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ISO 16396-1

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Plastics — Polyamide (PA) moulding and extrusion materials —

Part 1: Designation system and basis for specifications

Plastiques — Matériaux à base de polyamide (PA) pour moulage et extrusion —

Partie 1: Système de désignation et base de spécifications

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 16396-1:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— “marking of products” has been deleted in the subtitle; the subtitle has been replaced by “Part 1: Designation system and basis for specifications”;

— the abbreviation for “Injection moulding” has been changed back to “M” in Table 4;

— “Multiple processing modes” has been added in Table 4

— the reference to ISO 1874-2 has been changed to ISO 16396-2.

A list of all parts in the ISO 16396 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In practice, ISO 1043 and ISO 11469 are, in combination, being "improperly" used as a designation system for, e.g. marking. The aim of this document is to simplify the data block system and to connect more to ISO 1043 and ISO 11469, where the first two blocks are used for generic identification and marking of products.

Plastics — Polyamide (PA) moulding and extrusion materials —

Part 1: Designation system and basis for specifications

1 Scope

This document establishes a system of designation for polyamide (PA) moulding and extrusion materials, which can be used as the basis for specifications.

The types of polyamide plastics are differentiated from each other by a classification system based on appropriate levels of the designatory properties

a) viscosity number,

b) tensile modulus, and

c) nucleating additive,

and on information about composition, intended application and/or method of processing, important properties, additives, colorants, fillers, and reinforcing materials.

The designation system is applicable to all polyamide homopolymers, copolymers, and blends.

It is applicable to unmodified materials ready for normal use and materials modified, for example, by colorants, additives, fillers, reinforcing materials, and polymer modifiers.

This document does not apply to the following materials:

— monomer casting-type polyamides of PA 6;

— monomer casting-type polyamides of PA 12.

It is not intended to imply that materials having the same designation give the same performance. This document does not provide engineering data, performance data, or data on processing conditions which can be required to specify a material. If such additional properties are required, they can be determined according to the test methods specified in ISO 16396-2, if suitable.

In order to specify a thermoplastic material for a particular application, additional requirements can be given in data block 5 (see 4.1).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

ISO 527 (all parts), *Plastics — Determination of tensile properties*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 16396-2, *Plastics — Polyamide (PA) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Designation system

4.1 General

The symbol "%" used in this document means mass fraction.

The designation system for thermoplastics is based on the following standard pattern:

Designation						
Description block	Identity block					
Thermoplastics (optional)	International Standard Block	Individual-item Block				
		Data block 1	Data block 2	Data block 3	Data block 4	Data block 5

The designation consists of an optional description block, reading "Thermoplastics", and an identity block comprising the International Standard number and an individual-item block. For unambiguous designation, the individual-item block is subdivided into five data blocks comprising the following information.

Data block 1: Position 1: Identification of the plastic by its abbreviated term (PA), in accordance with ISO 1043-1 and information about the composition of the polymer.

Position 2: Information on the use of plasticizer (P) or impact modifier (I) (see 4.2).

Data block 2: Position 1: Fillers or reinforcements and their nominal content.

Position 2: Flame retardant information.

Position 3: Declaration of recyclate (R) (see 4.3).

Data block 3: Position 1: Intended application and/or method of processing. Positions 2 to 8: Important properties, additives, and supplementary information (see 4.4).

Data block 4: Designatory properties (see 4.5).

Data block 5: For the purpose of specification, the fifth data block contains appropriate information (see 4.6).

The first character of the individual-item block shall be a hyphen. The data blocks shall be separated from each other by commas.

If a data block is not used, this shall be indicated by doubling the separation sign, i.e. by two commas („). Terminal commas can be omitted.

NOTE Data blocks 1 and 2 together form the part marking symbol, connected with a hyphen, and placed between the punctuation marks ">" and "<", where no spaces are used between the codes.

