Designation: D 4000 – 03a

An American National Standard

Standard Classification System for Specifying Plastic Materials[1]

This standard is issued under the fixed designation D 4000; 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 may serve 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 callout (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 callout, it is advisable for the user to consult the supplier to secure callout 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D 150 Test Methods for A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials

D 256 Test Method for Determining the Izod Pendulum Impact Resistance of Notched Specimens of Plastics

D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials

D 395 Test Methods for Rubber Property—Compression Set

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension

D 471 Test Method for Rubber Property—Effect of Liquids

D 495 Test Method for High-Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation

D 569 Method for Measuring the Flow Properties of Thermoplastic Molding Materials

D 570 Test Method for Water Absorption of Plastics

D 573 Test Method for Rubber—Deterioration in an Air Oven

D 575 Test Methods for Rubber Properties in Compression

D 618 Practice for Conditioning Plastics for Testing

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

D 638 Test Method for Tensile Properties of Plastics

D 648 Test Method for Deflection Temperature of 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).

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

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

Under Flexural Load
D 695 Test Method for Compressive Properties of Rigid Plastics
D 706 Specification for Cellulose Acetate Molding and Extrusion Compounds
D 707 Specification for Cellulose Acetate Butyrate Molding and Extrusion Compounds
D 747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
D 785 Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
D 787 Specification for Ethyl Cellulose Molding and Extrusion Compounds
D 789 Test Methods for Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)
D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D 792 Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement
D 883 Terminology Relating to Plastics
D 955 Test Method for Measuring Shrinkage from Mold Dimensions of Molded Plastics
D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics
D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber
D 1203 Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials
D 1434 Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
D 1435 Practice for Outdoor Weathering of Plastics
D 1499 Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1525 Test Method for Vicat Softening Temperature of Plastics
D 1562 Specification for Cellulose Propionate Molding and Extrusion Compounds
D 1600 Terminology for Abbreviated Terms Relating to Plastics
D 1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
D 1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method
D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D 1822 Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials
D 1898 Practice for Sampling of Plastics
D 1929 Test Method for Ignition Properties of Plastics
D 2116 Specification for FEP-Fluorocarbon Molding and Extrusion Materials
D 2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
D 2240 Test Method for Rubber Property—Durometer Hardness
D 2287 Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
D 2288 Test Method for Weight Loss of Plasticizers on Heating
D 2565 Practice for Operating Xenon Arc-Type Light-Exposure Apparatus With and Without Water for Exposure of Plastics
D 2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
D 2584 Test Method for Ignition Loss of Cured Reinforced Resins
D 2632 Test Method for Rubber Property—Resilience by Vertical Rebound
D 2843 Test Method for Density of Smoke from the Burning or Decomposition of Plastics
D 2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
D 2951 Test Method for Resistance of Types III and IV Polyethylene Plastics to Thermal Stress-Cracking
D 3012 Test Method for Thermal Oxidative Stability of Propylene Plastics, Using a Biaxial Rotator
D 3029 Test Methods for Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Tup (Falling Weight)
D 3294 Specification for PTFE Resin Molded Sheet and Molded Basic Shapes
D 3295 Specification for PTFE Tubing
D 3296 Specification for FEP-Fluorocarbon Tube
D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
D 3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis
D 3595 Specification for Polychlorotrifluoroethylene (PCTFE) Extruded Plastic Sheet and Film
D 3638 Test Method for Comparative Tracking Index of Electrical Insulating Materials
D 3801 Test Method for Measuring the Comparative Extinguishing Characteristics of Solid Plastics in a Vertical Position
D 3892 Practice for Packaging/Packing of Plastics
D 3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
D 3915 Specification for Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications
D 3935 Specification for Polycarbonate (PC) Unfilled and Reinforced Material
D 3965 Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Compounds for Pipe and Fittings
D 3985 Test Method for Oxygen Gas Transmission Rate Through Plastic Film and Sheeting Using a Coulometric Sensor

