



Designation: ~~D6779—20~~ D6779 – 21

Standard Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)¹

This standard is issued under the fixed designation D6779; 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 U.S. Department of Defense.

1. Scope*

1.1 This classification system covers polyamide materials suitable for molding and extrusion. Some of these compositions are also suitable for application from solution.

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

1.3 This classification system and subsequent line callout (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 can 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 standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—This classification system is similar to ~~ISO 1874~~ ISO 16396-1/-2, although the technical content is significantly different.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

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

[D789 Test Method for Determination of Relative Viscosity of Concentrated Polyamide \(PA\) Solutions](#)

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.

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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

- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D883 Terminology Relating to Plastics
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D3892 Practice for Packaging/Packing of Plastics
- D4000 Classification System for Specifying Plastic Materials
- D5740 Guide for Writing Material Standards in the Classification Format
- D6260 Test Method for Gravimetric Determination of Carbon Black in Nylon Materials (PA) (Withdrawn 2004)³
- D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)³
- E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- 2.2 IEC/ISO Standards:⁴
- IEC 60243-1 Electrical Strength of Insulating Materials—Test Methods—Part 1: Tests at Power Frequencies
- IEC 60250 Recommended Methods for the Determination of the Permittivity and Dielectric Dissipation Factor of Electrical Insulating Materials at Power, Audio and Radio Frequencies Including Metre Wavelengths
- ISO 75-1 Plastics—Determination of Temperature of Deflection Under Load—Part 1: General Test Methods
- ISO 75-2 Plastics—Determination of Temperature of Deflection Under Load—Part 2: Plastic and Ebonite
- ISO 179-1 Plastics—Determination of Charpy Impact Strength—Part 1: Non-instrumented Impact Test
- ISO 294-1 Plastics—Injection Moulding of Test Specimens of Thermoplastic Materials—Part 1: General Principles, Multipurpose-Test Specimens and Bars
- ISO 307 Determination of Viscosity Number of Polyamides In Dilute Solutions
- ISO 527-1 Plastics—Determination of Tensile Properties—Part 1: General Principles
- ISO 527-2 Plastics—Determination of Tensile Properties—Part 2: Testing Conditions
- ISO 1183 Plastics—Methods for Determining the Density and Relative Density of Non-Cellular Plastics
- ~~ISO 1874-1 Plastics—Polyamide (PA) Homopolymers and Copolymers for Moulding and Extrusion—Part 1: Designation~~
- ~~ISO 1874-2.2 Plastics—Polyamide (PA) Homopolymers and Copolymers for Moulding and Extrusion—Part 2: Preparation of Test Specimens and Determination of Properties~~
- ~~ISO 3167 Plastics, Multipurpose Test Specimens~~
- ISO 3451-4 Plastics—Determination of Ash—Part 4: Polyamides
- 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
- ISO 15512 Plastics—Determination of Water Content
- ISO 16396-1 Plastics—Polyamide (PA) moulding and extrusion materials—Part 1: Designation system, marking of products and basis for specifications
- ISO 16396-2 Plastics—Polyamide (PA) moulding and extrusion materials—Part 2: Preparation of test specimens and determination of properties
- ISO 20753 Plastics—Test Specimens

3. Terminology

3.1 The terminology used in this classification system is in accordance with Terminologies **D883** and **D1600**.

4. Classification

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

NOTE 2—An example of this classification system for unreinforced polyamide is given as follows: The designation PA0123 indicates the following:

PA	=	polyamide as found in Terminology D1600 ,
01 (group)	=	polyamide 66,
2 (class)	=	heat stabilized, and
3 (grade)	=	with a minimum viscosity number of 210 and the requirements given in Table PA.

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

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

~~PA = polyamide as found in Terminology D1600,~~
~~01 (group) = polyamide 66,~~
~~2 (class) = heat stabilized, and~~
~~3 (grade) = with a minimum viscosity number of 210 and the requirements given in Table PA.~~

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)
<u>C</u>	<u>carbon- and graphite-fiber-reinforced</u>	<u>±2 %</u>
<u>G</u>	<u>glass-reinforced</u>	<u>±2 %</u>
<u>L</u>	<u>lubricants (such as PTFE, graphite, silicone, and molybdenum disulfide)</u>	<u>Depends upon material and process—to be specified.</u>
<u>M</u>	<u>mineral-reinforced</u>	<u>±2 %</u>
<u>R</u>	<u>combinations of reinforcements or fillers, or both</u>	<u>±3 %</u>

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

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NOTE 3—An example of this classification system for reinforced polyamide is given as follows: The designation PA012G35 indicates the following:

PA = polyamide as found in Terminology D1600,
01 (group) = polyamide 66,
2 (class) = heat stabilized, and
G35 (grade) = nominal 35 % glass with the requirements given in Table PA.

