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# Standard Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)<sup>1</sup>

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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This 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 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*

<sup>1</sup> This classification system is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

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*Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D789 Test Method for Determination of Relative Viscosity of Concentrated Polyamide (PA) Solutions

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)<sup>3</sup>

D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)<sup>3</sup>

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

### 2.2 IEC/ISO Standards:<sup>4</sup>

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

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

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

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

- 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 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.

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<br>(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 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.

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/m<sup>2</sup>, min,
- 7 = Deflection temperature at 1.8 MPa, 200°C, min, and
- 0 = Unspecified.

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

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/m<sup>2</sup>, min,
- 2 = Deflection temperature at 1.8 MPa, 55°C, min, and
- 0 = unspecified.

TABLE PA Requirements for Polyamides Dry-as-Molded<sup>A,B</sup>

| Group | Description Class            | Description       | Grade             | Description <sup>C</sup>  | Viscosity Number, ISO 307, min, mL/g | Density, <sup>D</sup> ISO 1183 g/cm <sup>3</sup> | Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min | Tensile Modulus, <sup>E</sup> ISO 527-1 and ISO 527-2, MPa, min | Charpy Impact Resistance, ISO 179/1eA, kJ/m <sup>2</sup> , min | Deflection Temperature, <sup>F</sup> 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 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 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 Nucleated, heat-stabilized |                   | 1                 | Requirements the same as corresponding grades under Group 01, Class 3 |                                      |  |   |   |  |   |      |     |
|       |                              |                   | 2                 |   |                                      |  |   |   |  |   |      |     |
|       |                              |                   | 3                 |   |                                      |  |   |   |  |   |      |     |
|       |                              |                   | 4                 |   |                                      |  |   |   |  |   |      |     |
|       |                              |                   | 5                 |   |                                      |  |   |   |  |   |      |     |
|       |                              | 0 other           |                   |   |                                      |  |   |   |  |   |      |     |
|       | 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   |      |     |

**TABLE PA Requirements for Polyamides Dry-as-Molded<sup>A,B</sup>**

| Group | Description Class | Description                      | Grade | Description <sup>C</sup> | Viscosity Number, ISO 307, min, mL/g | Density, <sup>D</sup> ISO 1183 g/cm <sup>3</sup> | Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min | Tensile Modulus, <sup>E</sup> ISO 527-1 and ISO 527-2, MPa, min | Charpy Impact Resistance, ISO 179/1eA, kJ/m <sup>2</sup> , min | Deflection Temperature, <sup>F</sup> ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min |
|-------|-------------------|----------------------------------|-------|--------------------------|--------------------------------------|--|---|---|--|---|
|       |                   |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       | 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                    |                                      |  |   |   |  |   |
|       | 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 <sup>G</sup>  | 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                 | Other                            | 0     | other                    |                                      |  |   |   |  |   |
| 02    | PA6               | General-purpose                  | 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  |

