Designation: D6779 - 12 D6779 - 12a

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.

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 and health practices and determine the applicability of regulatory requirements prior to use.

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

2. Referenced Documents

2.1 ASTM Standards:²

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D789 Test Methods for Determination of Solution Viscosities of Polyamide (PA) 98-d8bfa99dfb54/astm-d6779-12a

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

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

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.

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.



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

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:

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

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/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.

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.

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

Group	Description	n 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/m², min	Deflection Temperature, ^F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min
01	PA66	1	General-	1		135	1.13 to 1.15	70	2300	3.3	60
			purpose	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



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

roup 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/m², min	Deflection Temperatu ISO 75- and ISO 75-2 at 1.8 MF °C, min
			M40	40 % mineral		1.45 to 1.55	80	5000	2.0	100
	_		0	other						
	2	Heat-	1		135	1.13 to 1.15	70 70	2300	3.0	60
		stabilized	2		165	1.13 to 1.15	70	2300	3.0	60
			3 4		210	1.13 to 1.15	70 70	2300	3.0	60
			5	re eveled	270	1.13 to 1.15 1.13 to 1.15	70	2300	3.0	60 60
			6	recycled	115 135		70 70	2300 2300	3.0 3.0	60
			G15	recycled 15 % glass		1.13 to 1.15 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	• • •		.00	- 300		
	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
	4	Nucleated,	0 1	other	Poguiromento	the same as a	orrosponding a	rades under Gro	oup 01 Class 3	
	4	heat-	2		requirements	trie same as c	orresponding gr	ades under Gro	Jup 01, Class 3	
		stabilized	3 4							
			5 0	other						
	5	Impact-	1			LLMAKE	IOTT			
						1.06 to 1.12	52	1700	9.0	50
	3	•		recycled		1.06 to 1.12 1.06 to 1.12	52	1700 1600	9.0 8.0	50 50
	J	modified	2	recycled 15 % glass		1.06 to 1.12	50	1600	8.0	50
	J	•		15 % glass						
	3	•	2 G15			1.06 to 1.12 1.15 to 1.23	50 85	1600 3000	8.0 6.0	50 210
	6	•	2 G15 G35	15 % glass 35 % glass		1.06 to 1.12 1.15 to 1.23	50 85	1600 3000 5500	8.0 6.0	50 210
	6	modified Impact-	2 G15 G35 0	15 % glass 35 % glass	M D677	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41	50 85 110	1600 3000 5500	8.0 6.0 6.0	50 210 225
	6	modified Impact-	2 G15 G35 0 1	15 % glass 35 % glass other ASI	TM D677	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12	50 85 110	1600 3000 5500	8.0 6.0 6.0	50 210 225 50
	6	modified Impact- modified, cata	2 G15 G35 0 1	15 % glass 35 % glass other AST	<u>TM D677</u> 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12	50 85 110 52 7-869 50 d8	1600 3000 5500 1700 1600 54	8.0 6.0 6.0 9.0 4/astr8.0d67	50 210 225 79-1.50
	6	modified Impact- modified, Cata heat-	2 G15 G35 0 1 log/2an	15 % glass 35 % glass other AST recycled IST/9b 15 % glass	<u>FM D677</u> 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23	50 85 110 52 7-86 50 85	1600 3000 5500 1700 1600 554 3000	8.0 6.0 6.0 4/ast 8.0 67 6.0	50 210 225 79-1 50 210
	6	modified Impact- modified, Cata heat-	2 G15 G35 0 1 G2/2 G15 G35	15 % glass 35 % glass other ASI recycled ISI/9b 15 % glass 35 % glass	T <u>M D677</u> 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41	50 85 110 52 7-85 50 85 110	1600 3000 5500 1700 1600 54 3000 5500	8.0 6.0 6.0 4/ast 8.0 67 6.0 6.0	50 210 225 79-1 50 210 225
	6 ards	modified Impact- modified, cata heat- stabilized	2 G15 G35 0 1 G15 G35 M40 R35	15 % glass 35 % glass other ASI recycled MASI 15 % glass 35 % glass 40 % mineral	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48	50 85 110 52 7-85 50 85 110 75 80	1600 3000 5500 1700 1600 54 3000 5500 4500 5500	8.0 6.0 6.0 4/ast 8.0 67 6.0 6.0 4.0 3.0	50 210 225 79-1 50 210 225 200
	6 ards	modified Impact- modified, Cata heat-	2 G15 G35 0 1 2 G15 G35 M40 R35 0 1	15 % glass 35 % glass other ASI recycled 15 % glass 35 % glass 40 % mineral 35 % filler other	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.38 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48	50 85 110 52 50 85 110 75 80	1600 3000 5500 1700 1600 5500 4500 5500 1500	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0	50 210 225 79-1 50 210 225 200
	6 ards	modified Impact- modified, cata heat- stabilized	2 G15 G35 0 1 0/2 G15 G35 M40 R35 0 1	15 % glass 35 % glass other ASI recycled SI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other	<u>FM D677</u> 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.38 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10	50 85 110 52 50 85 110 75 80 42 40	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0	50 210 225 79- 50 210 225 200 45 45
	6 ards	modified Impact- modified, cata heat- stabilized	2 G15 G35 0 1 0/2 G15 G35 M40 R35 0 1 2 G15	15 % glass 35 % glass other ASI recycled SI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23	50 85 110 52 85 110 75 80 42 40 70	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0	50 210 225 79- 50 210 225 200 45 45 180
