



Standard Classification System for Nylon Injection and Extrusion Materials (PA)¹

This standard is issued under the fixed designation D 4066; 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 classification system covers nylon materials suitable for injection molding and extrusion. Some of these compositions are also suitable for compression molding and application from solution.

1.2 The properties included in this classification system are those required to identify the compositions covered. There may be other requirements necessary to identify particular characteristics important to specialized applications. These may be specified by using the suffixes as given in Section 5.

1.3 This classification system and subsequent line call-out (specification) are intended to provide a means of calling out 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 plastic 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 costs involved, and the inherent properties of the material other than those covered by this classification system.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 The following precautionary caveat pertains only to the test methods portion, Section 11, of this classification system. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This classification system is similar to ISO 1874-1/-2 1993, although the technical content is significantly different.

NOTE 2—This classification system is being revised to include international 4-mm specimens and test procedures as the standard for compliance. The 3.2-mm specimens; test methods; and Tables PA, A, and B are included in Appendix X3 as a reference for those wishing to use them. It is recommended that the material manufacturer be consulted on all call-outs against this classification system.

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-CAC~~ Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical ~~Insulating~~ ~~Materials~~²-Insulation

D 256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

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

D 618 Practice for Conditioning Plastics ~~and Electrical Insulating Materials~~ for Testing

D 638 Test Method for Tensile Properties of Plastics

D 648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D 789 Test Methods for Determination of ~~Relative Viscosity, Melting Point, and Moisture Content~~ Solution Viscosities of Polyamide (PA)

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D 883 Terminology Relating to Plastics

D 1600 ~~Terminology for Abbreviated Terms Relating to Plastics~~³

¹ This classification system is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (~~Section D20.15.09~~).

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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*, Vol 10.01, 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.

D1898 Practice for Sampling of Plastics³

D1999 Guide for Selection of Specimens and Test Parameters for International Commerce³

D3418 Test Method for Transition Temperatures of Polymers by Thermal Analysis—Terminology for Abbreviated Terms Relating to Plastics

D 3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry

D 3641 Practice for Injection Molding Test Specimens of Thermoplastic Molding and Extrusion Materials

D 3892 Practice for Packaging/Packing of Plastics

D 4000 Classification System for Specifying Plastic Materials

D 5630 Test Method for Ash Content in Thermoplastics—Plastics

D 6260 Test Method for Gravimetric Determination of Carbon Black in Nylon Materials PA⁶-(PA)

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 *Military and Federal Specifications and Standards:*³

L-P-410 Plastic, Polyamide (Nylon) Rigid: Rods, Tubes, Flats, Molded and Cast Parts

VV-I-530 Insulating Oil, Electrical (for Transformers, Switches, and Circuit Breakers)

2.3 *ISO Standards:*⁴

ISO 75-1:1993 Plastics—Determination of Temperature of Deflection Under Load—Part 1: General Test Methods

ISO 75-2:1993 Plastics—Determination of Temperature of Deflection Under Load—Part 2: Plastic and Ebonite

ISO 178:1993 Plastics—Determination of Flexural Properties

ISO 180:1993 Plastics—Determination of Izod Impact Strength

ISO/DIS 294-1:1995 Plastics—Injection Moulding of Test Specimens of Thermoplastic Materials—Part 1: General Principles, Multipurpose-Test Specimens (ISO Mould Type A) and Bars (ISO Mould Type B)

ISO 307 Determination of Viscosity Number of Polyamides In Dilute Solutions

ISO 527-1:1993 Plastics—Determination of Tensile Properties—Part 1: General Principles

ISO 527-2:1993 Plastics—Determination of Tensile Properties—Part 2: Testing Conditions

ISO 960:1969 Plastics—Determination of the Water Content in Polyamides

ISO 1183:1987 Plastics—Methods for Determining the Density and Relative Density of Non-Cellular Plastics

ISO 1874-1:1992 Plastics—Polyamide (PA) Homopolymers and Copolymers for Moulding and Extrusion Part 1: Designation