**TABLE PA Requirements for Polyamides Dry-as-Molded<sup>A,B</sup>**

| Group           | Description Class | Description                          | Grade             | Description <sup>C</sup> | Viscosity Number, ISO 307, min, mL/g | Density, <sup>D</sup> ISO 1183 g/cm <sup>3</sup> | Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min | Tensile Modulus, <sup>E</sup> ISO 527-1 and ISO 527-2, MPa, min | Charpy Impact Resistance, ISO 179/1eA, kJ/m <sup>2</sup> , min | Deflection Temperature, <sup>F</sup> ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min |     |    |
|-----------------|-------------------|--------------------------------------|-------------------|--------------------------|--------------------------------------|--|---|---|--|---|-----|----|
| 03 <sup>H</sup> | PA11              | 5 Impact-modified                    | 5                 | recycled                 | 135                                  | 1.12 to 1.14                                     | 70  | 2100  | 2.5  | 50  |     |    |
|                 |                   |                                      | 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  |     |    |
|                 |                   |                                      | 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   |     |    |
|                 |                   |                                      | G40               | 40 % glass               |                                      | 1.39 to 1.47                                     | 135   | 8000  | 10   | 200   |     |    |
|                 |                   |                                      | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   | 6 Impact-modified, heat-stabilized   | 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  |     |    |
|                 |                   | 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                              | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   |                                      | 1                 | General purpose          | 1                                    |  | 115 to 140  | 1.01 to 1.06  | 35   | 900   | 4.0 | 36 |
|                 |                   |                                      | 2                 |                          | 2                                    |  | 160 to 190  | 1.01 to 1.06  | 35   | 900   | 6.0 | 36 |
|                 |                   |                                      | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   |                                      | 2 Heat-stabilized | 1                        |                                      |  | 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 |
|                 |                   |                                      |                   | 3                        | UV Stabilized                        |  | 160 to 190  | 1.01 to 1.06  | 35   | 900   | 4.0 | 36 |
|                 |                   |                                      |                   | 4                        |                                      |  | 210 to 255  | 1.01 to 1.06  | 35   | 900   | 6.0 | 36 |
|                 |                   |                                      | 3 Plasticized     | 0                        | other                                |  |   |   |  |   |     |    |
|                 |                   |                                      |                   | 1                        |                                      |  | 170 to 200  | 1.01 to 1.06  | 30   | 370   | 25  | 36 |
|                 |                   | 4 Plasticized, Heat Stabilized       | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   |                                      | 1                 |                          |                                      | 180 to 240                                       | 1.01 to 1.06  | 35  | 500  | 25  | 36  |    |
|                 |                   |                                      | 2                 |                          |                                      | 170 to 200                                       | 1.01 to 1.06  | 35  | 400  | 25  | 36  |    |
|                 |                   |                                      | 3                 |                          |                                      | 115 to 140                                       | 1.01 to 1.06  | 30  | 350  | 25  | 36  |    |
|                 |                   |                                      | 4                 | UV Stabilized            |                                      | 175 to 240                                       | 1.01 to 1.06  | 35  | 400  | 25  | 36  |    |
|                 |                   |                                      | 5                 |                          |                                      | 170 to 190                                       | 1.01 to 1.06  | 30  | 370  | 25  | 36  |    |
| 6               |                   |                                      |                   | 200 to 230               | 1.01 to 1.06                         | 35   | 370   | 25  | 36   |   |     |    |
| 7               | UV Stabilized     |                                      |                   | 160 to 240               | 1.01 to 1.06                         | 35   | 340   | 25  | 36   |   |     |    |
| 0               | other             |                                      |                   |                          |                                      |  |   |   |  |   |     |    |
| 04              | PA12              |                                      | 0 Other           | 0                        | other                                |  |   |   |  |   |     |    |
|                 |                   | 1                                    |                   | General purpose          | 1                                    |  | 100 to 210  | 1.00 to 1.06  | 30   | 800   | 2.5 | 35 |
|                 |                   | 2                                    |                   |                          |                                      | 100 to 210                                       | 1.00 to 1.06  | 35  | 1000   | 2.5   | 35  |    |
|                 |                   | 3                                    |                   |                          |                                      | 211 to 270                                       | 1.00 to 1.06  | 35  | 1000   | 2.5   | 35  |    |
|                 |                   | 4                                    |                   |                          |                                      | 271 to 340                                       | 1.00 to 1.06  | 35  | 1000   | 2.5   | 35  |    |
|                 |                   | 2 Heat-stabilized                    | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   |                                      | 1                 |                          |                                      | 100 to 150                                       | 1.00 to 1.06  | 35  | 800  | 2.5   | 35  |    |
|                 |                   |                                      | 2                 |                          |                                      | 151 to 210                                       | 1.00 to 1.06  | 35  | 800  | 2.5   | 35  |    |
|                 |                   |                                      | 3                 |                          |                                      | 211 to 280                                       | 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                 |                          |                                      | 100 to 180                                       | 1.00 to 1.06  | 35  | 800  | 1.0   | 35  |    |
|                 |                   |                                      | 2                 |                          |                                      | 181 to 250                                       | 1.00 to 1.06  | 35  | 800  | 1.0   | 35  |    |
|                 |                   |                                      | 0                 | other                    |                                      |  |   |   |  |   |     |    |
|                 |                   | 4 Plasticized                        | 1                 |                          |                                      | 100 to 280                                       | 1.00 to 1.06  | 30  | 300 to 550   | 15  |     |    |
|                 |                   |                                      | 2                 |                          |                                      | 100 to 280                                       | 1.00 to 1.06  | 30  | 450 to 750   | 10  |     |    |
| 0               | other             |                                      |                   |                          |                                      |  |   |   |  |   |     |    |