	6 ards	modified Impact- modified, cata heat- stabilized	2 G15 G35 0 1 C15 G35 M40 R35 0 1 2 G15 G35	15 % glass 35 % glass other ASI recycled SI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.38 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10	50 85 110 52 50 85 110 75 80 42 40	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0	50 210 225 79- 50 210 225 200 45 45
	6 ards 7	modified Impact- modified, Cata heat- stabilized Toughened	2 G15 G35 0 1 C15 G35 M40 R35 0 1 2 G15 G35	15 % glass 35 % glass other ASI recycled SI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass	TM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 7-8b 50 85 110 75 80 42 40 70 110	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11	50 210 225 79- 50 210 225 200 45 45 180 220
	6 ards 7	modified Impact- modified, cata heat- stabilized Toughened	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35	15 % glass 35 % glass other ASI recycled ISI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 7-85 50 85 110 75 80 42 40 70 110	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11	50 210 225 79-150 210 225 200 45 45 180 220
	6 ards 7	modified Impact- modified, cata heat- stabilized Toughened Tough- ened,	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2	15 % glass 35 % glass other ASI recycled ISI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.38 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 50 85 110 75 80 42 40 70 110	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11	50 210 225 79- 50 210 225 200 45 45 180 220
	6 ards 7	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat-	G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2	15 % glass 35 % glass other ASI recycled SI/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass	FM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.23 1.38 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.25 to 1.11 1.15 to 1.23	50 85 110 52 50 85 110 75 80 42 40 70 110	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500	8.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180
	6 ards 7	modified Impact- modified, cata heat- stabilized Toughened Tough- ened,	2 G15 G35 0 1 Q15 G35 M40 R35 0 1 2 G15 G35 0 1 2	15 % glass 35 % glass other recycled \$1,96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass other	TM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110	1600 3000 5500 1700 1800 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500	8.0 6.0 6.0 9.0 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220
	6 ards 7	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35	15 % glass 35 % glass other recycled \$1,96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass other	76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11	50 210 225 79 - 50 210 225 200 45 45 180 220 45 45 180 220 230
	6 ards 7	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 G35 0 1 2 G15 G35 M40 R35	15 % glass 35 % glass other recycled \$1/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass other recycled 55 % glass 56 % glass 57 % glass	TM D677 76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110	1600 3000 5500 1700 1800 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500	8.0 6.0 6.0 9.0 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11	50 210 225 79 - 50 210 225 200 45 45 180 220 45 45 180 220
	6 ards 7	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35	15 % glass 35 % glass other recycled \$1,96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass other	76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11	50 210 225 79- 50 210 225 200 45 45 180 220 45 180 220 230
	6 ards 7	modified Impact- modified, cata heat- stabilized Toughened Tough- ened, heat- stabilized	2 G15 G35 0 1 2 G15 G35 M40 R35 0 1 2 G15 G35 G35 G35 G45 M35 G45 M35	15 % glass 35 % glass other recycled \$1/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass other recycled 55 % glass 56 % glass 57 % glass	76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110 130 70	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0	50 210 225 50 79- 50 210 225 200 45 45 180 220 45 45 180 220 230
	6 ards 7	modified Impact- modified, Cata heat- stabilized Tough- ened, heat- stabilized Weather-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M40 R35	15 % glass 35 % glass other recycled 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 35 % glass 35 % mineral other	 76ca28-7 	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 230
	6 ards 7 7 8 8	modified Impact- modified, Cata heat- stabilized Tough- ened, heat- stabilized Weather- stabil-	G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M40 R35	15 % glass 35 % glass other recycled \$1,96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 45 % glass 35 % mineral other recycled	 76ca28-7 	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 230
	6 ards 7 7 8 8	modified Impact- modified, Cata heat- stabilized Tough- ened, heat- stabilized Weather- stabil- ized ^G	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M40 1 2 G15 G35 0 1 2 G15 G35	15 % glass 35 % glass other recycled 15 9 h 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 45 % glass 35 % glass 45 % glass 35 % mineral other recycled other	 76ca28-7 	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 230
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Tough- ened, heat- stabilized Weather- stabil- ized ^G Other	G15 G35 O 1 G15 G35 M40 R35 O 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 G35	15 % glass 35 % glass other recycled 15 9 h 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 45 % glass 35 % glass 45 % glass 35 % mineral other recycled other	76ca28-7	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 9-22 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70 65	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 230 60 60