D 4020 Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
D 4066 Classification System for Nylon Injection and Extrusion Materials
D 4067 Specification for Reinforced and Filled Polyphenylene Sulfide Injection Molding and Extrusion Materials
D 4101 Specification for Propylene Plastic Injection and Extrusion Materials
D 4181 Specification for Acetal (POM) Molding and Extrusion Materials
D 4203 Specification for Styrene-Acrylonitrile (SAN) Injection and Extrusion Materials
D 4216 Specification for Rigid Poly(Vinyl Chloride (PVC) and Related Plastic Building Products Compounds
D 4329 Practice for Operating Light and Water Apparatus (Fluorescent UV Condensation Type) for Exposure of Plastics
D 4349 Specification for Polyphenylene Ether (PPE) Materials
D 4364 Practice for Performing Accelerated Outdoor Weathering of Plastics Using Concentrated Natural Sunlight
D 4396 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related Plastic Compounds for Nonpressure Piping Products
D 4441 Specification for Aqueous Dispersions of Polytetrafluorethylene
D 4474 Specification for Styrenic Thermoplastic Elastomer Injection Molding and Extrusion Materials (TES)
D 4549 Specification for Polystyrene Molding and Extrusion Materials (PS)
D 4550 Specification for Thermoplastic Elastomer-Ether-Ester (TEEE)
D 4617 Specification for Phenolic Compounds (PF)
D 4634 Specification for Styrene-Maleic Anhydride Materials (S/MA)
D 4673 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Molding and Extrusion Materials
D 4745 Specification for Filled Compounds of Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials
D 4812 Test Method for Unnotched Cantilever Beam Impact Strength of Plastics
D 4894 Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials
D 4895 Specification for Polytetrafluoroethylene (PTFE) Resins Produced from Dispersion
D 4976 Specification for Polyethylene Plastics Molding and Extrusion Materials
D 5021 Specification for Thermoplastic Elastomer–Chlorinated Ethylene Alloy (TECEA)
D 5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics
D 5046 Specification for Fully Crosslinked Elastomeric Alloys (FCEAs)
D 5138 Specification for Liquid Crystal Polymers (LCP)
D 5203 Specification for Polyethylene Plastics Molding and Extrusion Materials from Recycled Post-Consumer HDPE Sources
D 5279 Test Method for Measuring the Dynamic Mechanical Properties of Plastics in Torsion
D 5420 Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
D 5436 Specification for Cast Poly(Methyl Methacrylate) Plastic Rods, Tubes, and Shapes
D 5628 Test Method for Impact Resistance of Flat, Rigid Plastic Specimens by Means of a Falling Dart (Tup or Falling Weight)
D 5630 Test Method for Ash Content in Plastics
D 5675 Classification for Fluoropolymer Micropowders
D 5676 Specification for Recycled Polystyrene Molding and Extrusion Materials
D 5927 Specification for Thermoplastic Polyester TPES Injection and Extrusion Materials Based on ISO Test Methods
D 5990 Classification System for Polyketone Injection and Extrusion Materials (PK)
D 6338 Classification System for Highly Crosslinked Thermoplastic Vulcanizates (HCTPVS)
D 6339 Specification for Syndiotactic Polystyrene Molding and Extrusion (SPS)
D 6358 Classification System for Poly(Phenylene Sulfide) Injection Molding and Extrusion Materials Using ISO Methods
D 6360 Practice for Enclosed Carbon-Arc Exposures of Plastics
D 6457 Specification for Extruded and Compression Molded Rod and Heavy-Walled Tubing Made from Polytetrafluoroethylene (PTFE)
D 6585 Specification for Unsintered Polytetrafluoroethylene (PTFE) Extruded Film or Tape
E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E 84 Test Method for Surface Burning Characteristics of Building Materials
E 96 Test Methods for Water Vapor Transmission of Materials
E 104 Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions
E 162 Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
F 372 Test Method for Water Vapor Transmission of Flexible Barrier Materials Using an Infrared Detection Technique

2.2 *Federal Standard:*[3]

Department of Transportation Federal Motor Vehicle Safety Standard No. 302

2.3 *Underwriters Laboratories:*[4]

UL94 Standards for Tests for Flammability for Parts in Devices and Appliances

[3] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
[4] Available from Underwriters Laboratories, Inc., Publication Stock, 333 Pfingsten Rd., Northbrook, IL 60062.

2.4 *IEC and ISO Standards:*[5]

IEC 93 Recommended Methods of Tests for Volume and Surface Resistivities of Electrical Insulation Materials

IEC 112 Recommended Method for Determining the Comparative Tracking Index of Solid Insulation Materials Under Moist Conditions

IEC 243 Recommended Methods of Test for Electrical Strength of Solid Insulating Materials at Power Frequencies

IEC 250 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 60695-11-10: Fire Hazard Testing—Part 11-10: Test Flames—50 W Horizontal and Vertical Flame Tests

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

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 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 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