~~PA = polyamide as found in Terminology D1600,~~
~~01 (group) = polyamide 66,~~
~~2 (class) = heat stabilized, and~~
~~G35 (grade) = nominal 35 % glass with the requirements given in Table PA.~~

NOTE 4—This part of the classification system uses percent of reinforcements or additives, or both, in the callout of the modified basic material. The types and percentages of reinforcements and additives are sometimes shown on the supplier's technical data sheet. 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 5—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 glass fiber level of 33 % is included with Grade G35 as shown in Note 4.

NOTE 6—Ash content of filled or reinforced materials is determined using Test Method ISO 3451-4.

4.2 Variations of polyamide 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 polyamide and Table A or B is used to specify property requirements.

4.2.1 Specific requirements for variations of polyamide 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 materials, not every possible combination of the properties exists or can be obtained.

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

NOTE 7—An example of this classification system for a reinforced polyamide material is given as follows. The designation PA0110G30A42270 would indicate the following material requirements:

PA0110 = Polyamide 66, from Table PA,
G30 = Glass reinforced at 30 % nominal,
A = Table A property requirements,
4 = Tensile strength, 140 MPa, min,
2 = Tensile modulus, 4500 MPa, min,
2 = Charpy impact, 5.0 kJ/m², min,
7 = Deflection temperature at 1.8 MPa, 200°C, min, and
0 = Unspecified.

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

~~PA0110 = Polyamide 66, from Table PA,
 G30 = Glass reinforced at 30 % nominal,
 A = Table A property requirements,
 4 = Tensile strength, 140 MPa, min,
 2 = Tensile modulus, 4500 MPa, min,
 2 = Charpy impact, 5.0 kJ/m², min,
 7 = Deflection temperature at 1.8 MPa, 200°C, min, and
 0 = Unspecified.~~

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

<https://standards.iteh.ai/catalog/standards/sist/89bb9bb5-d3a1-4ef7-9d23-6f37010b66b1/astm-d6779-21>

NOTE 8—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 **D4000** suffixes. Suffix values will override the PA table values. An example of an unreinforced polyamide material is given as follows: PA0212KN023. This example is a general purpose, low viscosity PA6 material where K denotes tensile properties, N denotes tensile modulus with ISO 527 as the test method, and 023 denotes a value of 2300 MPa. This value for tensile modulus overrides the normal table value. This example can be applied to replace all table values, that is, tensile stress, notched Charpy 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 9—Pigmented or colored polyamides 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 Charpy impact and elongation values. In a typical white pigmented polyamide, elongation losses of up to 50 % and Charpy impact losses of up to 30 % are common. To specify property requirements of pigmented materials, use Table B.

NOTE 10—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 = Polyamide 6, heat stabilized, from Table PA,
B = Table B property requirements,
5 = Tensile strength, 70 MPa, min,
4 = Tensile modulus, 2400 MPa, min,
2 = Charpy impact, 4.0 kJ/m², min,
2 = Deflection temperature at 1.8 MPa, 55°C, min, and
0 = unspecified.

- PA0220 = Polyamide 6, heat stabilized, from Table PA;
- B = Table B property requirements;
- 5 = Tensile strength, 70 MPa, min;
- 4 = Tensile modulus, 2400 MPa, min;
- 2 = Charpy impact, 4.0 kJ/m², min;
- 2 = Deflection temperature at 1.8 MPa, 55°C, min, and
- 0 = unspecified.