**TABLE PA Requirements for Polyamides Dry-as-Molded<sup>A,B</sup>**

| Group | Description Class                | Description                  | Grade  | Description <sup>C</sup> | Viscosity Number, ISO 307, min, mL/g | Density, <sup>D</sup> ISO 1183 g/cm <sup>3</sup> | Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min | Tensile Modulus, <sup>E</sup> ISO 527-1 and ISO 527-2, MPa, min | Charpy Impact Resistance, ISO 179/1eA, kJ/m <sup>2</sup> , min | Deflection Temperature, <sup>F</sup> ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min |      |      |     |     |
|-------|----------------------------------|------------------------------|--|--------------------------|--------------------------------------|--|---|---|--|---|------|------|-----|-----|
| 05    | PA612                            | Plasticized, heat-stabilized | 1  |                          | 100 to 280                           | 1.00 to 1.06                                     | 20  | 200 to 350  | 20   |   |      |      |     |     |
|       |                                  |                              | 2  |                          | 100 to 280                           | 1.00 to 1.06                                     | 30  | 300 to 550  | 15   |   |      |      |     |     |
|       |                                  |                              | 3  |                          | 100 to 280                           | 1.00 to 1.06                                     | 30  | 450 to 750  | 10   |   |      |      |     |     |
|       |                                  |                              | 4  |                          | 100 to 280                           | 1.00 to 1.06                                     | 35  | 550 to 950  | 5.0  |   |      |      |     |     |
|       |                                  |                              | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  | 0                            | Other  | 0                        | 0                                    | other  |   |   |  |   |      |      |     |     |
|       |                                  |                              |  |                          | 1                                    | General purpose                                  | 100 to 139  | 1.05 to 1.07  | 50   | 1800  | 2.0  | 45   |     |     |
|       |                                  | 06                           | PA46   | Heat-stabilized          | 2                                    |  | 140 to 199  | 1.05 to 1.07  | 50   | 1800  | 2.5  | 45   |     |     |
|       |                                  |                              |  |                          | 3                                    |  | 200   | 1.05 to 1.07  | 50   | 1800  | 3.0  | 45   |     |     |
|       |                                  |                              |  |                          | 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                                |  |   |   |  |   |      |      |     |     |
|       |                                  |                              |  | 2                        | Heat-stabilized                      | 1  | 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                            |                              |  |                          |                                      |  |   |   |  |   |      |      |     |     |
| 3     | Weather-stabilized <sup>G</sup>  | 1                            | 1  |                          | 140                                  | 1.05 to 1.07                                     | 50  | 1800  | 1.5  | 45  |      |      |     |     |
|       |                                  |                              | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
| 07    | PA6T/MPMDT                       | Other                        | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  |                              | 1  | General-purpose          | 1                                    |  | 170   | 1.16 to 1.20  | 85   | 2300  | 6.0  |      |     |     |
|       |                                  |                              |  |                          | 2                                    |  | 195   | 1.16 to 1.20  | 85   | 2300  | 6.0  | 140  |     |     |
|       |                                  | 0                            | other  |                          |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  | 2                            | Heat-stabilized                                | 1                        | 1                                    |  | 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  |                          |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  | 3                            | Flame-retardant <sup>I</sup> , heat-stabilized | 1                        | 1                                    |  |   | 1.32 to 1.36  | 45   | 2250  | 4.0  | 140  |     |     |
|       |                                  |                              |  |                          | 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                            |                              |  |                          |                                      |  |   |   |  |   |      |      |     |     |
| 4     | Impact-modified, heat-stabilized | 1                            | 1  |                          |                                      | 1.08 to 1.12                                     | 40  | 1500  | 50   | 70  |      |      |     |     |
|       |                                  |                              | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  |                              | 5  |                          |                                      |  | 1.16 to 1.20  | 75  | 2200   | 3.0   | 140  |      |     |     |
| 0     | other                            |                              |  |                          |                                      |  |   |   |  |   |      |      |     |     |
| 0     | Other                            | 0                            | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  |                              | 1  | Heat-stabilized          | G35                                  | 35 % glass                                       |   | 1.42 to 1.52  | 200  | 10 000  | 8.0  | 250  |     |     |
| 0     | Other                            | 0                            | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  |                              | 1  | General purpose          | G45                                  | 45 % glass                                       |   | 1.53 to 1.63  | 210  | 12 000  | 8.0  | 250  |     |     |
| 08    | PA66 copolymers + blends         | 66/6 heat-stabilized         | 0  | other                    |                                      |  |   |   |  |   |      |      |     |     |
|       |                                  |                              | 1  | 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  |   |      |      |     |     |
|       |                                  | 2                            | 66/6 heat-stabilized                           | 0                        | 0                                    | other  |   |   |  |   |      |      |     |     |
|       |                                  |                              |  |                          | 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                         | 0                        | 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   |      |      |     |     |