ISO/DIS 1874-2.2:1995 Plastics—Polyamide (PA) Homopolymers for Moulding and Extrusion—Part 2: Preparation of Test Specimens and Determination of Properties

ISO 3146: Plastics—Determination of Melting Behaviour (Melting Temperature or Melting Range) of Semi-Crystalline Polymers

ISO 3167 Plastics, Multipurpose Test Specimens

ISO 3451-4:1994 Plastics—Determination of Ash—Part 4: Polyamides

3. Terminology

3.1 The terminology used in this classification system is in accordance with Terminologies D 883 and D 1600.

4. Classification

4.1 Nylon materials are classified into groups according to their composition. These groups are subdivided into classes and grades as shown in the Basic Property Table (Table PA).

NOTE 3—An example of this classification system for unreinforced nylon is given as follows: The designation PA0123 indicates the following:

PA = polyamide (nylon) as found in Terminology D 1600,
 01 (group) = 66 nylon,
 2 (class) = heat stabilized, and
 3 (grade) = with a minimum viscosity number of 210 and the requirements given in Table PA.

NOTE 4—An example of this classification system for reinforced nylon is given as follows: The designation PA012G35 indicates the following:

PA = polyamide (nylon) as found in Terminology D 1600,
 01 (group) = 66 nylon,
 2 (class) = heat stabilized, and
 G35 (grade) = nominal 35 % glass with the requirements given in Table PA.

³Annual Book of ASTM Standards, Vol 08.01.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

⁴Discontinued; see 1997 Annual Book of ASTM Standards, Vol 08.01.

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

4.1.1 Grades of reinforced or filled versions, or both, of the basic materials are identified by a single letter that indicates the reinforcement or filler used and two digits, in multiples of 5, that indicate the nominal quantity in percent by weight. Thus, a letter designation G for glass reinforced and 35 for percent or reinforcement, G35, specifies a material with a nominal glass level of 35 %. The reinforcement letter designations and associated tolerance levels are shown as follows:

Symbol	Material	Tolerance (Based on the Total Mass)
C	carbon- and graphite-fiber-reinforced	±2 %
G	glass-reinforced	±2 %
L	lubricants (such as PTFE, graphite, silicone, and molybdenum disulfide)	Depends upon material and process—to be specified.
M	mineral-reinforced	±2 %
R	combinations of reinforcements or fillers, or both	±3 %

NOTE 5—This part of the classification system uses percent of reinforcements or additives, or both, in the call-out of the modified basic material. The types and percentages of reinforcements and additives should be shown on the supplier’s technical data sheet unless they are proprietary in nature. If necessary, additional control of these reinforcements and additives can be accomplished by use of the suffix part of the system (see Section 5).

NOTE 6—Materials containing reinforcements or fillers, or both, at nominal levels not in multiples of 5 are included in the nearest PA grade designation. For example, a material with a nominal material level of 28 % is included with Grade M30.

NOTE 7—An example of this classification system for a 33 % glass-reinforced nylon is given as follows. The designation PA011G35 indicates the following:

- PA = polyamide (nylon) as found in Terminology D 1600,
- 01 (group) = 66 nylon,
- 1 (class) = general purpose, and
- G35 (grade) = with requirements given in Table PA.

NOTE 8—Ash content of filled or reinforced materials may be determined using Test Method D 5630.