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min								
01	PA66	1	General-purpose	1		135	1.13 to 1.15	70	2300	3.3	60								
				2		165	1.13 to 1.15	70	2300	3.3	60								
				3		210	1.13 to 1.15	70	2300	3.3	60								
				4		270	1.13 to 1.15	70	2300	3.3	60								
				5	recycled	115	1.13 to 1.15	70	2300	3.3	60								
				6	recycled	135	1.13 to 1.15	70	2300	3.3	60								
				7		115	1.13 to 1.15	70	2300	3.3	60								
				G15	15 % glass	...	1.20 to 1.26	100	4000	3.0	215								
				G20	20 % glass	...	1.25 to 1.33	115	5000	4.0	220								
				G25	25 % glass	...	1.29 to 1.37	140	6000	5.0	225								
				G35	35 % glass	...	1.35 to 1.45	170	8000	7.0	235								
				G40	40 % glass	...	1.42 to 1.52	175	9000	8.0	235								
				G45	45 % glass	...	1.45 to 1.55	180	10 000	9.0	240								
				G50	50 % glass	...	1.51 to 1.61	190	11 000	10.0	245								
				M40	40 % mineral	...	1.45 to 1.55	80	5000	2.0	100								
		0	other																
		2		2	Heat-stabilized	1		135	1.13 to 1.15	70	2300	3.0	60						
						2		165	1.13 to 1.15	70	2300	3.0	60						
						3		210	1.13 to 1.15	70	2300	3.0	60						
						4		270	1.13 to 1.15	70	2300	3.0	60						
						5	recycled	115	1.13 to 1.15	70	2300	3.0	60						
						6	recycled	135	1.13 to 1.15	70	2300	3.0	60						
						G15	15 % glass	...	1.20 to 1.26	100	4000	3.0	220						
						G25	25 % glass	...	1.29 to 1.37	140	6000	5.0	225						
						G30	30 % glass	...	1.32 to 1.42	160	7000	6.0	230						
						G35	35 % glass	...	1.35 to 1.45	170	8000	7.0	235						
						G40	40 % glass	...	1.43 to 1.53	175	9000	8.0	235						
						G45	45 % glass	...	1.45 to 1.55	180	10 000	9.0	240						
						G50	50 % glass	...	1.51 to 1.61	190	11 000	10.0	245						
						M40	40 % mineral	...	1.45 to 1.55	80	5000	2.0	100						
						R20	20 % filler	...	1.23 to 1.31	70	3200	1.5	...						
				R40	40 % filler	...	1.43 to 1.53	100	5500	2.5	200								
				0	other														
				3		3	Nucleated	1		135	1.13 to 1.15	80	2500	2.8	60				
								2		165	1.13 to 1.15	80	2500	2.8	60				
								3		210	1.13 to 1.15	80	2500	2.8	60				
								4		270	1.13 to 1.15	80	2500	2.8	60				
								5	recycled	115	1.13 to 1.15	80	2500	2.8	60				
								6	recycled	135	1.13 to 1.15	80	2500	2.8	60				
								0	other										
								4		4	Nucleated, heat-stabilized	1		Requirements the same as corresponding grades under Group 01, Class 3					
		2																	
		3																	
		4																	
		5																	
0	other																		
5		5	Impact-modified									1		...	1.06 to 1.12	52	1700	9.0	50
												2	recycled	...	1.06 to 1.12	50	1600	8.0	50
				G15	15 % glass	...	1.15 to 1.23					85	3000	6.0	210				
				G35	35 % glass	...	1.31 to 1.41					110	5500	6.0	225				
				0	other														
				6		6	Impact-modified, heat-stabilized	1		...	1.08 to 1.12	52	1700	9.0	50				
								2	recycled	...	1.08 to 1.12	50	1600	8.0	50				
G15	15 % glass	...	1.15 to 1.23					85	3000	6.0	210								
G35	35 % glass	...	1.31 to 1.41					110	5500	6.0	225								
M40	40 % mineral	...	1.45 to 1.55					75	4500	4.0	...								
R35	35 % filler	...	1.38 to 1.48					80	5500	3.0	200								
0	other																		