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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	D 3965 D 4673		
AMMA	acrylonitrile-methyl methacrylate		E	
ARP	aromatic polyester	(see LCP)		
ASA	acrylonitrile-styrene-acrylate		E	
CA	cellulose acetate	D 706		
CAB	cellulose acetate butyrate	D 707		
CAP	cellulose acetate proprionate		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	D 1562		
CPE	chlorinated polyethylene		F	
CPVC	chlorinated poly(vinyl chloride)	D 4396, D 1784, D 5260, D 3915, D 4216		
CS	casein		H	H
CTA	cellulose triacetate		E	D
EC	ethyl cellulose	D 787	E	D
E-CTFE	ethylene-chlorotrifluoroethylene copolymer	D 3275		
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	D 3159		
EVA	ethylene-vinyl acetate		F	
FCEA	fully crosslinked elastomeric alloy	D 5046		
FEP	perfluoro (ethylene-propylene) copolymer	D 2116		
FF	furan formaldehyde	D 3296	H	H
HCTPV	highly crosslinked thermoplastic vulanizates	D 6338		
IPS	impact polystyrene	(see PS)		
LCP	liquid crystal polymer	D 5138		
MF	melamine-formaldehyde		H	H
PA	polyamide (nylon)	D 4066, D 6779		
PAEK	polyacryletherketone	D __		
PAI	polyamide-imide	D 5204	G	G
PARA	polyacryl amide			
PB	polybutene-1		F	
PBT	poly(butylene terephthalate)	(see TPES)		
PC	polycarbonate	D 3935		
PCTFE	polymonochlorotrifluoroethylene	D 1430, D 3595		
PDAP	poly(diallyl phthalate)		H	H
PE	polyethylene	D 1248, D 4976, D 3350, D 4020, D 5203		
PEBA	polyether block amide			
PEEK	polyetheretherketone			
PEI	polyether-imide	D 5205		
PEO	poly(ethylene oxide)	D __		
PESV	polyether sulfone			
PET	poly(ethylene terephthalate), general	(see TPES)		
PETG	glycol modified polyethylene terephthalate comonomer	(see TPES)		
PF	phenol-formaldehyde	D 4617		
PFA	perfluoro alkoxy alkane	D 3307		
PI	polyimide		G	G
PIB	polyisobutylene		F	
PK	polyketone	D 5990		
PMMA	Poly(methyl methacrylate)	D 788, D 5436		D
PMP	poly(4-methylpentene-1)		F	
POM	polyoxymethylene (acetal)	D 4181, D 6778		
POP	polyphenylene oxide	(see PPE)		
PP	poly(propylene plastics)	D 4101		
PPA	polyphthalamide	D 5336		
PPE	polyphenylene ether	D 4349		
PPOX	poly(propylene oxide)			
PPS	poly(phenylene sulfide)	D 4067, D 6358		
PPSU	poly(phenyl sulfone)		G	G
PS	polystyrene	D 4549, D 5676		
PSU	polysulfone	D 6394		

TABLE 1 *Continued*

Standard Symbol	Plastic Family Name	ASTM[A] Standard	Suggested Reference Cell Tables for Materials Without an ASTM Standard[B]	
			Unfilled	Filled
PTFE	polytetrafluoroethylene	D 1430, D 3159, D 3222, D 3294, D 3295, D 3307, D 4441, D 4745, D 4894, D 4895, D 5575, D 6314, D 6457, D 6585		
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)	D 2287	F	D
PVDC	poly(vinyl idene chloride)		F	D
PVDF	poly(vinyl idene fluoride)	D 3222		
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	D 4203		
SB	styrene-butadiene		E	D
SI	silicone plastics		G	G
S/MA	styrene-maleic anhydride	D 4634		
SMS	styrene-methylstyrene		E	D
SPS	syndiotactic polystyrene	D 6339		
TECEA	thermoplastic elastomer-chlorinated ethylene alloy	D 5021		
TEEE	thermoplastic elastomer, ether-ester	D 4550		
TEO	thermoplastic elastomer-olefinic	D 5593		
TES	thermoplastic elastomer-stryenic	D 4474		
TPE	thermoplastic elastomer	(see individual material)		
TPES	thermoplastic polyester (general)	D 4507		
TPU	thermoplastic polyurethane	D 5476		
UF	urea-formaldehyde		H	H
UP	unsaturated polyester	D __		
VDF	vinylidene fluoride	D 5575		

[A]The standards listed are those in accordance with this classification. D __ indicates that a standard is being developed by the subcommittee responsible.

[B]Cell Tables A and B have been reserved for the referenced standards and will apply to unfilled and filled materials covered in those standards.

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

[A]Ash content of filled or reinforced materials, or both may be determined using either Test Method D 5630 or ISO 3451–1 where applicable.

[B]Additional symbols may be added to this table as required.

3. Terminology

3.1 *Definitions*—The definitions used in this classification system are in accordance with Terminology D 883.

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.

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

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

5. Classification

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 D 1600.

NOTE 4—For example: PA = polyamide (nylon).