TABLE PA Requirements for Nylons Dry-as-Molded^{A,B}

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C				
01	66 Nylon	1	General-purpose	1		135	1.13–1.15	70	2 300	3.3	60				
				2		165	1.13–1.15	70	2 300	3.3	60				
				3		210	1.13–1.15	70	2 300	3.3	60				
				4		270	1.13–1.15	70	2 300	3.3	60				
				5	recycled	115	1.13–1.15	70	2 300	3.3	60				
				6	recycled	135	1.13–1.15	70	2 300	3.3	60				
				0	other										
				G15	15 % glass	...	1.20–1.26	100	4 000	3.0	215				
				G20	20 % glass	...	1.25–1.33	115	5 000	4.0	220				
				G25	25 % glass	...	1.29–1.37	140	6 000	5.0	225				
				G35	35 % glass	...	1.35–1.45	170	8 000	7.0	235				
				G40	40 % glass	...	1.42–1.52	175	9 000	8.0	235				
				G45	45 % glass	...	1.45–1.55	180	10 000	9.0	240				
				M40	40 % mineral	...	1.45–1.55	80	5 000	2.0	150				
						2	Heat-stabilized	1		135	1.13–1.15	70	2 300	3.0	60
								2		165	1.13–1.15	70	2 300	3.0	60
								3		210	1.13–1.15	70	2 300	3.0	60
4		270	1.13–1.15					70	2 300	3.0	60				
5	recycled	115	1.13–1.15					70	2 300	3.0	60				
6	recycled	135	1.13–1.15					70	2 300	3.0	60				
0	other														
G15	15 % glass	...	1.20–1.26					100	4 000	3.0	220				
G25	25 % glass	...	1.29–1.37					140	6 000	5.0	225				
G30	30 % glass	...	1.32–1.42					160	7 000	6.0	230				
G35	35 % glass	...	1.35–1.45					170	8 000	7.0	235				
G40	40 % glass	...	1.43–1.53					175	9 000	8.0	235				
G45	45 % glass	...	1.45–1.55					180	10 000	9.0	240				
M40	40 % mineral	...	1.45–1.55					80	5 000	2.0	150				
R20	20 % filler	...	1.23–1.31					70	3 200	1.5	...				
R40	40 % filler	...	1.43–1.53					100	5 500	2.5	200				
		3	Nucleated					1		135	1.13–1.15	80	2 500	2.8	60
				2		165	1.13–1.15	80	2 500	2.8	60				
				3		210	1.13–1.15	80	2 500	2.8	60				
				4		270	1.13–1.15	80	2 500	2.8	60				
				5	recycled	115	1.13–1.15	80	2 500	2.8	60				
				6	recycled	135	1.13–1.15	80	2 500	2.8	60				



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Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/1A, Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C
				0	other						
		4	Nucleated, heat-stabilized	1							
				2							
				3							
				4							
				0	other						
		5	Impact-modified	1		...	1.06–1.12	52	1 700	9.0	50
				2	recycled	...	1.06–1.12	50	1 600	8.0	50
				0	other	...					
				G15	15 % glass	...	1.15–1.23	85	3 000	6.0	210
				G35	35 % glass	...	1.31–1.41	110	5 500	6.0	225
		6	Impact-modified, heat-stabilized	1		...	1.08–1.12	52	1 700	9.0	50
				2	recycled	...	1.08–1.12	50	1 600	8.0	50
				0	other	...					
				G15	15 % glass	...	1.15–1.23	85	3 000	6.0	210
				G35	35 % glass	...	1.31–1.41	110	5 500	6.0	225
				M40	40 % mineral	...	1.45–1.55	75	4 500	4.0	...
				R35	35 % filler	...	1.38–1.48	80	5 500	3.0	200
		7	Toughened	1		...	1.06–1.10	42	1 500	40	45
				2	recycled	...	1.05–1.11	40	1 300	35	45
				0	other	...					
				G15	15 % glass	...	1.15–1.23	70	2 800	9.0	180
				G35	35 % glass	...	1.28–1.38	110	5 500	11	220
		8	Toughened, heat-stabilized	1		...	1.06–1.10	42	1 500	40	45
				2	recycled	...	1.05–1.11	40	1 300	35	45
				0	other	...					
				G15	15 % glass	...	1.15–1.23	70	2 800	9.0	180
				G35	35 % glass	...	1.28–1.38	110	5 500	11	220
				G45	45 % glass	...	1.39–1.49	130	8 000	10	230
				M35	35 % mineral	...	1.37–1.47	70	3 800	6.0	...
		9	Weather-stabilized ^F	1		135	1.13–1.17	80	2 400	2.5	60
				2	recycled	115	1.13–1.17	65	2 200	2.0	60
				0	other						
		0	Other	0	other						
02	6-Nylon	1	General-purpose	1		135	1.12–1.14	75	2 400	4	50
02	6-Nylon	1	General-purpose	1		100	1.12–1.14	75	2 400	4	50
				2		175	1.12–1.14	70	2 200	3	50
				2		135	1.12–1.14	70	2 200	3	50
				3		200	1.12–1.15	70	2 200	3	50
				3		150	1.12–1.15	70	2 200	3	50
				4		230	1.12–1.15	70	2 200	3	50
				4		200	1.12–1.15	70	2 200	3	50
				0	other						
				G15	15 % glass		1.20–1.28	110	4 200	4	170
				G15	15 % glass		1.20–1.28	110	4 200	4	170
				G25	25 % glass		1.28–1.36	140	6 500	6.5	180
				G25	25 % glass		1.28–1.36	135	5 000	6.5	180
				G30	30 % glass		1.32–1.40	150	7 000	7.5	180
				G35	35 % glass		1.38–1.44	155	7 500	8	180
				G00	other						
				M30	30 % mineral		1.30–1.40	70	3 200	2.4	50
				M30	30 % mineral		1.30–1.40	70	3 200	2.4	50
				M40	40 % mineral		1.44–1.52	75	4 500	4	70
				M40	40 % mineral		1.44–1.52	75	4 500	4	70
				M00	other						
				R40	40 % glass/mineral		1.42–1.50	100	6 000	3	180
				R00	other						
		2	Heat-stabilized	1		135	1.12–1.14	75	2 400	4	50