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min		
02	PA6	7	Toughened	1		...	1.06 to 1.10	42	1500	40	45		
				2	recycled	...	1.05 to 1.11	40	1300	35	45		
				G15	15 % glass	...	1.15 to 1.23	70	2800	9.0	180		
				G35	35 % glass	...	1.28 to 1.38	110	5500	11	220		
				0	other								
		8	Toughened, heat-stabilized	1		...	1.06 to 1.10	42	1500	40	45		
				2	recycled	...	1.05 to 1.11	40	1300	35	45		
				G15	15 % glass	...	1.15 to 1.23	70	2800	9.0	180		
				G35	35 % glass	...	1.28 to 1.38	110	5500	11	220		
				G45	45 % glass	...	1.39 to 1.49	130	8000	10	230		
				M35	35 % mineral	...	1.37 to 1.47	70	3800	6.0	...		
				0	other								
		9	Weather-stabilized ^G	1		135	1.13 to 1.17	80	2400	2.5	60		
				2	recycled	115	1.13 to 1.17	65	2200	2.0	60		
				0	other								
		0	General-purpose	0	other								
				1		100	1.12 to 1.14	75	2400	4.0	50		
				2		135	1.12 to 1.14	70	2200	3.0	50		
				3		150	1.12 to 1.15	70	2200	3.0	50		
				4		200	1.12 to 1.15	70	2200	3.0	50		
				G15	15 % glass	...	1.20 to 1.28	110	4200	4.0	170		
				G25	25 % glass	...	1.28 to 1.36	135	5000	6.5	180		
				G30	30 % glass	...	1.32 to 1.40	150	7000	7.5	180		
				G35	35 % glass	...	1.38 to 1.44	155	7500	8.0	180		
				G40	40 % glass	...	1.41 to 1.48	175	10 000	9.0	190		
				M30	30 % mineral	...	1.30 to 1.40	70	3200	2.4	50		
				M40	40 % mineral	...	1.44 to 1.52	75	4500	4.0	70		
				R40	40 % glass/mineral	...	1.42 to 1.50	100	6000	3.0	180		
				0	other								
				2	Heat-stabilized	1		100	1.12 to 1.14	75	2400	4.0	50
						2		135	1.12 to 1.14	70	2200	3.0	50
						3		150	1.12 to 1.15	70	2200	3.0	50
		4				200	1.12 to 1.15	70	2200	3.0	50		
		5	recycled			135	1.12 to 1.14	70	2000	3.0	50		
		G5	5 % glass			...	1.16 to 1.22	85	2500	2.5	110		
		G15	15 % glass			...	1.20 to 1.28	110	4200	4.0	180		
		G25	25 % glass			...	1.28 to 1.36	135	5000	6.5	190		
		G30	30 % glass			...	1.32 to 1.40	150	7000	7.5	190		
		G35	35 % glass			...	1.38 to 1.44	155	7500	8.0	190		
		G40	40 % glass			...	1.41 to 1.48	175	10 000	9.0	190		
		G45	45 % glass			...	1.46 to 1.54	175	10 000	10	190		
		G50	50 % glass			...	1.52 to 1.60	175	10 000	10	190		
		G60	60 % glass			...	1.66 to 1.74	175	10 000	10	190		
		G65	65 % glass			...	1.70 to 1.78	175	13 000	10	200		
		M30	30 % mineral			...	1.30 to 1.40	70	3200	2.4	50		
		M35	35 % mineral			...	1.39 to 1.47	70	3500	3.0	60		
		M40	40 % mineral	...	1.44 to 1.52	75	4500	4.0	70				
R20	20 % glass/mineral	...	1.25 to 1.33	80	3200	2.5	120						
R40	40 % glass/mineral	...	1.42 to 1.50	100	6000	3.0	180						
0	other												
3	Nucleated and lubricated	1		100	1.12 to 1.14	70	2300	2.5	50				
		2		135	1.12 to 1.14	70	2300	2.5	50				
		3		150	1.12 to 1.15	75	2300	2.5	50				
		4		200	1.12 to 1.15	80	2300	2.5	50				
0	other												
4	Nucleated and heat-stabilized	1		100	1.12 to 1.14	70	2300	2.5	50				
		2		135	1.12 to 1.14	70	2300	2.5	50				
		3		150	1.12 to 1.15	75	2300	2.5	50				
		4		200	1.12 to 1.15	80	2300	2.5	50				
		5	recycled	135	1.12 to 1.14	70	2100	2.5	50				
0	other												
5	Impact-modified	1		...	1.05 to 1.12	45	1700	30	45				
		2		...	1.05 to 1.18	55	2000	6.0	45				
		3		...	1.05 to 1.18	40	1000	6.0	35				
		G15	15 % glass	...	1.15 to 1.24	75	3300	9.0	130				
		G30	30 % glass	...	1.30 to 1.40	135	6500	15	180				
G35	35 % glass	...	1.32 to 1.42	135	6800	15	190						

