds after fifth flame application), fourth digit “1” or “0” for flaming drips, last three significant digits are thickness of sample tested in mm × factor of 0.1.
G Specific gravity	
Second letter	A = ASTM D792 (tolerance ± 0.02) (ISO 1183 Method A) B = ASTM D792 (tolerance ± 0.05) (ISO 1183 Method A) C = ASTM D792 (tolerance ± 0.005) (ISO 1183 Method A) D = ASTM D1505 (tolerance ± 0.02) E = ASTM D1505 (tolerance ± 0.05)

TABLE *Continued*

Symbol	Characteristic
	F = ASTM D1505 (tolerance ± 0.005) H = ASTM D792/D 1505D1505 (max) L = ASTM D792/D 1505D1505 (min) Three-digit number $\times$ factor of 0.010 = requirement value
H	Heat resistance, properties at temperature Second letter A = heat aged for 70 h at $100 \pm 2^\circ\text{C}$, ASTM D573 B = heat aged for 70 h at $150 \pm 2^\circ\text{C}$, ASTM D573 C = heat aged for 70 h at $200 \pm 2^\circ\text{C}$, ASTM D573 Three-digit number is obtained from Suffix Table 1. It indicates change in hardness, tensile strength, elongation and volume. Second letter D = tested at $100 \pm 2^\circ\text{C}$ E = tested at $125 \pm 2^\circ\text{C}$ F = tested at $150 \pm 2^\circ\text{C}$ Three-digit numbers obtained from Suffix Table 2. It indicates tensile strength, elongation, and tear strength. Example: HE565 specifies that the material has a minimum of 15 MPA tensile strength, 400 % elongation, and a tear strength of 40 kN/m when tested at 125°C. Second letter L = low-temperature brittleness, ASTM D2137 Three-digit number indicates the temperature ($^\circ\text{C}$) above which the material is non-brittle. Example: HL055 material is non-brittle according to ASTM D2137a, above -55°C.
I	Not to be used at this time
J	Hardness Second letter A = ASTM D2240 (Type A) tolerance ± 5 (ISO 868) B = ASTM D2583 (Barcol), min D = ASTM D2240 (Type D) tolerance ± 3 (ISO 868) E = ASTM D785 (Rockwell E), min K = ASTM D785 (Rockwell K), min L = ASTM D785 (Rockwell L), min (ISO 2039-2) M = ASTM D785 (Rockwell M), min (ISO 2039-2) R = ASTM D785 (Rockwell R), min (ISO 2039-2)
K	Three-digit number = value Tensile strength Second letter B = at break, ASTM D638 C = at rupture, ASTM D412 D = tensile stress at break, ISO 527-1 and ISO 527-2 E = tensile stress at 50 % strain, ISO 527-1 and ISO 527-2 Three-digit number = value, MPa, min Example: KC040 specifies a tensile strength at rupture of 40 MPa M = tensile stress, ASTM D412 First digit indicates the elongation at which the tensile stress is measured. 1 = 25 % 2 = 100 % 3 = 300 % Final two digits = value, MPa, min N = tensile modulus, ISO 527-1 and ISO 527-2 Three-digit number $\times$ factor of 100 = value, MPa, min S = tensile set, ASTM D412 First digit indicates the elongation at which the set is measured. 1 = 50 % 2 = 100 % 3 = at break 4 = 200 % Final two digits indicate the maximum percent set. Example: KS208 specifies a maximum tensile set of 8 % when tested at 100 % extension. Y = yield, ASTM D638 X = tensile stress at yield, ISO 527-1 and ISO 527-2
L	Three-digit number = value, MPa, min Elongation Second letter B = break, ASTM D638 C = break, ASTM D412 D = break, ISO 527 Three-digit number = value, %, min R = resilience, ASTM D2632 First digit: 1 = minimum 2 = maximum Final two digits indicate percent rebound Example: LR 150 specifies a minimum rebound of 50 % T = tear strength, ASTM D624 Die C Three-digit number = value, kN/m, min Y = yield, ASTM D638 X = yield, ISO 527
M	Three-digit number = value, %, min Moisture resistance or content Second letter A = ASTM D570 (24-h immersion) (ISO 62) B = ASTM D570 (2-h immersion)