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

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 002 = color on drawing
B	Fluid resistance Second letter A = reference fuel A, ASTM D 471, aged 70 h at 23 ± 2°C B = reference fuel C, ASTM D 471, aged 70 h at 23 ± 2°C C = ASTM #1 oil, ASTM D 471, aged 70 h at 100 ± 2 °C D = IRM 902 oil, ASTM D 471, aged 96 h at 100 ± 2°C E = IRM 903 oil, ASTM D 471, aged 70 h at 100 ± 2°C F = Distilled water, ASTM D 471, aged 70 h at 100 ± 2°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 D 1525, load 10 N, Rate A (Vicat) C = ASTM D 1525, load 10 N, Rate B (Vicat) D = ASTM D 3418 (Transition temperature DSC/DTA) (ISO 11357-1 and 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 D 1525, load 50 N, Rate A (Vicat) L = ASTM D 1525, load 50 N, Rate B (Vicat) Three-digit number = minimum value °C
E	Electrical Second letter A = dielectric strength (short-time), ASTM D 149 (IEC 243) Three-digit number × factor of 0.1 = kV/mm, min B = dielectric strength (step by step), ASTM D 149 (IEC 243) Three-digit number × factor of 0.1 = kV/mm, min C = insulation resistance, ASTM D 257 (IEC 93) Three-digit number × factor of 10^{14} = Ω, min D = dielectric constant at 1 MHz, ASTM D 150, max (IEC 250) Three-digit number × factor of 0.1 = value E = dissipation factor at 1 MHz, ASTM D 150, max (IEC 250) Three-digit number × factor of 0.0001 = value F = arc resistance, ASTM D 495, min Three-digit number = value G = volume resistivity, ASTM D 257 (IEC 93) Three-digit number × factor of 10^{14} = Ω-cm, min H = comparative tracking index, ASTM D 3638, ac frequency, 50 Hz, 0.1 % ammonium chloride (IEC 112) Three-digit number = V, min J = volume resistivity, ASTM D 257 (IEC 93), Ω-cm K = surface resistivity, ASTM D 257 (IEC 93), Ω (per square) First digit indicates: 1 = minimum requirement 2 = maximum requirement Final two digits indicate the exponential value of the base 10

TABLE 3 *Continued*

Symbol	Characteristic
	Example: EJ206 specifies a maximum volume resistivity of $10^6\Omega$-cm
F	Flammability
	Second letter A = ASTM D 635 (burning rate) (IEC 60695-11-10)
	000 = to be specified by user
	B = ASTM D 2863 (oxygen index) (ISO 4589)
	Three-digit number = value %, max
	C = ASTM D 1929, Procedure A (flash-ignition)
	Three-digit number = value, °C, min
	D = ASTM D 1929, Procedure B (self-ignition)
	Three-digit number = value, °C, min
	E = ASTM D 3713
	000 = to be specified by user
	F = ASTM D 3801
	000 = to be specified by user
	G = ASTM E 162
	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
	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 = E84
	000 = to be specified by user
	J = FMVSS 302 (ISO 3795)
	000 = to be specified by user
	K = density of smoke, ASTM D 2843
	000 = to be specified by user
	L = UL (IEC 60695-11-10)
	First digit indicates minimum specimen thickness
	Molding Materials (mm) / Thin Films (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)
	2 = Horizontal (H)
	3 = 125mm flame (5V)
	4 = Vertical thin materials (VTM)
	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
G	Specific gravity
	Second letter A = ASTM D 792 (tolerance ± 0.02) (ISO 1183 Method A)
	B = ASTM D 792 (tolerance ± 0.05) (ISO 1183 Method A)
	C = ASTM D 792 (tolerance ± 0.005) (ISO 1183 Method A)
	D = ASTM D 1505 (tolerance ± 0.02)
	E = ASTM D 1505 (tolerance ± 0.05)
	F = ASTM D 1505 (tolerance ± 0.005)
	H = ASTM D 792/D 1505 (max)
	L = ASTM D 792/D 1505 (min)
	Three-digit number × factor of 0.010 = requirement value
H	Heat resistance, properties at temperature
	Second letter A = heat aged for 70 h at 100 ± 2°C, ASTM D 573

TABLE 3 *Continued*

Symbol	Characteristic
	B = heat aged for 70 h at 150 ± 2°C, ASTM D 573
	C = heat aged for 70 h at 200 ± 2°C, ASTM D 573
	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 ± 2°C
	E = tested at 125 ± 2°C
	F = tested at 150 ± 2°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 D 2137
	Three-digit number indicates the temperature (°C) above which the material is non-brittle. Example: HL055 material is non-brittle according to ASTM D 2137a, above − 55°C.
I	Not to be used at this time
J	Hardness
	Second letter A = ASTM D 2240 (Type A) tolerance ±5 (ISO 868)
	B = ASTM D 2583 (Barcol), min
	D = ASTM D 2240 (Type D) tolerance ±3 (ISO 868)
	E = ASTM D 785 (Rockwell E), min
	K = ASTM D 785 (Rockwell K), min
	L = ASTM D 785 (Rockwell L), min (ISO 2039-2)
	M = ASTM D 785 (Rockwell M), min (ISO 2039-2)
	R = ASTM D 785 (Rockwell R), min (ISO 2039-2)
	Three-digit number = value
K	Tensile strength
	Second letter B = at break, ASTM D 638
	C = at rupture, ASTM D 412
	D = tensile stress at break, ISO 527-1 and 527-2
	E = tensile stress at 50 % strain, ISO 527-1 and 527-2
	Three-digit number = value, MPa, min
	Example: KC040 specifies a tensile strength at rupture of 40 MPa
	M = tensile stress, ASTM D 412
	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 527-2
	Three-digit number × factor of 100 = value, MPa, min
	S = tensile set, ASTM D 412
	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 D 638
	X = tensile stress at yield, ISO 527-1 and 527-2
	Three-digit number = value, MPa, min
L	Elongation
	Second letter B = break, ASTM D 638
	C = break, ASTM D 412
	D = break, ISO 527
	Three-digit number = value, %, min
	R = resilience, ASTM D 2632
	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 D 624 Die C
	Three-digit number = value, kN/m, min
	Y = yield, ASTM D 638
	X = yield, ISO 527
	Three-digit number = value, %, min
M	Moisture resistance or content
	Second letter A = ASTM D 570 (24-h immersion) (ISO 62)
	B = ASTM D 570 (2-h immersion)
	C = ASTM D 570 (long-term immersion)
	D = ASTM D 570 (½-h boiling water immersion)
	E = ASTM D 570 (48 h at 50°C immersion)
	F = ASTM D 789 (ISO 15512, Method B), moisture content
	Three-digit number × factor of 0.01 = value, percent max
N	Flexural strength