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min	
03 ^H	PA11	6	Impact-modified, heat-stabilized	G40	40 % glass		1.39 to 1.47	135	8000	10	200	
				0	other							
				1			1.05 to 1.12	45	1700	30	45	
				2			1.05 to 1.18	55	2000	6.0	45	
				3			1.05 to 1.18	40	1000	6.0	35	
				4			1.05 to 1.18	25	1000	30	30	
				G15	15 % glass		1.15 to 1.24	75	3300	9.0	130	
				G30	30 % glass		1.30 to 1.40	135	6500	15	180	
				G35	35 % glass		1.32 to 1.42	135	6800	10	190	
				G40	40 % glass		1.39 to 1.47	135	8000	10	200	
		M35	35 % mineral		1.35 to 1.45	65	3200	3.0	50			
		M40	40 % mineral		1.39 to 1.47	65	3200	3.0	50			
		0	other									
		7	Flexural-modified, heat-stabilized									
		1	injection molding		1.05 to 1.16	55	2375 max	10	45			
		2	extrusion		1.05 to 1.16	30	2000 max	7.0	25			
		3	blends		1.05 to 1.10	35	1700 max	4.5	35			
		0	other									
		0	other									
		1	General purpose				115 to 140	1.01 to 1.06	35	900	4.0	36
		2					160 to 190	1.01 to 1.06	35	900	6.0	36
		0	other									
		2	Heat-stabilized									
		1			1.05 to 1.06	35	900	4.0	36			
		2			1.01 to 1.06	35	900	6.0	36			
		3			1.01 to 1.06	35	900	4.0	36			
		4			1.01 to 1.06	35	900	6.0	36			
		0	other				210 to 255	1.01 to 1.06	35	900	6.0	36
		3	Plasticized									
		1			1.01 to 1.06	30	370	25	36			
0	other											
4	Plasticized, Heat Stabilized											
1			1.01 to 1.06	35	500	25	36					
2			1.01 to 1.06	35	400	25	36					
3			1.01 to 1.06	30	350	25	36					
4			1.01 to 1.06	35	400	25	36					
5			1.01 to 1.06	30	370	25	36					
6			1.01 to 1.06	35	370	25	36					
7			1.01 to 1.06	35	340	25	36					
0	other											
0	other											
04	PA12	0	Other									
1	General purpose											
1			1.00 to 1.06	30	800	2.5	35					
2			1.00 to 1.06	35	1000	2.5	35					
3			1.00 to 1.06	35	1000	2.5	35					
4			1.00 to 1.06	35	1000	2.5	35					
0	other											
2	Heat-stabilized											
1			1.00 to 1.06	35	800	2.5	35					
2			1.00 to 1.06	35	800	2.5	35					
3			1.00 to 1.06	35	1000	2.5	35					
G15	15 % glass		1.10 to 1.20	75	3000	10	160					
G25	25 % glass		1.10 to 1.25	90	3000	15	160					
G30	30 % glass		1.15 to 1.30	95	4000	15	160					
G40	40 % glass		1.30 to 1.45	100	4500	15	160					
R30	30 % filler		1.18 to 1.32	55	3500	5.0	100					
0	other											
3	Nucleated											
1			1.00 to 1.06	35	800	1.0	35					
2			1.00 to 1.06	35	800	1.0	35					
0	other											
4	Plasticized											
1			1.00 to 1.06	30	300 to 550	15						
2			1.00 to 1.06	30	450 to 750	10						
0	other											
5	Plasticized, heat-stabilized											
1			1.00 to 1.06	20	200 to 350	20						
2			1.00 to 1.06	30	300 to 550	15						
3			1.00 to 1.06	30	450 to 750	10						
4			1.00 to 1.06	35	550 to 950	5.0						
0	other											
0	other											
05	PA612	0	Other									
1	General purpose											
1			1.05 to 1.07	50	1800	2.0	45					
2			1.05 to 1.07	50	1800	2.5	45					
3			1.05 to 1.07	50	1800	3.0	45					