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	G15 G35 O 1 G15 G35 M40 R35 O 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 G35 O 0 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 O 0 1 2 G15 O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15 % glass 35 % glass other recycled 15 9 h 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 45 % glass 35 % glass 45 % glass 35 % mineral other recycled other	 76ca28-7 135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 9 2 1 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200	8.0 6.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 60 60
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	G15 G35 O 1 G15 G35 M40 R35 O 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 G35 O 1 2 G15 G35	15 % glass 35 % glass other recycled 15 9 h 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 45 % glass 35 % glass 45 % glass 35 % mineral other recycled other		1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.3 1.31 to 1.41 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70 65	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 45 45 180 220 30 60 60
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	G15 G35 O 1 G15 G35 M40 R35 O 1 2 G15 G35 O 1 2 G15 G35 G45 M35 O 1 2 G15 G35 G45 G35 G45 G45 G45 G45 G45 G45 G45 G45 G45 G4	15 % glass 35 % glass other recycled 15 9 h 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 45 % glass 35 % glass 45 % glass 35 % mineral other recycled other	135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.2 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17 1.12 to 1.14 1.12 to 1.14 1.12 to 1.14	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200	8.0 6.0 6.0 6.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 230 60 60 50 50 50 50 170
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M35 0 1 2 G15 G35 0 1 2 G15 G35 0 1 2 G15 G35 0 1 2 G15 G35 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15 % glass 35 % glass other recycled \$1/9b 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 45 % glass 35 % mineral other recycled other other	135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17 1.12 to 1.14 1.12 to 1.14 1.12 to 1.14 1.12 to 1.15 1.12 to 1.15	50 85 110 52 50 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200	8.0 6.0 6.0 9.0 4/ast 8.0 167 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 50 79 - 50 210 225 200 45 45 180 220 230 60 60 50 50 50 50 50 50 50 50 50 5
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	G15 G35 O 1 G15 G35 M40 R35 O 1 2 G15 G35 O 1 2 G15 G35 G45 M35 O 1 2 G15 G35 G45 G35 G45 G45 G45 G45 G45 G45 G45 G45 G45 G4	15 % glass 35 % glass other recycled \$1.96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 35 % glass 45 % glass 35 % mineral other recycled other recycled other 15 % glass 35 % glass 35 % mineral other	135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.13 to 1.17 1.12 to 1.14 1.12 to 1.14 1.12 to 1.14 1.12 to 1.15 1.20 to 1.28	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2400 2200 2200 2200 4200	8.0 6.0 6.0 6.0 9.0 4.0 8.0 16.0 6.0 4.0 3.0 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 79- 50 210 225 200 45 45 180 220 230 60 60 50 50 50 50 170
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M35 0 1 2 G15 G35 G35 O 1 2 G15 G35 O 0 1 2 G15 G35 O 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15 % glass 35 % glass other recycled \$1,96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 35 % glass 45 % glass 35 % mineral other recycled other other	135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.108 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.12 to 1.14 1.12 to 1.14 1.12 to 1.14 1.12 to 1.15 1.20 to 1.28 1.28 to 1.36	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2200 2200 2200 2200 4200 5000	8.0 6.0 6.0 6.0 9.0 4.0 8.0 16.0 6.0 4.0 3.0 40 35 9.0 11 10 6.0 2.5 2.0 4.0 3.0 3.0 4.0 6.0 6.0 4.0 3.0	50 210 225 79- 50 210 225 200 45 45 180 220 230 60 60 60
	6 ards 7 8 8 9 0	modified Impact- modified, Cata heat- stabilized Toughened Tough- ened, heat- stabilized Weather- stabil- ized ^G Other General-	2 G15 G35 0 1 G15 G35 M40 R35 0 1 2 G15 G35 0 1 2 G15 G35 M35 0 1 2 G15 G35 G35 G35 G35 G35 G35 G35 G35 G35 G3	15 % glass 35 % glass other recycled \$1.96 15 % glass 35 % glass 40 % mineral 35 % filler other recycled 15 % glass 35 % glass other recycled 15 % glass 35 % glass 35 % glass 35 % glass 45 % glass 35 % mineral other recycled other recycled other 15 % glass 35 % glass 35 % mineral other	135 115	1.06 to 1.12 1.15 to 1.23 1.31 to 1.41 2.1.08 to 1.12 1.08 to 1.12 1.15 to 1.23 1.31 to 1.41 1.45 to 1.55 1.38 to 1.48 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.06 to 1.10 1.05 to 1.11 1.15 to 1.23 1.28 to 1.38 1.39 to 1.49 1.37 to 1.47 1.13 to 1.17 1.12 to 1.14 1.12 to 1.14 1.12 to 1.14 1.12 to 1.15 1.20 to 1.28 1.28 to 1.38 1.28 to 1.36 1.29 to 1.28 1.21 to 1.28 1.22 to 1.28 1.23 to 1.28 1.23 to 1.28 1.24 to 1.28 1.25 to 1.28 1.26 to 1.28 1.27 to 1.28 1.28 to 1.36 1.32 to 1.40	50 85 110 52 85 110 75 80 42 40 70 110 42 40 70 110 130 70 80 65	1600 3000 5500 1700 1600 54 3000 5500 4500 5500 1500 1300 2800 5500 1500 1300 2800 5500 8000 3800 2200 2200 2200 2200 2200 4200 5000 7000	8.0 6.0 6.0 6.0 4.0 3.0 40 35 9.0 11 40 35 9.0 11 10 6.0 2.5 2.0	50 210 225 50 79-1 50 210 225 200 45 45 180 220 230 60 60 60