TABLE 3 *Continued*

Symbol	Characteristic
	Second letter A = ASTM D 790, specimen = 3.2 × 13 × 76 mm, speed = 1.3 mm/min
	B = ASTM D 790, 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 D 256 (Test Method A, Izod)
	000 = no break
	Three-digit number = value, J/m, min
	B = ASTM D 256 (Test Method B, Charpy)
	Three-digit number = value, J/m, min
	C = ASTM D 256 (Test Method C)
	Three-digit number = value, J/m, min
	D = ASTM D 256 (Test Method D)
	Three-digit number = value, J/m, min
	E = ASTM D 256 (Test Method E)
	Three-digit number = value, J/m, min
	F = ASTM D 5628
	1 = Configuration FA
	2 = Configuration FB
	3 = Configuration FC
	4 = Configuration FD
	5 = Configuration FE
	Two-digit number × 10 = value, J, min
	G = ASTM D 5420
	1 = ASTM D 5420 Configuration GA
	2 = ASTM D 5420 Configuration GB
	3 = ASTM D 5420 Configuration GC
	4 = ASTM D 5420 Configuration GD
	5 = ASTM D 5420 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 D 4812
	Three-digit number × factor 10 = value, J/m, min
	000 = no break
	L = Low temperature brittleness, ASTM D 746 (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 D 1822, Type S, 3 mm thick
	T = ASTM D 1822, Type L, 3 mm thick
	Three-digit number = value, kJ/m^2, min
Q	Compressive strength
	Second letter A = ASTM D 695
	B = ISO 604
	Three-digit number = value, MPa, min
	D = compression deflection, ASTM D 575, 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 D 395, (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
	Final two digits indicate maximum percent set.
R	Volatile loss, gas and vapor permeability
	Second letter A = ASTM D 1203, Test Method A
	B = ASTM D 1203, Test Method B
	C = ASTM D 2288

TABLE 3 *Continued*

Symbol	Characteristic
	D = ASTM D 2584
	Three-digit number × factor of 0.01 = value, percent, max
	E = ASTM D 3985
	F = ASTM D 1434 (Test Method M)
	G = ASTM E 96 (Test Method E)
	H = ASTM F 372
	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 cm^3·mil/m^2·24 h·atm, max
	02 = 10.0 cm^3·mil/m^2·24 h·atm, max
	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 D 1434.
S	Oxidative stability, mold shrinkage, and shear modulus
	Oxidative stability tests
	Second letter A = ASTM D 3012 at 150°C (ISO 4577)
	Three-digit number = value days to failure, min
	C = ASTM D 3895
	Three-digit number = value minutes to failure, min
	E = environmental stress crack resistance, ASTM D 1693
	Three-digit number = f_{20} h, min
	T = thermal stress crack resistance, ASTM D 2951
	Three-digit number = h (without cracking), min
	Mold shrinkage tests
	H = ASTM D 955 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 D 5279, +23°C, 1 Hz (ISO 6721-1 and 6722-2)
	Three-digit number × factor 100 = value, MPa, min
T	Transmission-haze
	Second letter A = ASTM D 1003, specimen 6.4 mm thick
	B = ASTM D 1003, specimen 3.2 mm thick
	C = ASTM D 1003, 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 D 790, specimen = 3.2 by 13 by 76 mm, speed = 1.3 mm/min
	B = ASTM D 790, specimen = 6.4 by 13 by 127 mm, speed = 2.7 mm/min
	C = ASTM D 790 (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 D 747
	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 D 790, specimen-3.2 by 13 by 76 mm, speed − 1.3 mm/min
	F = ASTM D 790, specimen = 6.4 by 13 by 127 mm, speed = 2.7 mm/min
	G = ASTM D 790 (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

