

(R) CLASSIFICATION SYSTEM FOR AUTOMOTIVE POLYAMIDE (PA) PLASTICS

Foreword—This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

1. **Scope**—This SAE Recommended Practice provides a system for classification and specification for limited number of polyamides (nylons) used in the Automotive Industry. Based upon ASTM D 4066, Classification System for Nylon Injection and Extrusion Materials (PA), it calls for additional descriptive characteristics and properties commonly used in the Automotive Industry.

This document applies to natural and non-color matched black, heat-stabilized polyamide compounds only. Color matched compounds shall be defined by the proprietary OEM standards.

This document allows for the use of recycled, reconstituted, and regrind materials provided that the requirements as stated in this document are met, the material has not been altered or modified to change its suitability for safe processing and use, and the material shall be identified as such.

- 1.1 **Purpose**—The purpose of this document is to:

- a. Standardize the grades of unreinforced and reinforced polyamides (nylons) 66, 6, and 66/6 used for the Automotive Industry
- b. Standardize the test methods used to characterize the properties of these materials
- c. Provide a method for specifying these materials by the use of a simple line call-out designation

2. **References**

- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. The latest issues of ISO, SAE, and ASTM publications shall apply.

- 2.1.1 **SAE PUBLICATIONS**—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J369—Flammability of Automotive Interior Materials-Horizontal Test Method
SAE J1756—Test Procedure to Determine the Fogging Characteristics of Interior Automotive Materials
SAE J1885—Exposure to Interior Xenon-Arc Weatherometer
SAE J1960—Exposure to Exterior Xenon-Arc Weatherometer
SAE J1976—Outdoor Weathering of Exterior Materials

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SAE J1639 Revised MAY95

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTMD789-92—Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)

ASTM D 3763-93—High Speed Puncture Properties Plastics Using Load Displacement Sensors

ASTM D 4066-92a—Nylon Injection and Extrusion Materials (PA)

ASTM D 5279-92—Measuring Dynamic Mechanical Properties of Plastics in Torsion

ASTM E 831-86—Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis

2.1.3 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO75-1:1993—Plastics—Determination of temperature of deflection under load—Part 1: General test methods

ISO75-2:1993—Plastics—Determination of temperature of deflection under load—Part 2: Plastic and Ebonite

ISO 105/A02:1993—Textiles—Grey scale for assessing change in color

ISO 178:1993—Plastics—Determination of flexural properties

ISO 180:1993—Plastics—Determination of Izod impact strength

ISO 188:1982—Rubber—Accelerated aging

ISO/DIS 294-1:1995—Plastics—Injection molding of test specimens of thermoplastic materials

ISO/DIS294-3:1995—Plastics—Injection molding of test specimens of thermoplastic materials—Part 3: Plates (ISO mold type D)

ISO/DIS294-4:1995—Plastics—Injection molding of test specimens of thermoplastic materials—Part 4: Determination of molding shrinkage

ISO 295:1991—Plastics—Compression molding of test specimens of thermosetting materials

ISO 527-1:1993—Plastics—Determination of tensile properties—Part 1: General principles

ISO 527-2:1993—Plastics—Determination of tensile properties—Part 2: Testing conditions

ISO 960:1988—Plastics—Polyamides (PA)—Determination of water content

ISO 1183:1987—Plastics—Methods for determining the density of non-cellular plastics

ISO1874-2:1995—Plastics—Polyamide (PA) molding and extrusion materials—Part 2: Preparation of test specimens and determination of properties

ISO 3146:1985—Plastics—Determination of melting behavior of semi-crystalline polymers

ISO 3167:1993—Plastics—Preparation and use of multipurpose test specimen

ISO 3451/4:1986—Plastics—Determination of ash—Part 4: Polyamides

ISO 3795:1989—Road vehicles—Determination of burning behavior of interior materials for motor vehicles

2.1.4 AATCC GRAY SCALE PUBLICATION—Available from AATCC, P.O. Box 12215, Research Triangle Park, North Carolina 27709 and British Standard Institution, 10 Blackfriars Str., Manchester, M3 5TD, England.