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40 % glass/ mineral	Heat-Stabilized	2		1		100	1.12-1.14	75	2 400	4	50
				2		175	1.12-1.14	70	2 200	3	50
				2		135	1.12-1.14	70	2 200	3	50
				3		200	1.12-1.15	70	2 200	3	50
				3		150	1.12-1.15	70	2 200	3	50
				4		230	1.12-1.15	70	2 200	3	50
				4		200	1.12-1.15	70	2 200	3	50
				7	recycled	135	1.12-1.14	70	2 000	3	50
				0	other						
				G5	5 % glass		1.16-1.22	85	2 500	2.5	110
				G15	15 % glass		1.20-1.28	110	4 200	4	180
				G15	15 % glass		1.20-1.28	110	4 200	4	180
				G25	25 % glass		1.28-1.36	140	6 500	6.5	190
				G25	25 % glass		1.28-1.36	135	5 000	6.5	190
				G30	30 % glass		1.32-1.40	150	7 000	7.5	190
				G35	35 % glass		1.38-1.44	155	7 500	8	190
				G35	35 % glass		1.36-1.44	155	7 500	8	190
				G45	45 % glass		1.46-1.54	175	10 000	10	190
				G50	50 % glass		1.52-1.60	175	10 000	10	190
				G65	65 % glass		1.70-1.78	175	13 000	10	200
				G00	other						
				M30	30 % mineral		1.30-1.40	70	3 200	2.4	50
				M35	35 % mineral		1.39-1.47	70	3 500	3	60
				M40	40 % mineral		1.44-1.52	75	4 500	4.5	70R40
				M40	40 % mineral		1.44-1.52	75	4 500	4	70
				M00	other						
				M00	other						
R20	20 % glass/ mineral		1.25-1.33	80	3 200	2.5	120				
R40	40 % glass/ mineral		1.42-1.50	100	6 000	3	180				
R40	40 % glass/ mineral		1.42-1.50	100	6 000	3	180				
R00	other										
3	Nucleated and-lubricated	4		135	1.12-1.14	70	2 300	2.5	50		
3	Nucleated			1		100	1.12-1.14	70	2 300	2.5	50
				2		175	1.12-1.14	70	2 300	2.5	50
				2		135	1.12-1.14	70	2 300	2.5	50
				3		200	1.12-1.15	75	2 300	2.5	50
				3		150	1.12-1.15	75	2 300	2.5	50
				4		230	1.12-1.15	80	2 300	2.5	50
				4		200	1.12-1.15	80	2 300	2.5	50
				0	other						
4	Nucleated and-heat-stabilized	4		135				100	1.12-1.14		
4	Nucleated and Heat-Stabilized			1		135			100	1.12-1.14	
				2		175	1.12-1.14	70	2 300	2.5	55
				2		135	1.12-1.14	70	2 300	2.5	50
				3		200	1.12-1.15	75	2 300	2.5	55
				3		150	1.12-1.15	75	2 300	2.5	50
				4		230	1.12-1.15	80	2 300	2.5	55-50
				4		200	1.12-1.15	80	2 300	2.5	50
				7	recycled	135	1.12-1.14	70	2 100	2.5	50
0	other										
5	Impact-modified			1		105-1.12	45	1 700	30	45	
				1		105-1.12	45	1 700	30	45	
				2		105-1.18	60	2 000	6	50	
				2		105-1.18	55	2 000	6	45	
				3		105-1.18	60	2 000	6	50	
				3		105-1.18	40	1 000	6	35	
				0	other						G30
0	other										
30 % glass	1.32-1.40	G15	15 % glass		1.15-1.24	75	3 300	9	130		