TABLE 3 *Continued*

Symbol	Characteristic
	Three digit number × factor 100 = value, MPa, min
V	Viscosity—flow rate
	Second Letter A = relative viscosity, ASTM D 789
	Three-digit number = value, min
	Second letter B = ASTM D 1238 (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 D 1238 (ISO 1133)
	First digit 1 = Condition 275/0.325
	2 = Condition 230/2.16
	3 = Condition 190/1.05
	4 = Condition 190/10.00
	5 = Condition 300/1.20
	6 = Condition 190/5.0
	7 = Condition 235/1.05
	8 = Condition 235/2.16
	9 = Condition 235/5.0
	0 = Condition 250/2.16
	Second letter D = ASTM D 1238 (ISO 1133)
	First digit 1 = Condition 310/12.5
	2 = Condition 210/2.16
	3 = Condition 285/2.16
	4 = Condition 315/5.0
	For second letters B, C, and D
	Second and third digit = value
	01 = 0.1 max
	02 = >0.1 to 0.3
	03 = >1 to 4
	04 = >0.3 to 0.5
	05 = >4 to 6
	06 = >0.5 to 0.7
	07 = >6 to 8
	08 = >0.7 to 0.9
	09 = >8 to 10
	10 = >0.9 to 1.1
	15 = >10 to 20
	25 = >20 to 30
	35 = >30 to 40
	45 = >40 to 50
	55 = >50 to 60
	65 = >60 to 70
	75 = >70 to 80
	85 = >80 to 90
	95 = >90 to 100
	99 = >100
	Second Letter E = flow temperature, ASTM D 569
	Three-digit number = minimum value °C
W	Weather resistance
	Second letter A = ASTM D 1435 (ISO 4607)
	First digit 1 = tensile strength change
	2 = flexural strength change
	3 = flexural modulus change
	4 = weight change
	5 = elongation change
	6 = dimensional change
	Second and third digit = value, percent, max
	B = (enclosed carbon-arc type), ASTM D 6360
	000 = to be specified by user
	C = Ozone resistance, ASTM D 1149 (100-ppm ozone)
	Three-digit number × factor of 10 = h for first crack, min
	D = (fluorescent-UV-condensation type) ASTM D 4329 (ISO 4892-3)
	E = (xenon-arc type) ASTM D 2565 (ISO 4892-2)
	F = (fresnel concentrator type) ASTM D 4364 (ISO 877)
	G = (open-flame carbon-arc) ASTM D 1499 (ISO 4892–4)
	000 = to be specified by user
X	Humidity aging and accelerated service

TABLE 3 *Continued*

Symbol	Characteristic
	Second letter A = ASTM E 104, Test Method A B = ASTM E 104, Test Method B C = ASTM E 104, Test Method C
	First digit 1 = tensile strength change 2 = flexural strength change 3 = flexural modulus change 4 = weight change 5 = elongation change 6 = dimensional change
	Second and third digit = value, %, max
Y	Deflection temperature
	Second letter A = ASTM D 648, stress 1.82 MPa, unannealed specimen, width, 3.2 mm B = ASTM D 648, stress 1.82 MPa, unannealed specimen, width, 6.4 mm C = ASTM D 648, stress 1.82 MPa, unannealed specimen, width, 13 mm D = ASTM D 648, stress 0.455 MPa, unannealed specimen, width, 3.2 mm E = ASTM D 648, stress 0.455 MPa, unannealed specimen, width, 6.4 mm F = ASTM D 648, stress 0.455 MPa, unannealed specimen, width, 13 mm G = ISO 75-1 and 75-2, stress 1.80 MPa, unannealed specimen, positioned edgewise H = ISO 75-1 and 75-2, stress 0.450 MPa, unannealed specimen, positioned edgewise I = ISO 75-1 and 75-2, stress 1.80 MPa, unannealed specimen, positioned flatwise J = ISO 75-1 and 75-2, stress 0.450 MPa, unannealed specimen, positioned flatwise
	Three-digit number = value, °C, min
Z	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 D 638) when exposed 500 h to Type DH light source per ASTM G 151 and G 153 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.

[A] ISO 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 D 412, % change, max	unspecified	±5	±10	±10	±20	±20	±40	±40	±60	specify value
2	Elongation change, ASTM D 412, % change, max	unspecified	±5	±10	±15	±20	±30	±40	±50	±70	specify value
3	Volume change, ASTM D 471, % 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 D 412, MPa, min	unspecified	2	4	6	10	15	20	25	35	specify value
2	Ultimate elongation, ASTM D 412, %, min	unspecified	100	150	200	250	300	400	500	600	specify value
3	Tear strength, ASTM D 624, 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 D 683, MPa, min[A]	unspecified	35	45	50	55	65	70	75	85	specify value
2	Flexural modulus, ASTM D 790, 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 D 256, J/m, min[B]	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	80	90	100	110	120	130	140	150	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

[A]MPa × 145 = psi
[B]J/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 D 638, MPa, min[A]	unspecified	55	70	80	90	105	115	125	140	specify value
2	Flexural modulus, ASTM D 790, 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 D 256, J/m, min[B]	unspecified	15	33	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	75	85	95	110	120	130	140	155	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