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

Group [Description Class	s Descripti	on Grade	Description ^C	Viscosity Number, ISO 307, min, mL/g	Density, ^D ISO 1183 g/cm ³	Tensile Strength ISO 527 and ISO 527- MPa, m	Modulus, ^E -1 ISO 527-1 and -2, ISO 527-2,	Charpy Impact Resistance, ISO 179/ 1eA, kJ/m², min	Deflection Temperature, F ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min
			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	114	0	other	400	4 40 += 4 44	7.5	0.400	4.0	50
	2	Heat- stabilized	1 2		100 135	1.12 to 1.14 1.12 to 1.14	75 70	2400 2200	4.0 3.0	50 50
		Stabilizeu	3		150	1.12 to 1.14 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 G50	45 % glass 50 % glass		1.46 to 1.54 1.52 to 1.60	175 175	10 000 10 000	10 10	190 190
			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
	2	Nucleoted	0	other	100	11240 111	3	2200	2.5	FO
	3	Nucleated and	1 2		100	1.12 to 1.14 1.12 to 1.14	70 70	2300 2300	2.5 2.5	50 50
		lubricated			150	1.12 to 1.14 1.12 to 1.15	75	2300	2.5	50
		idoliodiod	(ht_0^3)	Other	200	1.12 to 1.15	80	2300	2.5	50
	4	Nucleated	1		100	1.12 to 1.14	70	2300	2.5	50
		and heat-	2		135	1.12 to 1.14	70	2300	2.5	50
		stabilized	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 other AS	135 FM D677	1.12 to 1.14 9-12a	70	2100	2.5	50
	5 c://ctandard	Impact-	1 atalog/stan			1.05 to 1.12	7 8 6 6 6	1700	30	45 770 125
		modified C	atalog/s 2 an 3			1.05 to 1.18 1.05 to 1.18	/-86955 40	1000	6.0	35
			G15	15 % glass		1.15 to 1.16	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 0	40 % glass other		1.39 to 1.47	135	8000	10	200
	6	Impact-	1			1.05 to 1.12	45	1700	30	45
		modified,	2			1.05 to 1.18	55	2000	6.0	45
		heat-	3			1.05 to 1.18	40	1000	6.0	35
		stabilized	4 G15	15 % along		1.05 to 1.18	25 75	1000	30	30 130
			G15 G30	15 % glass 30 % glass		1.15 to 1.24 1.30 to 1.40	75 135	3300 6500	9.0 15	130 180
			G35	35 % glass		1.30 to 1.40	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 0	40 % mineral other		1.39 to 1.47	65	3200	3.0	50
	7	Flexural- modified,	1	injection molding		1.05 to 1.16	55	2375 max	10	45
		heat-	2	extrusion		1.05 to 1.16	30	2000 max	7.0	25
		stabilized	3	blends		1.05 to 1.10	35	1700 max	4.5	35
	_	Oth -	0	other						
03 ^H F	0 PA11 1	Other General	0 1	other	115 to 140	1.01 to 1.06	35	900	4.0	36
03 F	All I	purpose	2			1.01 to 1.06	35 35	900	6.0	36
		Parbooc	0	other	100 10 190	10 1.00	55	300	0.0	00