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min		
06	PA46	2	Heat-stabilized	G35	35 % glass		1.28 to 1.38	140	7000	9.0	175		
				G45	45 % glass		1.38 to 1.48	150	8500	11	180		
				0	other								
				1		140	1.05 to 1.07	50	1800	2.0	45		
				G20	20 % glass		1.17 to 1.25	105	4500	5.0	170		
				G30	30 % glass		1.25 to 1.33	120	5500	5.0	170		
				G35	35 % glass		1.28 to 1.38	140	7000	9.0	175		
				0	other								
				1		140	1.05 to 1.07	50	1800	1.5	45		
				3	Weather-stabilized ^G								
				0	Other		other						
				1	General-purpose		other						
		2		170	1.16 to 1.20	85	2300	6.0					
		2		195	1.16 to 1.20	85	2300	6.0	140				
		0	other										
		1	Heat-stabilized	165	1.16 to 1.20	85	2300	6.0	140				
		2		195	1.16 to 1.20	85	2300	6.0	140				
		G15	15 % glass		1.25 to 1.31	125	5000	3.6	240				
		G30	30 % glass		1.38 to 1.42	175	8000	7.5	280				
		G40	40 % glass		1.48 to 1.53	195	10 000	10.0	280				
		G50	50 % glass		1.58 to 1.63	210	12 000	12.0	280				
		G60	60 % glass		1.70 to 1.77	215	16 000	10.0	280				
		R50	50 % filler		1.60 to 1.67	140	9000	4.0	280				
		0	other										
1			1.32 to 1.36	45	2250	4.0	140						
3	Flame-retardant ^H , heat-stabilized												
G15	15 % glass		1.55 to 1.59	115	6000	4.5	270						
G30	30 % glass		1.63 to 1.69	155	10 000	7.5	280						
G40	40 % glass		1.76 to 1.80	145	11 000	8.0	280						
G45	45 % glass		1.75 to 1.79	165	12 000	8.0	280						
0	other												
1			1.08 to 1.12	40	1500	50	70						
0	other												
4	Impact-modified, heat-stabilized												
5	Wear-resistant, heat-stabilized												
1		75	1.16 to 1.20	75	2200	3.0	140						
0	other												
07	PA6T/MPMDT	0	Other		other								
1	Heat-stabilized	G35	35 % glass		1.42 to 1.52	200	10 000	8.0	250				
G45	45 % glass		1.53 to 1.63	210	12 000	8.0	250						
0	other												
08	PA66 copoly-mers + blends	0	Other		other								
1	PA66/6 General purpose	G15	15 % glass		1.20 to 1.26	90	3500	3.0	180				
G35	35 % glass		1.35 to 1.45	160	7500	8.0	190						
G45	45 % glass		1.45 to 1.55	180	8500	10	200						
0	other												
2	66/6 heat-stabilized	G15	15 % glass		1.20 to 1.26	90	3500	3.0	180				
G25	25 % glass		1.29 to 1.37	115	4500	6.5	190						
G35	35 % glass		1.35 to 1.45	160	7500	8.0	190						
G45	45 % glass		1.45 to 1.55	180	8500	10	200						
M20	20 % mineral		1.25 to 1.33	70	3000	4.0							
M30	30 % mineral		1.35 to 1.45	75	4000	3.0							
M40	40 % mineral		1.45 to 1.55	75	4000	3.0							
0	other												
3	66 + 6 general purpose	G15	15 % glass		1.20 to 1.26	100	4000	3.0	200				
G35	35 % glass		1.35 to 1.45	170	8000	9.0	210						
G45	45 % glass		1.45 to 1.55	190	10 000	10	220						
0	other												
4	66 + 6 heat-stabilized	M20	20 % mineral		1.25 to 1.33	70	3000	3.0					
M40	40 % mineral		1.45 to 1.55	75	4500	3.0							
09	PA6 copoly-mer + blends	0	Other		other								
1	PA6 + polypropylene blend				1.00 to 1.05	50	2000	7.0	50				

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min				
10	PA6T/66	0	Heat-stabilized	G35	35 % glass		1.23 to 1.33	150	8500	9.0	200				
				R35	35 % filler		1.28 to 1.38	53	6000	2.0	135				
				0	other										
		1	Other	0	other										
			Heat-stabilized	G35	35 % glass		1.41 to 1.51	175	9000	6.0	270				
		2	High heat, heat stabilized	0		G45	45 % glass		1.52 to 1.62	205	12 000	7.5	270		
						G60	60 % glass		1.72 to 1.82	230	19 000	8.0	270		
						0	other								
				G35	35 % glass		1.39 to 1.49	180	9000	6.0	285				
					G45	45 % glass		1.49 to 1.59	210	12 000	9.0	285			
					G60	60 % glass		1.72 to 1.82	240	19 000	8.0	285			
		3	Impact-modified	0		G15	15 % glass		1.17 to 1.27	90	4500	6.5	245		
						G30	30 % glass		1.31 to 1.37	145	8000	10	270		
		4	Flame-retardant	0		G35	35 % glass		1.63 to 1.73	150	9000	7.0	260		
						G45	45 % glass		1.73 to 1.85	165	12 000	7.0	265		
5	Lubricated	0		G35	35 % glass		1.38 to 1.48	165	8500	6.0	285				
				0	other										
6	General Purpose	1		G35	20 % glass, reflective		1.41 to 1.51	95	7000	5.5	285				
				0	other										
11	PAMXD6	0	Other	0	other										
			General purpose	G30	30 % glass		1.43 to 1.47	170	10 000	4.5	225				
				G50	50 % glass		1.63 to 1.67	245	17 500	6.5	225				
		2	UV stability improved-exteriors	0		G60	60 % glass		1.75 to 1.79	240	21 000	8.0	225		
						G50	50 % glass		1.59 to 1.63	210	16 500	7.0	210		
						0	other								
3	Heat stabilized	G50	50 % glass		1.62 to 1.66	220	17 500	7.0	225						
12	PA6T/6I/66	0	Other	0	other										
			Heat-stabilized	G35	35 % glass		1.41 to 1.51	195	9500	7.0	265				
				G45	45 % glass		1.52 to 1.62	220	14 000	7.0	265				
		1	Heat-stabilized	0		G60	60 % glass		1.72 to 1.82	250	20000	7.0	265		
						M40	40 % mineral		1.49 to 1.59	93	6000	2.5	140		
						R40	40 % glass/mineral		1.49 to 1.59	130	8000	3.0	225		
		2	Heat stabilized, high strength	0		R65	65 % glass/mineral		1.82 to 1.92	115	13 000	2.0	260		
						0	other								
						R65	65 % glass/mineral		1.76 to 1.86	175	14 500	4.5	265		
		3	Impact-modified	1	0	0	other								
										1.09 to 1.19	58	1800	12	110	
										1.06 to 1.16	43	1700	25	105	
										1.05 to 1.15	50	1700	5.0	80	
										1.08 to 1.18	62	2000	12	115	
										1.11 to 1.18	55	1800	40	100	
								1.09 to 1.19	52	1800	2.0	100			
								1.23 to 1.33	125	5500	5.5	240			
								1.30 to 1.40	160	7500	6.5	255			
								0	other						
								G15	15 % glass		1.23 to 1.33	125	5500	5.5	240
								G25	25 % glass		1.30 to 1.40	160	7500	6.5	255
4	Plating	0		M40	40 % mineral		1.43 to 1.53	55	3000	2.0	115				
				0	other										
5	Flame-retardant	0		G35	35 % glass		1.64 to 1.74	160	12 000	5.5	250				
				G45	45 % glass		1.74 to 1.84	170	14 000	5.5	250				
7	Lubricated	0	0	0	other										
								1.37 to 1.47	85	5700	2.0	170			
								1.49 to 1.59	75	5500	2.5	150			
								1.53 to 1.63	220	14 000	7.0	260			
								0	other						