TABLE *Continued*

Symbol	Characteristic
	C = ASTM D570 (long-term immersion) D = ASTM D570 (½-h boiling water immersion) E = ASTM D570 (48 h at 50°C immersion) F = ASTM D6869 (ISO 15512, Method B), moisture content Three-digit number × factor of 0.01 = value, percent max
N	Flexural strength Second letter A = ASTM D790 , specimen = 3.2 × 13 × 76 mm, speed = 1.3 mm/min B = ASTM D790 , specimen = 6.4 × 13 × 127 mm, speed = 2.7 mm/min C = ISO 178 , specimen = 80 × 10 × 4 mm, speed = 2 mm/min, 64-mm span Three-digit number = value, MPa, min
O	Not to be used at this time
P	Impact resistance Second letter A = ASTM D256 (Test Method A, Izod) 000 = no break Three-digit number = value, J/m, min B = ASTM D256 (Test Method B, Charpy) Three-digit number = value, J/m, min C = ASTM D256 (Test Method C) Three-digit number = value, J/m, min D = ASTM D256 (Test Method D) Three-digit number = value, J/m, min E = ASTM D256 (Test Method E) Three-digit number = value, J/m, min F = ASTM D5628 1 = Configuration FA 2 = Configuration FB 3 = Configuration FC 4 = Configuration FD 5 = Configuration FE Two-digit number × 10 = value, J, min G = ASTM D5420 1 = ASTM D5420 Configuration GA 2 = ASTM D5420 Configuration GB 3 = ASTM D5420 Configuration GC 4 = ASTM D5420 Configuration GD 5 = ASTM D5420 Configuration GE Two-digit number × 10 = value, J min H = ISO 6603-1 , specimen = 2-mm thickness Three-digit number = value, J J = low-temperature brittleness, ISO 974 Three-digit number = –°C, max K = ASTM D4812 Three-digit number × factor 10 = value, J/m, min 000 = no break L = Low temperature brittleness, ASTM D746 (Procedure A) Three-digit number = –°C, max M = ISO 180/1A (Izod), specimen = 80 × 10 × 4 mm N = ISO 179/1A (Charpy), specimen = 80 × 10 × 4 mm Three-digit number × factor 0.1 = value kJ/m ² , min S = ASTM D1822 , Type S, 3 mm thick T = ASTM D1822 , Type L, 3 mm thick Three-digit number = value, kJ/m ² , min U = ASTM D3763 , specimen = 3.2 mm thickness First digit = test velocity 0 = 2.2 m/s 1 = 3.4 m/s 2 = 6.6 m/s 9 = other Second Digit = Positive or Negative Value of ASTM D3763 Brittleness Temperature 0 = + and greater than 1 = + and less than 2 = - and less than Third Digit = Brittleness Temperature, °C 0 = 0 1 = 10 2 = 20 3 = 30 4 = 40 5 = 50 6 = 70 7 = 100 8 = 150 9 = unspecified V = ASTM D3763 , specimen = 3.2 mm thickness