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Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/1A, Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C				
		1.32–1.40		G15		15 % glass		1.15–1.24	75	3 300	9 130				
				G30	30 % glass		1.30–1.40	135	6 500	15	180				
				G35	35 % glass		1.32–1.42	135	6 800	15	190				
				G40	40 % glass		1.39–1.47	135	8 000	10	200				
				G00	other										
6	Impact-modified, heat-stabilized	1.32–1.40		1			1.05–1.12	45	1 700	30	45				
				2			1.05–1.18	60	2 000	6	50				
				2			1.05–1.18	55	2 000	6	45				
				3			1.05–1.18	60	2 000	6	50				
				3			1.05–1.18	40	1 000	6	35				
				4			1.05–1.18	25	1 000	30	30				
				0	other							G30			
				0	other										
				G15	15 % glass		1.15–1.24	75	3 300	9 130					
				G15	15 % glass		1.15–1.24	75	3 300	9 130					
				30 % glass	1.32–1.40	1.32–1.40		G30	30 % glass		1.30–1.40	135	6 500	15	180
G35	35 % glass		1.32–1.42					135	6 800	10	190				
G40	40 % glass		1.39–1.47					135	8 000	10	200				
G00	other														
M35	35 % mineral		1.35–1.45					65	3 200	3	50				
M40	40 % mineral		1.37–1.47					65	3 200	3	50				
M00	other														
8	Flexural-modified, heat-stabilized	1.32–1.40						2	injection molding		1.05–1.16	55	2 375max	10	45
								2	injection molding		1.05–1.16	55	2 375max	10	45
								3	extrusion		1.05–1.16	30	2 000max	7	25
								3	extrusion		1.05–1.16	30	2 000max	7	25
				4	blends		1.05–1.10	35	1 700max	4.5	35				
				0	other										
0	Other	1.32–1.40		0	other										
03 ^G	11 Nylon	1	General purpose	1		221	1.03–1.06								
				2		234	1.03–1.06	45	1000	4.0	35				
				3		252	1.03–1.06								
				4		291	1.03–1.06								
				5	hydrolysis-resistant		1.03–1.06								
				0	other										
2	Heat-stabilized	1.32–1.40		1		234	1.03–1.06								
				2		252	1.03–1.06	45	900	2.0	35				
				3		291	1.03–1.06								
				4	hydrolysis-resistant		1.03–1.06								
				0	other										
	Highly plasticized	1.32–1.40		1			1.03–1.06								
				2			1.03–1.06								
				3			1.03–1.06								
				4			1.03–1.06								
				0	other										
4	Highly plasticized, heat stabilized	1.32–1.40		1			1.03–1.06								
				2			1.03–1.06								
				3			1.03–1.06								
				4			1.03–1.06								
				0	other										
5	Moderately plasticized	1.32–1.40		1			1.03–1.06								
				2			1.03–1.06								
				3			1.03–1.06								
				4			1.03–1.06								
				5			1.03–1.06								