AATCC Evaluation Procedure 1

2.1.5 FMVSS PUBLICATION—Available from The Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

FMVSS 302

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1344—Marking of Plastic Parts

2.2.2 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 62:1980—Plastics—Determination of water absorption

3. **Description**

3.1 This classification system was developed to permit the addition of descriptive characteristics and values commonly used in Automotive Material Specifications for polyamides. All the requirements listed in Section 7 shall apply for initial qualification of the material. The requirements listed in Section 8 shall be required for initial qualification when the particular suffix is included in the line call-out for the material. The requirements listed in Appendix A, Table A1 for initial product certification shall be met with data representing 3 sigma values per 6.2. Production lots shall meet property control plan as agreed to between material supplier and user of this document.

4. **Classification**

4.1 Polyamide 6, 66, and 66/6 plastics are classified into "groups" based on the chemical composition. These groups are subdivided into "classes" and "grades" as shown in the Appendix A, Table A1.

4.2 An example of this classification system is as follows:

The designation PA1122 would indicate:

PA = polyamide (nylon)
11 = reinforced PA66
2 = glass reinforced, impact modified, heat stabilized
2 = 15% glass

5. **Line Call-outs**

5.1 A line call-out, which is a specification, shall contain this document's identification number and a material designation from Table 1 as illustrated in 4.2.

5.2 The line call-out specifies material meeting all requirements of this document. Note additional characterizations in Section 7 and Section 8—Suffixes.

The following is an example of a line call-out:

SAEJ1639PA1122

The previous specification would indicate:

SAE J1639 Classification System for Automotive PA Plastics

PA = polyamide (nylon)
11 = reinforced PA66
2 = glass reinforced, impact modified, heat stabilized
2 = 15% glass

TABLE 1—STANDARDIZED AUTOMOTIVE GRADES OF HEAT STABILIZED POLYAMIDES (PA)⁽¹⁾

PA Group	Description ⁽²⁾	Filler Content	Designation	Previous
66	General, Injection Molding	Unreinforced	0121	
	General, Extrusion Molding	Unreinforced	0122	none
	Impact modified	Unreinforced	0171	
	Impact modified	Unreinforced	0172	
	Glass fiber reinforced	15%	1112	
	Glass fiber reinforced	35%	1116	
	Glass fiber reinforced, impact modified	15%	1122	
	Mineral filled	40%	1137	
	Mineral/glass fiber reinforced	20%	1143	none
	Mineral/glass fiber reinforced	40%	1147	
	Mineral filled, impact modified	40%	1157	1156 (35%)
	Glass fiber reinforced, hydrolysis resistant	25%	1164	none
	Glass fiber reinforced, hydrolysis resistant	35%	1166	1165 (30%)
6	General, Injection Molding	Unreinforced	0222	
	General, Extrusion Molding	Unreinforced	0223	none
	Impact modified	Unreinforced	0282	
	Glass fiber reinforced	15%	1212	
	Glass fiber reinforced	25%	1214	
	Glass fiber reinforced	35%	1216	
	Glass fiber reinforced, impact modified	30%	1225	
	Mineral filled	30%	1235	
	Mineral filled	40%	1237	
	Mineral/glass fiber reinforced	40%	1247	
66/6	Glass fiber reinforced	35%	1816	1815 (30%)

- Grades commonly used in Automotive Industry. Additional grades may be included in the future as agreed to by the SAE Plastic Committee.
- All materials are heat stabilized.

5.3 The following definitions for tables in Appendix A of this document apply to unfilled and filled polyamides.

- Group 01 Unreinforced polyamide 66 (PA66) (all classes heat stabilized)
 - Injection and extrusion molding
 - Impact modified
- Group 02 Unreinforced polyamide 6 (PA6) (all classes heat stabilized)
 - Injection and extrusion molding
 - Impact modified
- Group 11 Reinforced/filled polyamide 66 (PA66) (all classes heat stabilized)
 - Glass fiber reinforced
 - Glass fiber reinforced, impact modified
 - Mineral filled
 - Mineral/glass fiber filled
 - Mineral filled, impact modified
 - Glass fiber reinforced, hydrolysis resistant
- Group 12 Reinforced/filled polyamide 6 (PA6) (all classes heat stabilized)
 - Glass fiber reinforced
 - Glass fiber reinforced, impact modified

SAE J1639 Revised MAY95

- Class 3 Mineral filled
- Class 4 Mineral/glass fiber filled
- e. Group 18 Reinforced/filled polyamide 66/6 (PA66/6) (all classes heat stabilized)
- Class 1 Glass fiber reinforced

The fourth digit in groups 11, 12, and 18 will define the nominal amount of reinforcement. Numerals 1 to 9 will designate the following:

- | | |
|-----------------------|-----------------------|
| 1=10% (Not specified) | 6=35% |
| 2=15% | 7=40% |
| 3=20% | 8=45% (Not specified) |
| 4=25% | 9=50% (Not specified) |
| 5=30% | 0 = Other |

6. Testing and Conditioning

6.1 Test Specimens—Test specimens shall be prepared as specified in Table 2. Unless otherwise specified, all tests shall be carried out on injection molded one-end gated test specimens.