TABLE *Continued*

Symbol	Characteristic
	First digit = test temperature, °C 0 = +23°C 1 = +10°C 2 = +0°C 3 = -10°C 4 = -15°C 5 = -20°C 6 = -30°C 7 = -40°C 8 = at ASTM D3763 Brittleness Temperature 9 = unspecified Second digit = type of energy absorbed 0 = average total energy absorbed 1 = average energy absorbed at maximum load Third digit = average energy absorbed, in J 0 = <5 1 = ≥5 and <10 2 = ≥10 and <20 3 = ≥20 and <30 4 = ≥30 and <40 5 = ≥40 and <50 6 = ≥50 and <70 7 = ≥70 and <100 8 = ≥100 and <150 9 = ≥150 When Suffix PV is to be reported, Suffix PU must also be reported in order that all test conditions are reported for the ASTM D3763 test.
Q	Compressive strength Second letter A = ASTM D695 B = ISO 604 Three-digit number = value, MPa, min D = compression deflection, ASTM D575, Test Method A First digit = % deflection 1 = 5 % 2 = 10 % 3 = 15 % 4 = 20 % 5 = 25 % 6 = 30 % 7 = 40 % 8 = 50 % Final two digits indicate minimum load in MPa Example: QD445 specifies a minimum load of 45 MPa when deflected 20 % S = compression set, ASTM D395, (Test Method B), run for 22 h. First digit = test temperature 1 = 23 ± 2°C 2 = 70 ± 2°C 3 = 100 ± 2°C 4 = 125 ± 2°C 5 = 150 ± 2°C
R	Final two digits indicate maximum percent set. Volatile loss, gas and vapor permeability Second letter A = ASTM D1203, Test Method A B = ASTM D1203, Test Method B C = ASTM D2288 D = ASTM D2584 Three-digit number × factor of 0.01 = value, percent, max E = ASTM D3985 F = ASTM D1434 (Test Method M) G = ASTM E96/E96M (Test Method E) H = ASTM F372 First digit 1 = oxygen 2 = nitrogen 3 = carbon dioxide 4 = water vapor 5 = hydrogen 6 = methane 7 = Fuel C 8 = helium 9 = hydrogen sulfide Second and third digit = value 00 = between user and producer 01 = 1.0 cm³·mil/m²·24 h·atm, max 02 = 10.0 cm³·mil/m²·24 h·atm, max

TABLE *Continued*

Symbol	Characteristic
	03 = 100.0 cm ³ ·mil/m ² ·24 h·atm, max 04 = 1.0 g·mil/m ² ·24 h, max 05 = 10.0 g·mil/m ² ·24 h, max 06 = 100.0 g·mil/m ² ·24 h, max (04 to 06 are water vapor units) These units are currently the industry standard. Conversions to other units may be made using appendixes in ASTM D1434 .
S	Oxidative stability, mold shrinkage, and shear modulus Oxidative stability tests Second letter A = ASTM D3012 at 150°C (ISO 4577) Three-digit number = value days to failure, min C = ASTM D3895 Three-digit number = value minutes to failure, min E = environmental stress crack resistance, ASTM D1693 Three-digit number = f_{20} h, min T = thermal stress crack resistance, ASTM D2951 Three-digit number = h (without cracking), min Mold shrinkage tests H = ASTM D955 Mold shrinkage First digit 1 = Compression molded bar 2 = Compression molded disk 3 = Transfer molded bar 4 = Transfer molded disk 5 = Injection molded bar 6 = Injection molded disk 7 = Injection molded plaque, 60 × 60 × 2 mm (ISO 294-4) Two-digit number × factor 0.001 = value, mm/mm ± 0.001 Shear modulus tests M = ASTM D5279 , +23°C, 1 Hz (ISO 6721-1 and ISO 6721-2) Three-digit number × factor 100 = value, MPa, min
T	Transmission-haze Second letter A = ASTM D1003 , specimen 6.4 mm thick B = ASTM D1003 , specimen 3.2 mm thick C = ASTM D1003 , specimen 1.6 mm thick First digit 1 = total luminous transmittance, min 2 = diffuse luminous transmittance, min 3 = haze, %, max Second and third digit = value
U	Flexural modulus, stiffness Second letter A = ASTM D790 , specimen = 3.2 by 13 by 76 mm, speed = 1.3 mm/min B = ASTM D790 , specimen = 6.4 by 13 by 127 mm, speed = 2.7 mm/min C = ASTM D790 (secant modulus), Test Method I, Procedure A, specimen = 3.2 by 13 mm (1 % strain) speed = 1.3 mm/min Three-digit number × factor 100 = value, MPa, min D = stiffness, ASTM D747 First digit 1 = -30°C Second and third digits × 1000 = value, MPa, max First digit 2 = 23°C 3 = 70°C Second and third digits × 1000 = value, MPa, min Second letter E = ASTM D790 , specimen-3.2 by 13 by 76 mm, speed = 1.3 mm/min F = ASTM D790 , specimen = 6.4 by 13 by 127 mm, speed = 2.7 mm/min G = ASTM D790 (secant modulus), Method I, Procedure A, specimen = 3.2 by 13 by 76 (1 % strain) speed = 1.3 mm/min M = ISO 178, chord modulus, specimen 80 × 10 × 4 mm, speed 2 mm/min, 64 mm span Three digit number × factor 100 = value, MPa, max N = ISO 178, chord modulus, specimen 80 × 10 × 4 mm, speed = 2 mm/min, 64-mm span Three digit number × factor 100 = value, MPa, min
V	Viscosity—flow rate Second Letter A = relative viscosity, ASTM D789 Three-digit number = value, min Second letter B = ASTM D1238 (ISO 1133) First digit 1 = Condition 125/0.325 2 = Condition 125/2.16 3 = Condition 150/2.16 4 = Condition 190/0.325 5 = Condition 190/2.16 6 = Condition 190/21.60 7 = Condition 200/5.0 8 = Condition 230/1.20 9 = Condition 230/3.80 0 = Condition 265/12.5 Second letter C = ASTM D1238 (ISO 1133) First digit 1 = Condition 275/0.325 2 = Condition 230/2.16 3 = Condition 190/1.05 4 = Condition 190/10.00