TABLE PA Requirements for Nylons Dry-as-Molded^{A,B}

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/1A, Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C
				0	other						
		6	Moderately plasticized, heat-stabilized	1			1.03–1.06				
				2			1.03–1.06				
				3			1.03–1.06				
				4			1.03–1.06				
				5			1.03–1.06				
				0	other						
		0	Other	0	other						
04	12 Nylon		General purpose	1		100–210	1.00–1.06	30	800	2.5	35
				2		100–210	1.00–1.06	35	1 000	2.5	35
				3		211–270	1.00–1.06	35	1 000	2.5	35
				4		271–340	1.00–1.06	35	1 000	2.5	35
				0	other						
		2	Heat-stabilized	1		100–150	1.00–1.06	35	800	2.5	35
				2		151–210	1.00–1.06	35	800	2.5	35
				3		211–280	1.00–1.06	35	1 000	2.5	35
				0	other						
				G15	15 % glass		1.10–1.20	75	3 000	10	160
				G25	25 % glass		1.10–1.25	90	3 000	15	160
				G30	30 % glass		1.15–1.30	95	4 000	15	160
				G40	40 % glass		1.30–1.45	100	4 500	15	160
				R30	30 % filler		1.22–1.28	55	3 500	5.0	100
		3	Nucleated	1		100–180	1.00–1.06	35	800	1.0	35
				2		181–250	1.00–1.06	35	800	1.0	35
				0	other						
		4	Plasticized	1		100–280	1.00–1.06	30	300–550	15	...
				2		100–280	1.00–1.06	30	450–750	10	...
				0	other						
		5	Plasticized, heat-stabilized	1		100–280	1.00–1.06	20	200–350	20	...
				2		100–280	1.00–1.06	30	300–550	15	...
				3		100–280	1.00–1.06	30	450–750	10	...
				4		100–280	1.00–1.06	35	550–950	5.0	...
				0	other						
		0	Other	0	other						
05	69 Nylon	1	General purpose	1			1.07–1.09				
				2			1.07–1.09				
				3			1.07–1.09				
				0	other						
		2	Heat-stabilized	1			1.07–1.09				
				2			1.07–1.09				
				3			1.07–1.09				
				0	other						
		0	Other	0	other						
06	612 Nylon	1	General purpose	1		100–139	1.05–1.07	50	1 800	2.0	45
				2		140–199	1.05–1.07	50	1 800	2.5	45
				3		200	1.05–1.07	50	1 800	3.0	45
				0	other						
				G35	35 % glass	...	1.28–1.38	140	7 000	9.0	175
				G45	45 % glass	...	1.38–1.48	150	8 500	11	180
		2	Heat-stabilized	1		140	1.05–1.07	50	1 800	2.0	45
				0	other						
				G30	30 % glass	...	1.25–1.33	120	5 500	5.0	170
				G35	35 % glass	...	1.28–1.38	140	7 000	9.0	175
		3	Weather-stabilized ^F	1		140	1.05–1.07	50	1 800	1.5	45
				0	other						
		0	Other	0	other						
07	610 Nylon	1	General purpose	1			1.05–1.09				
				2			1.05–1.09				



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TABLE PA Requirements for Nylons Dry-as-Molded^{A,B}