The specimens in Table 2 are required:

TABLE 2—TEST SPECIMENS

	Defined by:	Molded According to:
A. 150 minimum x 10 x 4.0 mm ± 0.2 mm	ISO 3167, Type A	ISO/DIS 294-1
B. 60 x 60 x 2.0 mm ± 0.1 mm	ISO 294-3:1995	ISO/DIS 294-3
C. 100 mm diameter x 3.2 mm ± 0.2 mm		Not Available
D. 355 x 100 x 2.0 mm ± 0.1 mm	FMVSS 302	ISO/DIS 294-1 (injection) ISO 295 (compression)

Test specimen A shall be molded using molding conditions defined in ISO 1874-2. Specimens with shorter dimensions shall be cut from the center portion of the test specimen A. No annealing allowed.

6.2 Statistical Data—Statistical data shall be derived from testing a minimum of 30 lots. The statistical data shall be submitted with initial characterization data (Section 7) of the material. The following properties are affected: tensile strength, flexural modulus, Izod impact at 23 °C ± 2 °C, and heat deflection temperature.

The user of this document shall define requirements for provisional approval prior to completion of 30 lot testing.

6.3 Conditioning and Test Conditions—All test values indicated herein are based on material with moisture content of 0.2% maximum (ISO 960, Method A/ASTM D 789). Immediately after molding, specimens shall be sealed in moisture-proof containers and stored at 23 °C ± 2 °C for at least 24 h. All tests shall be performed immediately after removal from the containers in a controlled atmosphere of 23 °C ± C °C and 50% ± 5% relative humidity unless otherwise specified.

7. Initial Characterization of Automotive Materials—The following test results shall be submitted as initial characterization of the material.

7.1 Infrared Spectrophotometry and/or Thermal Analysis—Infrared and/or thermal analysis spectra shall constitute the reference standard for the material supplied to a specification based on this classification system and shall be available on request.

7.2 Shear Modulus—A plotted curve, as described as follows, shall constitute the reference standard for the material supplied to a specification based on this classification system and shall be available on request.

Shear modulus versus temperature curve shall be plotted for -50 to $+210$ °C (PA6), 240 °C (PA66) temperature range, at 5 °C intervals.

7.2.1 TEST METHOD—ASTM D 5279, forced constant amplitude, fixed frequency of 1 Hz \pm 15% , strain level below 1% $60 \times 10 \times 4.0$ mm specimen, cut from the center of tensile specimen (specimen A). Specimen length between clamps 35 to 40 mm. Soak time at each temperature interval 3 min minimum.

7.3 Density

7.3.1 TEST METHOD—ISO 1183, Method A—Report density in g/cm^3

7.4 Heat Aging Performance—After aging for 1000 h at the appropriate temperature listed as follows, the tensile strength, Izod impact strength, or both must retain at least 75% of their original values. For unreinforced materials, tensile strength, 75% retention data, and impact strength value (or percent loss) are required. 75% Izod impact strength retention data is required for reinforced materials. For impact modified grades properties shall be retained at 75% of original minimums.

7.4.1 TEST METHOD—ISO 188, 150 air changes/h \pm 50 air changes/h. After heat aging, test specimens are to be conditioned in a desiccator for 3 to 5 h at 23 °C \pm 2 °C. Impact strength test specimens shall be notched before heat aging. Unaged property values shall be determined at the time of the aged properties determination. Oven aging temperatures: 110 °C for unreinforced grades, 140 °C for reinforced grades.

7.5 Engine Coolant Resistance—Use only for hydrolysis resistant PA66—After immersion for 1000 h at 125 °C and 103 kPa pressure in $50/50$ solution of water and approved automotive coolant concentrate, the tensile strength must retain a minimum of 20% of the original value listed in Appendix A, Table A1.