[A]MPa × 145 = psi
[B]J/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 D 638, MPa, min[A]	unspecified	10	20	30	40	50	60	70	80	specify value
2	Flexural modulus, ASTM D 790, 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 D 256, J/m, min[B]	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	40	50	60	70	85	95	105	115	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

[A]MPa × 145 = psi
[B]J/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 D 638, MPa, min[A]	unspecified	3	10	15	25	35	40	50	60	specify value
2	Flexural modulus, ASTM D 790, MPa, min[A]	unspecified	10	700	1 000	1 400	1 900	2 400	2 900	3 400	specify value
3	Izod impact, ASTM D 256, J/m, min[B]	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	25	40	55	70	80	90	100	110	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

[A]MPa × 145 = psi
[B]J/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 D 638, MPa, min[A]	unspecified	15	40	65	85	110	135	160	185	specify value
2	Flexural modulus, ASTM D 790, 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 D 256, J/m, min[B]	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	130	160	200	230	260	300	330	360	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

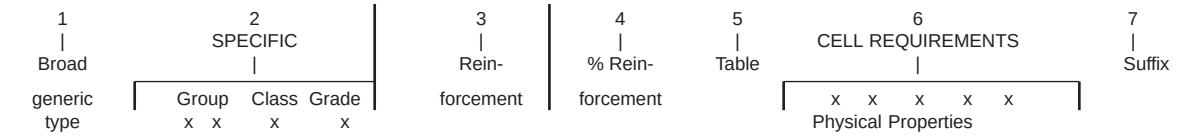
[A]MPa × 145 = psi
[B]J/m × 18.73 × 10^{-3} = ft·lbf/in.

Cell Table H Detail Requirements

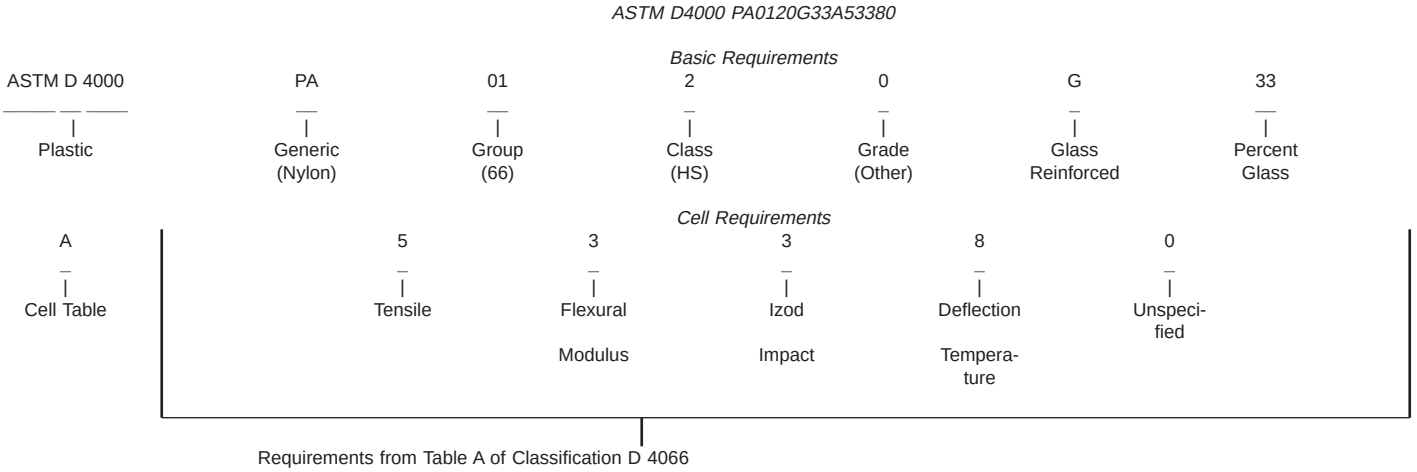
Designation Order Number	Property	Cell Limits									
		0	1	2	3	4	5	6	7	8	9
1	Tensile strength, ASTM D 638, MPa, min[A]	unspecified	15	55	95	135	175	215	255	290	specify value
2	Flexural modulus, ASTM D 790, MPa, min[A]	unspecified	200	4 500	9 000	13 000	17 000	20 000	25 000	30 000	specify value
3	Izod impact, ASTM D 256, J/m, min[B]	unspecified	15	30	50	135	270	425	670	950	specify value
4	Deflection temperature, ASTM D 648, (1820 kPa), °C, min	unspecified	35	100	160	230	290	350	420	480	specify value
5	To be determined	unspecified	...	...	...	...	...	...	...	...	...

[A]MPa × 145 = psi
[B]J/m × 18.73 × 10^{-3} = ft·lbf/in.