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min
13	PA 6T/6I	8	General purpose	G35	35 % glass, reflective		1.50 to 1.60	145	8500	5.5	255
		0		0	other						
		1	Heat-stabilized	G30	30 % glass	100	1.42 to 1.46	170	10 000	5.0	270
				G35	35 % glass		1.46 to 1.52	170	10 500	6.0	275
				G40	40 % glass	100	1.51 to 1.55	200	12 500	6.0	275
				G45	45 % glass	100	1.57 to 1.61	215	15 000	7.0	275
				G50	50 % glass	100	1.63 to 1.67	225	16 500	7.0	280
14	PA6/6T	0	Other	0	Other						
		1	High heat, heat-stabilized	1	Other	110	1.11 to 1.21	85	2700	6.0	85
				G25	25 % glass	110	1.30 to 1.40	140	7000	6.0	235
				G35	35 % glass	110	1.39 to 1.49	160	9000	8.0	235
				G50	50 % glass	110	1.57 to 1.67	200	14 000	10	235
				M5	5 % mineral	100	1.10 to 1.20	50	2400	10	220
				0	other						
15	PA4T copolymers + blends	2	Impact-modified, high heat, heat-stabilized	G30	30 % glass	110	1.32 to 1.42	140	7000	10	220
		3	Flame retardant, high heat, heat-stabilized	0	other						
				G25	25 % glass	105	1.33 to 1.43	120	7000	4.0	180
		1	General purpose	0	other (unfiled)		1.16 to 1.30	50	2500	2.0	140
				G30	30 % glass		1.38 to 1.48	160	9500	5.0	295
		2	Heat-stabilized	0	other						
				G30	30 % glass		1.40 to 1.50	150	9500	5.0	295
				G40	40 % glass		1.50 to 1.60	170	11 500	5.0	295
				G50	50 % glass		1.60 to 1.70	190	15 500	6.0	295
				0	other						
16	PA410 copolymers + blends	3	Impact modified, Heat-stabilized	G30	30 % glass		1.37 to 1.49	150	9000	6.0	285
		4	Flame retardant	0	other						
				G30	30 % glass		1.41 to 1.51	125	10 000	5.0	295
				G40	40 % glass		1.50 to 1.60	145	11 500	4.0	295
		5	Plating	0	other						
				1	35 % glass		1.48 to 1.62	100	10 000	1.0	285
				2	30 % glass, impact modified		1.40 to 1.52	90	7000	1.5	270
				3	30 % glass, flame retardant		1.54 to 1.64	75	9000	1.0	275
		0	Other	0	other						
		1	General purpose	1	other	120	1.07 to 1.13	65	2500	2.5	65
16	PA410 copolymers + blends	2		2		130	1.07 to 1.13	65	2500	2.5	65
				3		150	1.07 to 1.13	65	2500	2.5	65
				4		170	1.07 to 1.13	70	2500	3.0	65
		2	Heat-stabilized	0	other						
				G20	20 % glass		1.19 to 1.29	130	5500	6.0	190
				G25	25 % glass		1.24 to 1.34	140	6000	6.5	190
				G30	30 % glass		1.29 to 1.39	150	7000	7.0	200
				G35	35 % glass		1.34 to 1.43	160	8000	7.5	200
				G40	40 % glass		1.38 to 1.48	180	10 000	8.0	200
				G50	50 % glass		1.47 to 1.57	200	13 500	9.0	200
		G60	60 % glass		1.56 to 1.66	210	17 500	10	200		
		R30	30 % glass/mineral		1.30 to 1.40	70	6000	2.0	180		
		0	other								