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/1A, Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C
				3			1.05–1.09				
				0	other						
		2	Heat-stabilized	1			1.05–1.09				
				2			1.05–1.09				
				0	other						
		0	Other	0	other						
08	Special	1	n-alkoxy-alkyl 6:6	1			1.09–1.12				
				0	other						
09	46 Nylon	0	Other	0	other						
		1	General-purpose	1							
				2		170	1.16–1.20	85	2 300	6.0	140
				3		195	1.16–1.20	85	2 300	6.0	140
				0	other						
		2	Heat-stabilized	1							
				2		165	1.16–1.20	85	2 300	6.0	140
				3		195	1.16–1.20	85	2 300	6.0	140
				0	other						
				G15	15 % glass	...	1.25–1.31	125	5 000	3.6	240
				G30	30 % glass	...	1.38–1.42	175	8 000	7.5	280
				G40	40 % glass	...	1.48–1.53	195	10 000	10.0	280
				G50	50 % glass	...	1.58–1.63	210	12 000	12.0	280
				R50	50 % filler	...	1.60–1.67	140	9 000	4.0	280
		3	Flame-retardant, ^G heat-stabilized	1							
				2		...	1.32–1.36	45	2 250	4.0	140
				0	other						
				G15	15 % glass	...	1.55–1.59	115	6 000	4.5	270
				G30	30 % glass	...	1.63–1.69	155	10 000	7.5	280
				G40	40 % glass	...	1.76–1.80	145	11 000	8.0	280
				G45	45 % glass	...	1.75–1.79	165	12 000	8.0	280
		4	Impact-modified, heat-stabilized	1							
				2		...	1.08–1.12	40	1 500	50	70
				0	other						
		5	Wear-resistant heat-stabilized	1							
				2		...	1.16–1.20	75	2 200	3.0	140
				0	other						
		0	Other	0	other						
10	6T/MPMDT nylon	1	General-purpose	0	other						
		2	Heat-stabilized	G35	35 % glass	...	1.42–1.52	200	10 000	8.0	250
				G45	45 % glass	...	1.53–1.63	210	12 000	8.0	250
		0	Other	0	other						
11	66 nylon copoly-mers + blends	1	66/6	G15	15 % glass	...	1.20–1.26	90	3 500	3.0	180
			General-purpose	G35	35 % glass	...	1.35–1.45	160	7 500	8.0	190
				G45	45 % glass	...	1.45–1.55	180	8 500	10	200
		2	66/6 Heat-stabilized	G15	15 % glass	...	1.20–1.26	90	3 500	3.0	180
				G25	25 % glass	...	1.29–1.37	115	4 500	6.5	190
				G35	35 % glass	...	1.35–1.45	160	7 500	8.0	190
				G45	45 % glass	...	1.45–1.55	180	8 500	10	200
				M20	20 % mineral	...	1.25–1.33	70	3 000	4.0	...
				M30	30 % mineral	...	1.35–1.45	75	4 000	3.0	...
				M40	40 % mineral	...	1.45–1.55	75	4 000	3.0	...
		3	66 + 6 General purpose	G15	15 % glass	...	1.20–1.26	100	4 000	3.0	200
				G35	35 % glass	...	1.35–1.45	170	8 000	9.0	210
				G45	45 % glass	...	1.45–1.55	190	10 000	10	220

TABLE PA Requirements for Nylons Dry-as-Molded^{A,B}

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ISO 1183, g/cm ³	Tensile Strength, ^D ISO 527-1 and ISO 527-2, min, MPa	Flexural Modulus, ISO 178, Flexural Modulus, ISO 178, min, MPa	Izod Impact Resistance, ISO 180/4A, Izod Impact Resistance, ISO 180/1A, min, kJ/m ²	Deflection Temperature at 1.82 MPa, ^E ISO 75-1 and ISO 75-2 min, °C
		4	66 + 6 Heat-stabilized	M20 M40	20 % mineral 40 % mineral	...	1.25–1.33 1.45–1.55	70 75	3 000 4 500	3.0 3.0	...
		0	Other	0	other						
12	6 nylon co-polymer + blends	1	6 + polypropylene blend	1		...	1.00–1.05	50	2 000	7.0	50
			Heat-stabilized	0 other G35 R35	35 % glass 35 % filler	...	1.23–1.33 1.28–1.38	150 53	8 500 6 000	9.0 2.0	200 135
		0	Other	0	other						
13	6T/66 nylon	1	General-purpose	0	other						
		2	Heat-stabilized	G35 0	other	...	1.41–1.51	175	9 000	6.0	270
14	PA MXD6 + filters	1	General Purpose	G50 G60	50 % glass 60 % glass	...	1.64–1.66 1.76–1.78	255 280	18 000 21 000	10 8	230 230
		0	Other	0	other						
00	Other	0	Other	0	other						

^AData on 4-mm test specimens may be limited, and the minimum values may be changed in a later revision after a statistical data base of sufficient size is generated.