ASTM D 4000 Line Call-Out



1 = Two or more letters identify the generic family based on Terminology D 1600.
2 = Four digits identify the specific chemical group, the modification or use class, and the grade by viscosity or level of modification. A basic property table will provide property values.
3 = One letter indicates reinforcement type.
4 = Two digits indicate percent of reinforcement.
5 = One letter refers to a cell table listing of physical specifications and test methods.
6 = Five digits refer to the specific physical parameters listed in the cell table.
7 = Suffix codes indicate special requirements based on the application, and identify special tests (see Section 7).



5.2 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.

NOTE 5—The previous edition of this standard used three digits for group, class, and grade; 0120 is equivalent to 120.

NOTE 6—An example using the group, class, and grade is as follows: PA0122 would indicate: PA = polyamide (nylon), 01 (group) = 66 nylon, 2 (class) = heat stabilized, and 2 (grade) with requirements given in the (PA) basic property table of Classification D 4066.

5.2.1 The basic property tables have been developed to identify the commercially available unreinforced plastics into groups, classes, and grades. These tables are found in the standards listed in Table 1.

5.2.1.1 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 5.4.2).

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

5.3 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).

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

5.4 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 document. These tables should be used in the same manner as the cell tables that appear in the material specifications.

5.4.1 Although the values listed in cell tables include the range of properties available in existing materials, users should not infer that every possible combination of properties exists or can be obtained.

5.4.2 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.

NOTE 9—An example of a reinforced plastic identified by this classification system is as follows. The designation PA0120G33A53380 indicates the following with the material requirements from Classification D 4066:

PA0120	=	Nylon 66 heat stabilized from Table PA of Classification D 4066,
G33	=	Glass reinforced with 33 % glass, nominal, no requirement for shape or form,
A	=	Table A (D 4066) 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 10—An example of a reinforced plastic where the shape or form of the reinforcement is included is as follows. The designation PA 0120GE33A11110 indicates the following with the material requirements from Classification D 4066:

PA0120	=	Nylon 66 heat stabilized from Table PA of Classification D 4066,
GE33	=	Glass reinforced with 33 % glass, nominal, as beads (or spheres or balls),
A	=	Table A (D 4066) for property requirements,
1	=	Tensile strength, 35 MPa, min,
1	=	Flexural modulus, 1500 MPa, min,
1	=	Izod impact, 2.5 kJ/m^2, min,
1	=	Deflection temperature, 50°C, min, and
0	=	Unspecified.

6. Basic Requirements

6.1 The cell tables included as a part of the listed referenced standard shall be used to develop a line call-out for the materials listed in Table 1 covered by a material standard.

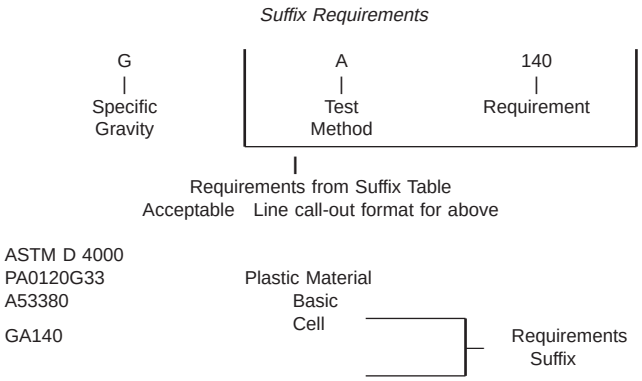
6.2 The cell tables included in this classification shall be used to develop a line call-out for the materials not covered by material standards (Table 1). When the existing cell table does not adequately describe the material, then suffixes may be used in place of a cell table designation.

6.3 A line call-out assembled using this classification system becomes a specification. The line call-out shall 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.

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 11—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 agreed upon between user and supplier.

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

7.4 When a standard for a material is listed in Table 1, the requirements of the referenced standard apply. If desired, the referenced standards may be used since a similar system is used in each document. 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 E 29.

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 ± 2°C and 50 ± 5 % relative humidity for not less than 40 h prior to testing, in accordance with Procedure A of Practice D 618 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 ± 5 % 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 callout).

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 12—If recycled plastics are allowed in the standard, insert the following phrase after the word "shipment" in the last sentence of 15.5: "the percent by weight of recycled plastic, as defined in 3.1 of Guide D 5033, if requested."

16. Packaging, Packing, and Marking

16.1 Provisions of Practice D 3892 apply for packaging, packing, and marking of plastic materials.

17. Keywords

17.1 classification; classification system; line callout; plastic; plastic materials

SUMMARY OF CHANGES

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.

D 4000 – 03a:
(*1*) Revised paragraph 15.4.
(*2*) Added Note 12.
D 4000 – 03:
(*1*) Added ISO 1133 as an alternative test method to Test Method D 1238.
(*2*) Editorially added to Table 1: ASTM Test Method D 6779 to PA, and Test Method D 6778 to POM.
D 4000 – 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.
D 4000 – 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.
D 4000 – 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 D 471.
(*3*) Table 3, Symbol C: Removed second letters A and E and added second letters K and L for Test Method D 1525, 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 F 814.
(*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 D 2445 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.