EXAMPLE

Designation										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
Thermo-plastics		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin			Application and processing		Properties	Additional information
		Type	Additive	Filler	Flame retardant	Recycle	Processing	Characteristics		
	16396	PA 6	P	(GF+MD) 25	FR(30)	(R50)	M	A	S14-060	
>Part marking<										
No	No	Yes		Yes			No		No	No

Designation: ISO 16396-PA 6-P,(GF+MD)25 FR(30) (R50),MA,S14-060,,

Part marking: >PA 6-P-(GF+MD)25FR(30)(R50)<

4.2 Data block 1

4.2.1 General

In this data block, after the hyphen, the plastic is identified by its abbreviated term (PA) in accordance with ISO 1043-1 and a symbol indicating the composition as specified in Table 1.

Polyamides containing plasticizer(s) can be designated by adding the letter P after the symbol, separated from it by a hyphen (example: PA 610-P).

Polyamides containing impact modifier(s) can be designated by adding the letter I after the symbol, separated from it by a hyphen (example: PA 6-I).

Examples of symbols indicating the chemical structure of copolyamide materials are given in Table 2.

Table 1 — Symbols indicating the chemical structure of polyamide materials in data block 1

Symbol	Name and chemical structure
	Aliphatic — One monomer
PA x	Polyamide, where x represents the number carbon atoms in the monomer. Examples: PA 6: Polyamide 6, homopolymer based on ε-caprolactam. PA 11: Polyamide 11, homopolymer based on 11-aminoundecanoic acid (see Annex A).
	Aliphatic — Two monomers — Diamine/dicarboxylic acid
PA xy	Polyamide, where — x represents the number carbon atoms in the diamine and — y represents the number of carbon atoms in the dicarboxylic acid (see Annex A). Examples: PA 46; Polyamide 46, homopolymer based on tetramethylenediamine and adipic acid PA 612; Polyamide 612, homopolymer based on hexamethylenediamine and dodecanedioic acid

Table 1 *(continued)*

Symbol	Name and chemical structure
	Semi aromatic — Two monomers — (aromatic) Diamine/(aromatic) dicarboxylic acid
PA xy	Polyamide, where — x represents the number carbon atoms in the diamine or the abbreviation of the diamine and — y represents the number of carbon atoms in the dicarboxylic acid or the abbreviation of the dicarboxylic acid (see Annex A). Examples: PA 4T, Polyamide 4T; homopolymer based on tetramethylenediamine and terephthalic acid. PA MXD6, Polyamide MXD6; homopolymer based on m-xylylenediamine and adipic acid.

Table 2 — Examples of symbols indicating the chemical structure of copolyamide materials in data block1

Symbol[a]	Chemical structure[b]
PA 66/610	Polyamide copolymers based on hexamethylenediamine, adipic acid and sebacic acid.
PA 6/12	Polyamide copolymers based on ε-caprolactam and laurolactam.
PA 6/66/PACM6	Polyamide ternary copolymers based on ε-caprolactam, hexamethylenediamine, adipic acid, bis(ρ-aminocyclohexyl)methane and adipic acid.
PA 46/6	Polyamide copolymers based on tetramethylenediamine, adipic acid and ε-caprolactam.
PA 4T/6T	Polyamide copolymers based on tetramethylenediamine, hexamethylenediamine and terephthalic acid.
PA 6T/XT	Polyamide copolymers based on hexamethylene diamine, an unspecified diamine and terephthalic acid.
PA 6T/66	Polyamide copolymers based on hexamethylene diamine, terephthalic acid and adipic acid.
PA 6T/6I	Polyamide copolymers based on hexamethylene diamine, terephthalic acid and isophthalic acid.
PA 6T/6I/66	Polyamide copolymers based on hexamethylene diamine, terephthalic acid, isophthalic acid and adipic acid.
PA66/6I	Polyamide copolymers based on hexamethylene diamine, adipic acid, and isophthalic acid.
PA NDT/INDT	Polyamide copolymers based on 1,6 diamino-2,2,4-trimethylenehexane, 1,6 diamino-2,4,4-trimethylenehexane and terephthalic acid.
PA 12/IPDI	Polyamide copolymers based on laurolactam, isophoronediamine, and isophthalic acid.
The following three designations include an indication of the mass fraction (see Annex A).	
PA 66/6(90/10)	Polyamide copolymers based on 90 % hexamethylenediamine and adipic acid and 10 % ε-caprolactam.
PA 6/66 (80/20)	Polyamide copolymers based on 80 % ε-caprolactam and 20 % hexamethylenediamine and adipic acid.
PA 66/6 (80/20)	Polyamide copolymers based on 80 % hexamethylenediamine and adipic acid and 20 % ε-caprolactam.