7.5.1 TEST METHOD—ISO 527-1 and ISO 527-2, 150 minimum $\times 10 \times 4.0$ mm specimen (specimen A), test speed 5 mm/min. Report type of stress (yield and/or break). Unaged property values shall be determined at the time of the aged properties determination. A minimum of 10 specimens shall be tested.

7.6 Impact Strength, Multiaxial—Applicable to impact modified materials only.

7.6.1 TEST METHOD—ASTM D 3763, 100 mm diameter $\times 3.2$ mm thick smooth surface injection-molded specimen (specimen C).

Impact velocity— 2.2 m/s for exterior, 6.6 m/s for interior applications.

Test at -40 °C ± 2 °C, or -30 °C ± 2 °C, or -15 °C ± 2 °C, or 0 °C ± 2 °C, and 23 °C ± 2 °C. Present all data and define the temperature at which ductile failure was observed.

Test specimens must be conditioned for a minimum of 6 h at test temperature prior to impact testing. Low temperature testing shall be conducted within the same environmental chamber as the clamp mechanism of the impact device. No transfer through ambient conditions is permitted.

Test a minimum of 10 specimens from 3 individual lots at a single condition.

Report should include:

- a. Detailed description of specimen preparation
- b. Molding conditions; melt and mold surface temperatures, and average injection velocity
- c. Number of samples tested per lot per temperature
- d. Numbers of lots tested
- e. Number of samples with ductile failure per each test condition
- f. Representative force versus deflection curve for each impact event
- g. Number of cracks and maximum length

Summarize testing at each condition by providing the energy in Joules (mean value) at maximum load (all the high and low values should be reported).

Report energy in Joules (mean value) at maximum load at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and at the lowest temperature that yields ductile failure, the standard deviation attained for that test run, and the impact velocity of the test.

A ductile failure is defined as a crack that does not radiate more than 10 mm from the point of impact.

7.7 Impact Strength, Izod At $-40\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$

- 7.7.1 TEST METHOD—ISO 180/1A, 80 x 10 x 4.0 mm specimen (use center section of specimen A), test at $-40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The test specimen must be conditioned for a minimum of 6 h at the previously specified temperature prior to impact test. Low temperature testing shall be done within the cold chamber, if not possible, test may be conducted outside, but within 5 s.

7.8 Flammability

- 7.8.1 TEST METHOD—ISO 3795/SAE J369, 100 mm/min maximum burn rate, 355 x 100 x 1.0 mm smooth surface injection- or compression-molded specimen (specimen D).

7.9 Coefficient of Linear Thermal Expansion

- 7.9.1 TEST METHOD—ASTM E 831 (TMA), -30 to $\pm 30\text{ }^{\circ}\text{C}$

Report average value x E-5/ $^{\circ}\text{C}$, for both the flow and cross-flow directions.

7.10 Mold Shrinkage

- 7.10.1 TEST METHOD—ISO/DIS 294-4, 60 x 60 x 2.0 mm smooth surface injection-molded specimen (specimen B).

Report values in percent (%) for both the flow and cross-flow directions, under the following conditions:

- a. Mold Shrinkage after 48 h storage at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ at $50\% \pm 5\%$ relative humidity
- b. Post Shrinkage after 48 h at $80\text{ }^{\circ}\text{C}$
- c. Post Shrinkage after 30 min at $120\text{ }^{\circ}\text{C}$

8. **Initial Characterization of Automotive Materials—Suffixes**—The following requirements are available in addition to the basic call-out by use of suffixes Z1, Z2, Z3, Z4, Z5, and Z6.

All test results shall be submitted with initial characterization, when specified.

- 8.1 **Suffix Z1—UV Light Resistant, Interior Xenon-Arc Exposure**—Applicable to color matched unpainted compounds only.

SAE J1639 Revised MAY95

8.1.1 TEST METHOD—SAE J1885, 601 kJ/m² minimum exposure. 60 x 60 mm minimum x 2.0 mm, smooth surface, low-gloss injection-molded specimen (specimen B). Rating 4, minimum (AATCC Evaluation Procedure 1/ISO 105/A02)

No objectional color change or surface defects allowed.

8.2 Suffix Z2—UV Light Resistant, Under Glass, Interior Florida Exposure—Applicable to color matched unpainted compounds only.