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

Group	Description	n 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/m², min	Deflection Temperature, ISO 75-1 and ISO 75-2, at 1.8 MPa, °C, min
		2	Heat-	1		115 to 140	1.01 to 1.06	35	900	4.0	36
			stabilized	2		160 to 190	1.01 to 1.06	35	900	6.0	36
				3	black		1.01 to 1.06	-35	900	-4.0	-36
				3	UV Stabilized	160 to 190	1.01 to 1.06	_35	900	4.0	_36
				4	Otabilizea	210 to 255	1.01 to 1.06	35	900	6.0	36
		3	0 Plasticized	other 1		170 to 200	1.01 to 1.06	30	370	25	36
		4	Districts of Lines	0	other	400 to 040	4.04 += 4.00	25	500	05	20
		4	Plasticized, Heat Stabilized	1 2			1.01 to 1.06	35 35	500 400	25 25	36 36
			Stabilizeu	3			1.01 to 1.06 1.01 to 1.06	30	350	25 25	36
				4	black		1.01 to 1.06	-35	400	25 25	-36
					UV		1.01 to 1.06	35	400	<u>25</u>	36
				4	Stabilized					_	
				5			1.01 to 1.06	30	370	25	36
				6			1.01 to 1.06	35	370	25	36
				7	black		1.01 to 1.06	-35	340	25	-36
				7	<u>UV</u>	160 to 240	1.01 to 1.06	_35	340	<u>25</u>	_36
				0	Stabilized other						
		0	Other	0	other						
04	PA12	1	General	1		100 to 210	1.00 to 1.06	30	800	2.5	35
			purpose	2		100 to 210	1.00 to 1.06	35	1000	2.5	35
				3			1.00 to 1.06	35	1000	2.5	35
				4 0	in the S	271 to 340	1.00 to 1.06	35	1000	2.5	35
		2	Heat-	1	other	100 to 150	1.00 to 1.06	35	800	2.5	35
			stabilized	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 0	30 % filler other		1.18 to 1.32	55	3500	5.0	100
		3	Nucleated	1	AST	100 to 180	1.00 to 1.06	35	800	1.0	35
				2	danda/ajat/0 h 7	181 to 250	1.00 to 1.06	35	800	1.0	35
			.teh.ai/catalc)g/soan 1	Cother S/SIST/9b /	100 to 280	1.00 to 1.06	30	300 to 550	4/astm-d6/ 15	
				2			1.00 to 1.06	30	450 to 750	10	
		5	Plasti-	0 1	other	100 to 280	1.00 to 1.06	20	200 to 350	20	
		J	cized,	2			1.00 to 1.06	30	300 to 550	15	
			heat-	3			1.00 to 1.06	30	450 to 750	10	
			stabilized	4			1.00 to 1.06	35	550 to 950	5.0	
				0	other	.00 10 200	100 100	00	222 10 000	0.0	
	D4.07.7	0	Other	0	other				46		
05	PA612	1	General	1			1.05 to 1.07	50	1800	2.0	45
			purpose	2			1.05 to 1.07	50	1800	2.5	45
				3	2F 0/ cl	200	1.05 to 1.07	50	1800	3.0	45 175
				G35	35 % glass		1.28 to 1.38	140	7000	9.0	175
				G45 0	45 % glass other		1.38 to 1.48	150	8500	11	180
		2	Heat-	1		140	1.05 to 1.07	50	1800	2.0	45
			stabilized	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 0	35 % glass other		1.28 to 1.38	140	7000	9.0	175
		3	Weather-	1	outet	140	1.05 to 1.07	50	1800	1.5	45
		ŭ	stabi-	•		0			. 300		
			lized ^G	0	other						
06	PA46	1	General-	1	-	170	1.16 to 1.20	85	2300	6.0	
			purpose	2		195	1.16 to 1.20	85	2300	6.0	140
				0	other						
		2	Heat- stabilized	1 2		165 195	1.16 to 1.20 1.16 to 1.20	85 85	2300 2300	6.0 6.0	140 140
			SIGUIIIZEU	G15	15 % glass	190	1.16 to 1.20 1.25 to 1.31	85 125	5000	3.6	240
				G30	30 % glass		1.38 to 1.42	175	8000	7.5	280