[a] Semi-crystalline polyamides can also be called polyphthalamides (PPA) if the residues of terephthalic acid or isophthalic acid or a combination of the two comprise at least 55 mole percentage of the dicarboxylic acid portion of the repeating structural units of the polymer chain (see ASTM D 5336).

[b] Other monomer combinations are possible

4.2.2 Blends

Blends can be made from materials mentioned in both tables and/or other polymers (see ISO 1043). For polymer blends or alloys, use the abbreviated terms for the basic polymers with the main component in first place followed by the other components in descending order according to their mass fractions, separated by a plus sign and no space before or after the plus sign.

EXAMPLE A blend of polyamide12 and polypropylene is designated: PA 12+PP.

4.3 Data block 2

In this data block, the type of filler and/or reinforcing material is represented by a single code letter in position 1, and its physical form by a second code letter in position 2, where the code letters are as specified in Table 3. Subsequently (without a space), the actual content by mass percent can be given by a two figure number in position 3.

Mixtures of filler materials or forms can be indicated by combining the relevant codes using the sign"+" and placing the whole between parenthesis or by combining the relevant codes using the sign "+" and placing the whole between parentheses followed by the total filler content. For example, a mixture of 25 % glass fibre (GF) and 10 % mineral powder (MD) would be indicated by (GF25+MD10) or (GF+MD)35.

For marking purposes, combining the relevant codes followed by the total filler content outside the parentheses is preferred.

Table 3 — Coding system for fillers and reinforcing materials in data block 2

Code-letter	Material (Position 1)	Form (Position 2)
B	Boron	Balls, beads, spheres
C	Carbon[a]	
D		Powder, dry blend
F		Fibre
G	Glass	Granules; ground
H		Whiskers
K	Calcium carbonate ($CaCO_3$)	
M	Mineral[a]	
ME	Metal[b]	
N		Nano
S	Organic, synthetic[a]	
T	Talcum	
X	Not specified	Not specified
Z	Others[a]	Others

[a] These materials can be identified after the code-letter, e.g. by chemical symbol or additional codes to be agreed upon.

[b] Metal filler shall be identified by the chemical symbol (in capital letters) after the mass content. For example, iron whiskers can be designated "MEH05FE".

Separated from the reinforcement code by a space, the addition of a flame retardant or flame retardant behaviour is represented by the abbreviated term "FR" followed, without a space, by a two digit code number between parentheses of the flame retardant type according ISO 1043-4.

Separated by a space from the flame retardant or the reinforcement code if no flame retardant code is used, the declaration of recyclate is represented by the code R between parentheses (R). Following the code R, the mass content can be given between the parentheses without a space. For example, a PA 66 containing 20 % glass fibre based upon a resin composed nominally of 70 % recyclate and 30 % virgin material will be indicated ISO 16396-PA 66,GF20 (R70).

4.4 Data block 3

In this data block, information about intended application and/or method of processing is given in position 1 and information about important properties, additives, and colour in positions 2 to 8. The code letters used are specified in Table 4. If information is presented in positions 2 to 8 and no specific information is given in position 1, the letter X (no indication) shall be inserted in position 1.