**TABLE PA Requirements for Polyamides Dry-as-Molded<sup>A,B</sup>**

| Group | Description Class      | Description                      | Grade | Description <sup>C</sup> | Viscosity Number, ISO 307, min, mL/g | Density, <sup>D</sup> ISO 1183 g/cm <sup>3</sup> | Tensile Strength, ISO 527-1 and ISO 527-2, MPa, min | Tensile Modulus, <sup>E</sup> ISO 527-1 and ISO 527-2, MPa, min | Charpy Impact Resistance, ISO 179/1eA, kJ/m <sup>2</sup> , min | Deflection Temperature, <sup>F</sup> ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min |
|-------|------------------------|----------------------------------|-------|--------------------------|--------------------------------------|--|---|---|--|---|
|       |                        |                                  | 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 copolymer + blends | 0 Other                          | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 1 PA6 + polypropylene blend      | 1     |                          |                                      | 1.00 to 1.05                                     | 50  | 2000  | 7.0  | 50  |
|       |                        | 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                    |                                      |  |   |   |  |   |
| 10    | PA6T/66                | 0 Other                          | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 1 Heat-stabilized                | G35   | 35 % glass               |                                      | 1.41 to 1.51                                     | 175   | 9000  | 6.0  | 270   |
|       |                        |                                  | 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                    |                                      |  |   |   |  |   |
|       |                        | 2 High heat, heat stabilized     | 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   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 3 Impact-modified                | 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   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 4 Flame-retardant                | 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   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 5 Lubricated                     | G35   | 35 % glass               |                                      | 1.38 to 1.48                                     | 165   | 8500  | 6.0  | 285   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 6 General Purpose                | 1     | 20 % glass, reflective   |                                      | 1.41 to 1.51                                     | 95  | 7000  | 5.5  | 285   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
| 11    | PAMXD6                 | 0 Other                          | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 1 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   |
|       |                        |                                  | G60   | 60 % glass               |                                      | 1.75 to 1.79                                     | 240   | 21 000  | 8.0  | 225   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 2 UV stability improved-exterior | 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   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
| 12    | PA6T/6I/66             | 0 Other                          | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 1 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   |
|       |                        |                                  | 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   |
|       |                        |                                  | R65   | 65 % glass/mineral       |                                      | 1.82 to 1.92                                     | 115   | 13 000  | 2.0  | 260   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 2 Heat stabilized, high strength | R65   | 65 % glass/mineral       |                                      | 1.76 to 1.86                                     | 175   | 14 500  | 4.5  | 265   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 3 Impact-modified                | 1     |                          |                                      | 1.09 to 1.19                                     | 58  | 1800  | 12   | 110   |
|       |                        |                                  | 2     |                          |                                      | 1.06 to 1.16                                     | 43  | 1700  | 25   | 105   |
|       |                        |                                  | 3     |                          |                                      | 1.05 to 1.15                                     | 50  | 1700  | 5.0  | 80  |
|       |                        |                                  | 4     |                          |                                      | 1.08 to 1.18                                     | 62  | 2000  | 12   | 115   |
|       |                        |                                  | 5     |                          |                                      | 1.11 to 1.18                                     | 55  | 1800  | 40   | 100   |
|       |                        |                                  | 6     |                          |                                      | 1.09 to 1.19                                     | 52  | 1800  | 2.0  | 100   |
|       |                        |                                  | 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   |
|       |                        |                                  | 0     | other                    |                                      |  |   |   |  |   |
|       |                        | 4 Plating                        | M40   | 40 % mineral             |                                      | 1.43 to 1.53                                     | 55  | 3000  | 2.0  | 115   |