TABLE Continued

1000

TABLE *Continued*

Symbol	Characteristic
Z	J = ISO 75-1 and ISO 75-2 , stress 0.450 MPa, unannealed specimen, positioned flatwise
	Three-digit number = value, °C, min
	Other special requirement
	Second letter from existing list of symbols where test or requirement is not available.
	These characteristics will be spelled out in detail and identified in sequence that is, 01, 02, 03, etc.
	Example ZW01
	Type I, tensile bars (ASTM D638) when exposed 500 h to Type DH light source per ASTM G151 and G153 shall retain 50 % min of their original tensile strength.
	Additional suffixes and requirements will be added to this classification system as test methods or requirements are developed or requested, or both.

^AISO documents listed in parentheses are similar to the ASTM documents and the same suffix may be applied.

SUFFIX TABLE 1 Property Change Table

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Hardness change, Shore D points	unspecified	±2	±2	±5	±5	±10	±10	±20	±20	specify value
	Tensile change, ASTM D412 , % change, max	unspecified	±5	±10	±10	±20	±20	±40	±40	±60	specify value
2	Elongation change, ASTM D412 , % change, max	unspecified	±5	±10	±15	±20	±30	±40	±50	±70	specify value
3	Volume change, ASTM D471 , % change, max	unspecified	±2	±5	±10	±15	±25	±30	±40	±60	specify value

SUFFIX TABLE 2 Tensile, Elongation and Tear Properties

Designation Order Number	Property	0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D412 , MPa, min	unspecified	2	4	6	10	15	20	25	35	specify value
2	Ultimate elongation, ASTM D412 , %, min	unspecified	100	150	200	250	300	400	500	600	specify value
3	Tear strength, ASTM D624 , KN/m, min	unspecified	5	10	20	30	40	60	80	100	specify value

Cell Table C Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	35	45	50	55	65	70	75	85	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	1 500	2 000	2 200	2 300	2 400	2 600	2 900	3 000	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	80	90	100	110	120	130	140	150	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

Cell Table D Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	55	70	80	90	105	115	125	140	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	700	3 000	5 000	7 000	9 000	12 000	14 500	16 000	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	33	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	75	85	95	110	120	130	140	155	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

Cell Table E Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	10	20	30	40	50	60	70	80	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	50	1 000	1 500	2 000	2 500	3 000	3 500	4 000	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	40	50	60	70	85	95	105	115	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