^BRefer to 9.1 for source of test pieces.

^CNo descriptions are listed unless needed to describe a special grade under the class. All other grades are listed by requirements.

^DCrosshead speed shall be 50 mm/min ± 10 % unless the specimen exhibits brittle failure (no yield point) and strain at break of <10 % in which case crosshead speed shall be 5 mm/min ± 25 %.

^EDeflection temperature shall be determined with the specimen in the flatwise position (Method A).

^FWeatherable nylon typically contains 1.90 to 2.25 % carbon black as determined in accordance with methods found in Test Method D 6260. It is possible that materials incorporating other pigments or soluble stabilizers, or both may prove adequate for particular applications.

^GRelative Viscosities for Group 03 were generated from a correlation with Test Method D 789, utilizing an Ubbelohde viscometer, and m-Cresol as the solvent. Refer to Table X3.1, Note B for more specific information.

4.2 Variations of nylon materials that are not in Table PA are classified in accordance with Tables PA and A or B. Table PA is used to specify the group of nylon and Table A or B is used to specify property requirements.

4.2.1 Specific requirements for variations of nylon materials shall be shown by a six-character designator. The designation will consist of the letter “A” or “B” and the five digits comprising the cell numbers for the property requirements in the order as they appear in Tables A and B.

4.2.1.1 Although the values listed are necessary to include the range of properties available in existing material, users should not infer that every possible combination of the properties exists or can be obtained.

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

NOTE 9—An example of this classification system for a reinforced nylon material is given as follows. The designation PA0110G30A22450 would indicate the following material requirements:

- PA0110 = 66 nylon, from Table PA,
- G30 = glass reinforced at 30 % nominal,
- A = Table A property requirements,
- 2 = 70-MPa tensile strength, min,
- 2 = 4 500-MPa flexural modulus, min,
- 4 = 10.0-kJ/m² Izod impact, min,
- 5 = 160°C deflection temperature at 1.82 MPa, min, and
- 0 = unspecified.

If no properties are specified, the designation would be PA0110G30A00000.

NOTE 10—When a grade of polyamide is not fully identified by a standard callout, it is possible to specify all table properties by the use of an addition of Classification D 4000 suffixes. Suffix values will override the PA table values.

An example of an unreinforced nylon material is given as follows: PA0212UM023. This example is a general purpose, low viscosity nylon 6 material where U denotes flexural modulus. M denotes ISO 178 as the test method, and 023 denotes a value of 2300 MPa. This value for flexural modulus overrides the normal table value.

This example can be applied to replace all table values, that is, tensile stress, notched Izod impact, and heat deflection temperature.

4.3 To facilitate the specification of special materials where the basic property table does not reflect the properties required,

Table B has been incorporated into this classification system. This table will be used in a manner similar to Table A.

NOTE 11—Pigmented or colored nylons can differ significantly from the natural polymers in mechanical properties depending on the choice of colorants and concentrations. The main property affected is ductility, as illustrated by a reduction in Izod impact and elongation values. In a typical white pigmented nylon, elongation losses of up to 50 % and Izod impact losses of up to 30 % are common. If specific properties of pigmented materials are necessary, Table B may be employed to specify property requirements.

NOTE 12—An example of a special material using this classification system is as follows: The designation PA0220B54220 would indicate the following material requirements from Table B:

PA0220 = 6 nylon, heat stabilized, from Table PA,
B = Table B property requirements,
5 = 70-MPa tensile strength, min,
4 = 2400-MPa flexural modulus, min,
2 = 4.0-kJ/m² Izod impact, min,
2 = 55°C deflection temperature at 1.82 MPa, min, and
0 = unspecified.

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