8.2.1 TEST METHOD—1 year, 5 degrees south, under PPG Herculite K, tempered safety glass, 3 mm thick. Applicable method shall be specified by the user of this document. 60 x 60 mm minimum x 2.0 mm, smooth surface, low-gloss injection-molded specimen (specimen B). Rating 4, minimum (AATCC Evaluation Procedure 1/ISO 105/A02)

No objectional color change or surface defects allowed.

8.3 Suffix Z3—UV Light Resistant, Exterior—Applicable to color matched unpainted compounds only.

8.3.1 XENON-ARC EXPOSURE—SAE J1960, 2500 kJ/m² minimum exposure. 60 x 60 mm minimum x 2.0 mm, smooth surface, low-gloss injection-molded specimen (specimen B). Rating 4, minimum (AATCC Evaluation Procedure 1/ISO 105/A02)

8.3.2 FLORIDA AND ARIZONA EXPOSURE—SAE J1976, 2 years, 5 degrees south, direct exposure. 60 x 60 mm minimum x 2.0 mm, smooth surface, low-gloss injection-molded specimen (specimen B). Rating 4, minimum (AATCC Evaluation Procedure 1/ISO 105/A02)

No objectional color change or surface defects allowed.

8.4 Suffix Z4—Fogging—Use only for interior application materials.

8.4.1 TEST METHOD—SAE J1756, 3 h at 100 °C ± 0.5 °C bath temperature, 21 °C ± 0.5 °C cooling temperature. Report minimum Fog Number.

8.5 Suffix Z5—Gloss—NOT APPLICABLE

8.6 Suffix Z6—Material is not Heat Stabilized—For color matched applications only.

8.6.1 The heat stabilizer package is deleted from the polyamide formulation for color matched and/or natural applications if the user of this document specifies Suffix Z6 as a part of the call-out.

8.7 The following is an example of a line call-out for a UV light resistant, color matched interior application polyamide 66 requiring use of suffixes Z1, Z2, and Z6:

SAEJ16390121Z1Z2Z4Z6

Z1 = UV Resistant, Interior, Xenon-Arc Exposure
Z2 = UV Resistant, Under Glass, Interior, Florida Exposure
Z4 = Fog Number 90 minimum
Z6 = Material is not heat stabilized

9. Test Methods—All requirements are listed in Appendix A, Table A1.

9.1 Tensile Strength

9.1.1 TEST METHOD—ISO 527-1 and ISO 527-2, 150 minimum x 10 x 4.0 mm specimen (specimen A), test speed: 50 mm/min (unreinforced and/or materials without yield point with elongation equal or greater than 10%), and 5 mm/min (reinforced and/or materials without yield point with elongation below 10%). Report type of stress (yield and/or break).

9.2 Flexural Modulus

9.2.1 TEST METHOD—ISO 178, 80 x 10 x 4.0 mm specimen (use center section of specimen A), 2 mm/min test speed, 64 mm support span.

9.3 Impact Strength, Izod

9.3.1 TEST METHOD—ISO 180/1A, 80 x 10 x 4.0 mm specimen (use center section of specimen A), test at 23 °C ± 2 °C. Minimum of 10 specimens for each test.

9.4 Heat Deflection Temperature at 1.80 MPa

9.4.1 TEST METHOD—ISO 75-1 and ISO 75-2, 80 x 10 x 4.0 mm specimen (use center section of specimen A), test flatwise at standard deflection of 0.34 mm ± 0.01 mm. Report minimum temperature in °C.