Cell Table F Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	3	10	15	25	35	40	50	60	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	10	700	1 000	1 400	1 900	2 400	2 900	3 400	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	25	40	55	70	80	90	100	110	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

Cell Table G Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	15	40	65	85	110	135	160	185	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	600	3 500	6 500	10 000	13 000	16 000	19 000	22 000	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	130	160	200	230	260	300	330	360	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

Cell Table H Detail Requirements

Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D638 , MPa, min ^A	unspecified	15	55	95	135	175	215	255	290	specify value
2	Flexural modulus, ASTM D790 , MPa, min ^A	unspecified	200	4 500	9 000	13 000	17 000	20 000	25 000	30 000	specify value
3	Izod impact, ASTM D256 , J/m, min ^B	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D648 , (1820 kPa), °C, min	unspecified	35	100	160	230	290	350	420	480	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

^AMPa × 145 = psi

^BJ/m × 18.73 × 10⁻³ = ft-lbf/in.

17. Keywords

17.1 classification; classification system; line call-out;
plastic; plastic materials

APPENDIX

X1. CODING OF FORMER SECTION “FL” IN TABLE 3

X1.1 In previous editions of this standard, section FL used a three-digit code to designate performance. This code is as follows:

L =		UL (IEC 60695-11-10)
First digit indicates minimum specimen thickness.		
Molding Materials Thin Films		
mm		µm
0	to be specified	to be specified
1	0.25	25.0
2	0.40	50.0
3	0.80	75.0
4	1.60	100.0
5	2.50	125.0
6	3.00	150.0
7	6.00	175.0
8	12.70	200.0
9	>12.70	>200.0

Second digit indicates type of flame test

- 1 = Vertical (V) [Now Section FF]
- 2 = Horizontal (H) [Now Section FA]
- 3 = 125 mm flame (5V) [Now Section FU, FV]
- 4 = Vertical thin materials (VTM) [Now Section FM]

Third digit indicates the flame rating

- 0 = (94V/94VTM) 0 - refer to **UL94**
- 1 = (94V/94VTM) 1 - refer to **UL94**
- 2 = (94V/94VTM) 2 - refer to **UL94**
- 3 = (94HB) 1 - burn rate < 40 mm/min
- 4 = (94HB) 2 - burn rate < 75 mm/min
- 5 = (94-5V) A no holes on plaques
- 6 = (94-5V) B with holes on plaques
- 7 = (94 foam) 1 refer to **UL94**
- 8 = (94 foam) 2 refer to **UL94**
- 9 = (94 foam) H refer to **UL94**

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D4000 - 11) that may impact the use of this standard. (May 1, 2012)

- (1) Rearranged table layout so that Tables 1, 2, and 2a all appear in Section 5, which was extensively revised.
- (2) Placed Table 3 (suffixes) and cell tables between Sections 16 and 17.
- (3) Removed a number of references in 2.1 because they refer to shapes or chemical resistance rather than thermoplastic materials. The same references were also removed from Table 1. The standards referenced in Table 1 refer to material standards only.
- (4) Retained “withdrawn” material standards in Table 1 because decades pass before they are forgotten.
- (5) Listed two revision years of D4066 because they are not identical in call-out identifications.
- (6) Revised Section 5 to simplify the flow of material, arranging

things in order from the simpler to the more complex line call-outs.

- (7) Added a diagram showing the structure of the line call-out for an unfilled material in 5.1.1. An example of such a call-out is found in Note 5.

(8) Subsection 5.2 introduces the call-out systems in use for filled or reinforced plastics. Subsection 5.2.1 illustrates the structure of the call-outs used, and subsection 5.2.2 shows examples of line call-outs for three different, reinforced materials.

- (9) Introduced the use of suffixes in Section 7, and the example shown in 7.3 has been rewritten to clarify the intent.

(10) A number of minor editorial changes have been made.

Committee D20 has identified the location of selected changes to this standard since the last issue (D4000 - 09b) that may impact the use of this standard. (April 1, 2011)

- (1) Added examples to Note 4.