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min		
17	PA9T	3	Impact-modified	1	unfilled	...	0.90 to 1.10	30	800	8.0	50		
				G30	30 % glass	...	1.25 to 1.35	120	6000	15	200		
				G40	40 % glass	...	1.35 to 1.45	150	9000	15	200		
		4	Flame retardant	0	other
				1	unfilled	...	1.05 to 1.25	60	3000	2.0	70		
				G30	30 % glass	...	1.35 to 1.45	120	8000	5.0	200		
		5	Plating	0	other
				G35	35 % glass	...	1.40 to 1.60	80	8000	2.0	200		
				0	other
		0	Other	0	other
				1	Heat-stabilized	...	115	1.12 to 1.16	75	2400	5.5	120	
				G30	30 % glass	1.35 to 1.45	165	9000	6.5	260	
		1	Heat-stabilized	G35	35 % glass	1.39 to 1.45	180	10 400	8.0	265	
				G50	50 % glass	1.56 to 1.60	215	15 400	11	265	
				0	other
		2	Impact-modified	1	other	1.10 to 1.14	70	2200	8.0	110	
				0	other
				3	Toughened	1.04 to 1.08	45	1600	40	115	
		2	Toughened	2	Extrusion Grade	1.06 to 1.10	45	1600	80	105	
				0	other
4	Flame Retardant			...	...	1.40 to 1.46	120	11 000	5.0	260	
4	Flame Retardant	G45	45 % glass	...	...	1.52 to 1.56	120	14 500	5.5	280	
		0	other	...	...	...	...	...	...	...	...
		0	Other	...	...	...	...	...	...	...	...
00	Other	0	Other	...	...	...	...	...	...	...

^A If data on 4-mm test specimens are limited, the minimum values will be changed in a later revision if a statistical database of sufficient size is generated, which justifies change.

^B Refer to 9.1 for source of test pieces.

^C No descriptions are listed unless needed to describe a special grade under the class. All other grades are listed by requirements.

^D Test Methods D792 is an acceptable alternative method.

^E Crosshead 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 %.

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

^G Weatherable nylon has typically contained about 2 % carbon black. Test Method D6260 - 98 (Withdrawn July 2004), D6260 Federal Specification L-P-419a, and other methods have been used to determine the amount of carbon black. It is possible that materials incorporating other pigments or soluble stabilizers, or both, may prove adequate for particular applications.

^H Relative Viscosities for Group 03 were generated from a correlation with Test Methods D789, utilizing an Ubbelohde viscometer, and m-Cresol as the solvent. Viscosity for groups 03, 04, and 05 (PA11, PA12, and PA6,12) in this classification shall be measured using solvents other than formic acid. Relative viscosities for Groups 03 and 04 shall be measured using 0.5 g of polymer dissolved in 99.5 g of m-cresol at 25.0 ± 0.1 °C in a Cannon-Fenske No. 200 viscometer. Inherent viscosity of Group 05 shall be measured using 0.5 g of polymer dissolved in 100 mL of m-cresol at 25.0 ± 0.1 °C in a Cannon-Fenske No. 200 viscometer. The inherent viscosity is calculated as follows:

$$\text{Inherent viscosity} = \frac{\ln(t_s/t_c)}{C}$$

where:

- t_s = average efflux time for sample solution,
- t_c = average efflux time for solvent, and
- C = concentration in g/100 mL.

^I For specific flammability requirements, use the proper suffix from Classification D4000, for example, FL310 = V0 at 0.8 mm.

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

Group	Description	Class	Description	Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min	Tensile Modulus, ^E ISO 527-1 and ISO 527-2, MPa, min	Charpy Impact Resistance, ISO 179/1eA, kJ/m ² , min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min
04	PA66	4	General-purpose	1		135	1.13 to 1.15	-70	2300	3-3	-60
				2		165	1.13 to 1.15	-70	2300	3-3	-60
				3		210	1.13 to 1.15	-70	2300	3-3	-60
				4		270	1.13 to 1.15	-70	2300	3-3	-60
				5	recycled	115	1.13 to 1.15	-70	2300	3-3	-60
				6	recycled	135	1.13 to 1.15	-70	2300	3-3	-60
				7		115	1.13 to 1.15	-70	2300	3-3	-60
				G15	15 % glass	...	1.20 to 1.26	100	4000	3-0	215
				G20	20 % glass	...	1.25 to 1.33	115	5000	4-0	220