9.5 Filler Content (Reinforced Materials Only)

9.5.1 TEST METHOD—ISO 3451/4—Report the temperature of calcination if different from ISO 3451/4.

10. Notes

10.1 Marginal Indicia—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE PLASTICS COMMITTEE

APPENDIX A

TABLE A1—REQUIREMENTS FOR POLYAMIDES 6, 66, AND 66/6 DRY-AS-MOLDED⁽¹⁾, HEAT STABILIZED STANDARDIZED AUTOMOTIVE GRADES

GROUP	CLASS Description	GRADE Description	Statistical Data Tensile Strength MPa min	Statistical Data Flexural Modulus MPa min	Statistical Data Izod Impact Resistance at 23 °C kJ/m	Statistical Data Heat Deflection Temperature at 1.80 MPa °C min	Initial Characterization Izod Impact Resistance at -40 °C ⁽²⁾ kJ/m ² min	Initial Characterization Density ⁽²⁾ g/cm ⁽³⁾	
01 Polyamide 66 ⁽³⁾	2 General, HS	1 Injection molding	70	2300	3.0	60	2.0	1.13–1.15	
		2 Extrusion molding	70	2300	3.0	60	2.0	1.13–1.15	
	7 Impact modified, HS	1 Injection molding	52	1700	9.0	50	4.0	1.06–1.10	
		2 Injection molding	42	1500	40	45	8.0	1.06–1.10	
02 Polyamide 6 ⁽⁴⁾	2 General, HS	2 Injection molding	70	2400	4.5	54	4.5	1.12–1.14	
		3 Extrusion molding	70	2400	4.5	50	4.5	1.12–1.14	
	8 Impact modified, HS	2 Injection molding	60	2000	6.0	50	4.0	1.05–1.16	
11 Polyamide 66 Reinforced/filled ⁽⁵⁾	1 Glass reinforced, HS	2 15%	100	4000	3.0	220	3.0	1.20–1.26	
		6 35%	170	8000	7.0	235	5.0	1.35–1.45	
	2 Glass reinforced, Impact modified, HS	2 15%	85	3000	6.0	210	3.0	1.15–1.21	
	3 Mineral filled, HS	7 40%	80	5000	2.0	150	1.0	1.45–1.55	
		4 Mineral/glass filled, HS	3 20%	70	3200	1.5	50	0.8	1.23–1.31
			7 40%	100	5500	2.5	200	1.8	1.43–1.53
	5 Mineral filled, Impact modified, HS	7 40% Mineral	75	4500	4.0	NA	3.0	1.45–1.55	
6 Glass reinforced, hydrolysis resistant ⁽⁶⁾ , HS	4 25%	140	6000	5.0	225	3.0	1.29–1.37		
	6 35%	170	8000	7.0	235	5.0	1.35–1.45		

**TABLE A1—REQUIREMENTS FOR POLYAMIDES 6, 66, AND 66/6 DRY-AS-MOLDED⁽¹⁾, HEAT STABILIZED
STANDARDIZED AUTOMOTIVE GRADES (CONTINUED)**

GROUP	CLASS Description	GRADE Description	Statistical	Statistical	Statistical	Statistical	Initial	Initial
			Data	Data	Data	Data	Characterization	
			Tensile	Flexural	Izod Impact	Heat Deflection	Izod Impact	Characterization
			Strength	Modulus	Resistance	Temperature	Resistance	Density ⁽²⁾
			MPa min	MPa min	at 23 °C	at 1.80 MPa	at -40 °C ⁽²⁾	g/cm ⁽³⁾
					kJ/m	°C min	kJ/m ² min	
12 Polyamide 6 Reinforced/filled ⁽⁵⁾	1 Glass reinforced, HS	2 15%	110	4500	4.5	180	4.0	1.20–1.28
		4 25%	140	6500	6.5	190	6.0	1.28–1.36
		6 35%	155	7500	9.0	190	7.0	1.34–1.40
	2 Glass reinforced impact modified, HS	5 30%	135	6500	15.0	190	10.5	1.32–1.40
		3 Mineral filled, HS	5 30%	70	3200	2.4	60	2.2
	7 40%		80	5000	4.5	75	3.5	1.42–1.47
	4 Mineral/glass filled, HS	7 40%	100	6000	3.0	190	2.5	1.42–1.50
1 Glass reinforced PA66/6		6 35%	160	7500	8.0	190	5.0	1.35–1.45

1. Moisture content 0.2% maximum. Test method: ISO 960, Method A/ASTM D 789
2. Values reported are for initial characterization of materials.
3. Melting Point 250 to 265 °C. Test method: ISO 3146, Method C
4. Melting Point 210 to 225 °C. Test method: ISO 3146, Method C
5. Filler content determination based on ISO 3451/4 Section 9.5
6. Hydrolysis resistance 1000 h test at 125 °C required Section 7.5
7. Melting Point for the copolymer products shall be reported at the time of initial characterization of the material. ISO 3146, Method C
NA Not Available

All values in the table are based on a limited ISO statistical data base (see 6.2) and will be revised as more data becomes available. Presently, certification of individual materials will be carried out through the Control Plan process.