- (2) In 5.1.1, added statements concerning usage of D4000 and

altered examples to illustrate correct usage.

(3) In Sections 6.1, 6.3, and 7.4, added statements concerning correct usage of D4000.

(4) In Note 6, Note 9, Note 10, and in 7.3, corrected examples

to conform to statements in 5.1.1.

(5) Revised relative humidity tolerance requirements to conform with Condition A of the latest issue of Practice D618.

This section identifies the location of selected changes to this classification system. For the convenience of the user, Committee D20 has highlighted those changes that may impact the use of this classification system. This section may also include descriptions of the changes or reasons for the changes, or both.

D4000 – 09b:

(1) Replaced reference to Guide D5033 with Guide D7209.

(2) Revised Note 10 to reflect the replacement of Guide D5033.

D4000 – 09a:

(1) Added D3763 under Section 2.

(2) In Table 3, Suffix Symbols under Symbol P added second letter U = ASTM D3763 and definition of numbers.

(3) In Table 3, Suffix Symbols under Symbol P added second letter V = ASTM D3763 and definition of numbers.

D4000 – 09:

(1) Revised suffix MF in Table 3.

D4000 – 08:

(1) Added polyphenylene (PPH) to Table 1.

D4000 – 07:

(1) Revised parts A, F, J, N, P, U, and V of Table 3's Section F. Thickness was rounded to the nearest 0.1 mm, and will be reported to three significant digits in mm $\times 10$.

(2) Revised parts C and D of Table 3's Section F. The temperature was reported in whole numbers to three significant digits.

(3) Revised parts U and V of Table 3's Section F. The time of flaming and afterglow were reported in seconds.

(4) An appendix was added for historical reference to deleted codes in Table 3.

D4000 – 04:

(1) Changed symbol FB from value % max to value % min in Table 3.

D4000 – 03a:

(1) Revised paragraph 15.4.

(2) Added Note 10.

D4000 – 03:

(1) Added ISO 1133 as an alternative test method to Test Method D1238.

(2) Editorially added to Table 1: ASTM Test Method D6779 to PA, and Test Method D6778 to POM.

D4000 – 01a:

(1) Table 2 replaced with new data.

(2) Table 2A added.

(3) Revised 5.3 to address option of using Table 2A for shape or form.

(4) Added new Note 10 and renumbered subsequent notes.

(5) Deleted "GA140" from the example in 5.1.1.

(6) Changed reference from "Specification" to Classification" in Note 9.

(7) Editorially changed 2.1 and Table 1 to include new standards.

(8) Editorially corrected Note 7.

D4000 – 01:

(1) Second letters J and K added for Symbol E in Table 3.

(2) Second letter G added for Symbol W in Table 3.

(3) Referenced Documents were updated to reflect the revisions to Table 3.

D4000 – 00a:

(1) Referenced Documents were updated to reflect the revisions to Table 3.

(2) Table 3, Symbol B: ES 27 was removed; incorporated in Test Method D471.

(3) Table 3, Symbol C: Removed second letters A and E and added second letters K and L for Test Method D1525, 50-N load.

(4) Table 3, Symbol D: Removed.

(5) Table 3, Symbol E: Added expression of results for second letter H.

(6) Table 3, Symbol F: Substituted IEC reference for Second Letter A to replace withdrawn ISO standard. Deleted repetition of the second letter L which referenced a deleted ASTM standard, Test Method F814.

(7) Table 3, Symbol K: Changed second letter M from tensile modulus to tensile stress.

(8) Table 3, Symbol M: Added ISO reference for second letter F.

(9) Table 3, Symbol S: Deleted references to withdrawn standards, ASTM Test Method D2445 and ISO 537. Added ISO 6721-1 and -2 as references for second letter M. Deleted second letter P as it was a repeat of second letter M.

(10) Table 3, Symbol U: Added second letter N to permit expression of flexural modulus by ISO 178 as a minimum value.

(11) Table 3, Symbol W: Added new ASTM standards for evaluating weather resistance.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).