BS EN ISO 16396-1:2015

BSI Standards Publication

Plastics — Polyamide (PA) moulding and extrusion materials

Part 1: Designation system, marking of products and basis for specifications

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National foreword

This British Standard is the UK implementation of EN ISO 16396-1:2015. It supersedes BS EN ISO 1874-1:2010 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/82, Thermoplastic materials.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Plastiques - Matériaux polyamides (PA) pour moulage et extrusion - Partie 1: Système de désignation, marquage des produits et base de spécification (ISO 16396-1:2015)

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN ISO 16396-1:2015) has been prepared by Technical Committee ISO/TC 61 “Plastics” in collaboration with Technical Committee CEN/TC 249 “Plastics” the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2015, and conflicting national standards shall be withdrawn at the latest by August 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 1874-1:2010.

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Endorsement notice

The text of ISO 16396-1:2015 has been approved by CEN as EN ISO 16396-1:2015 without any modification.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This first edition of ISO 16396-1 cancels and replaces ISO 1874-1:2010, which has been technically revised to introduce a new designation system.

The revised designation system is published under a new ISO number, as many existing documents refer to ISO 1874-1. If the existing ISO 1874-1 would be replaced by the new designation system, these documents would refer to the incorrect designation system.

In order to give users time to switch from ISO 1874-1 to ISO 16396-1, any designation system according to ISO 1874-1 is to be phased out in 5 to 10 years. During this period, ISO 1874-2 will effectively be Part 2 of this International Standard.

ISO 16396 consists of the following parts, under the general *Plastics — Polymide (PA) moulding and extrusion materials*:

— *Part 1: Designation system, marking of products and basis for specification*

Introduction

ISO 1874-1:2010 is complex and does not fit with daily practice anymore. In practice, ISO 1043 and ISO 11469 are, in combination, 'improperly' being used as a designation system for, e.g. marking. The aim of this International Standard 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.

INTERNATIONAL STANDARD ISO 16396-1:2015(E)

Plastics — Polyamide (PA) moulding and extrusion materials —

Part 1: Designation system, marking of products and basis for specifications

1 Scope

This part of ISO 16396 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 and

b) tensile modulus of elasticity

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

This part of ISO 16396 does not apply to the following materials:

a) monomer casting-type polyamides of PA 6;

b) monomer casting-type polyamides of PA 12.

It is not intended to imply that materials having the same designation give the same performance. This part of ISO 16396 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 will be determined in accordance with the test methods specified in ISO 1874-2, if suitable.

In order to designate a thermoplastic material to meet particular specifications, the requirements are to be given in data block 5 (see 3.1).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 1043-1:2011, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1874-2, *Plastics — Polyamide (PA) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

3 Designation system

3.1 General

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

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

Figure 1 — Data block designation system

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 3.2).

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

Position 2: Flame retardant information.

Position 3: Declaration of recyclate (R) (see 3.3).

Data block 3: Position 1: Intended application and/or method of processing.

Positions 2 to 8: Important properties, additives, and supplementary information (see 3.4).

Data block 4: Designatory properties (see 3.5).

Data block 5: For the purpose of specification, the fifth data block contains appropriate information (see 3.6).

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	Identity block									
		Individual-item block								
Ther-mo-plastics (optional)	ISO Standard	Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin			Application and pro-cessing		Properties	Additional informa-tion
		Type	Addi-tive	Filler	Flame retard-ant	Recy-clate	Process-ing	Character-istics		
	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)<

3.2 Data block 1

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

Polyamides containing an impact modifier 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/CM6	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.
PA 66/6I	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 content ratio (Annex A).	
PA 66/6 (90/10)	Polyamide copolymers based on 90 % (*m*/*m*) hexamethylenediamine and adipic acid and 10 % (*m*/*m*) ε-caprolactam.
PA 6/66 (80/20)	Polyamide copolymers based on 80 % (*m*/*m*) ε-caprolactam and 20 % (*m*/*m*) hexamethylenediamine and adipic acid.
PA 66/6 (80/20)	Polyamide copolymers based on 80 % (*m*/*m*) hexamethylenediamine and adipic acid and 20 % (*m*/*m*) 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 molar percentage of the dicarboxylic acid portion of the repeating structural units in the polymer chain (ASTM D 5336).

[b] Other monomer combinations are possible.

Blends

Blends can be made from materials mentioned in both tables and/or other polymers (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.

3.3 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, the code letters being 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 by the total filler content. For example, a mixture of 25 % (*m*/*m*) glass fibre (GF) and 10 % (*m*/*m*) mineral powder (MD) would be indicated by (GF25+MD10) or (GF+MD)35.

NOTE 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]	
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 would be indicated ISO 16396-PA 66,GF20 (R70).

3.4 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.

Table 4 — Codes used in data block 3

Code letter	First letter	Letters 2 to 8
A		Processing stabilized
B	Blow moulding	Antiblocking
C		Coloured
C1		Coloured but transparent
C2		Coloured, but non-transparant
D		Powder
D1		Dry blend
E	Extrusion	Expandable
E1	Extrusion of pipes	
E2	Extrusion of profiles	
E3	Extrusion of sheets	
E4	Extrusion of tubing	
F	Extrusion of film and thin sheeting	Special burning
F1		Non-flammable
F2		Flame retarded
F3		Flammable
G	General use	Granules
G1		Pellets
H	Coating	Heat-ageing stabilized
H1	Powder coating	Stabilized against radiation
K	Cable and wire coating	
L	Monofilament extrusion	Light and/or weather stabilized
L1		UV-stabilized
L2		Artificial light stabilized
M	Moulding	
M1	Injection moulding	
N		Natural (no colour added)
O1		Plateable
O_2		Laser printable
P		
R	Rotational moulding	Moulding release agent
S	Sintering	Lubricated
T	Tape manufacture	Transparent
T1		Translucent
T2		Opaque

Table 4 *(continued)*

Code letter	First letter	Letters 2 to 8
T3		Improved transmission in UV
T4		Light diffuser
W		Stabilized against hydrolysis
X	No indication	
Z		Antistatic

3.5 Data block 4

3.5.1 General

In this data block, the range of designatory property 1 is represented by a 3-figure code number (see 3.5.2), the range of designatory property 2 by a 3-figure code number (see 3.5.3). The code numbers are separated from each other by hyphens.

If a property value falls on or near a range limit, the manufacturer shall state which range will designate the material. If subsequent individual test values lie on, or on either side of, the limit because of manufacturing tolerances, the designation is not affected.

NOTE Not all combinations of the values of the designatory properties are provided by currently available materials.

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

a) viscosity number;

b) tensile modulus of elasticity;

c) nucleating additive.

Nucleated polyamides can be designated by the letter N in the very last position of data block 4.

3.5.2 Viscosity number

The viscosity number shall be determined in accordance with ISO 307, using the solvent specified in Table 5. The possible values of the designatory property 1 are divided into ranges, each represented by a 3-figure code number as specified in Table 5.

For copolyamides, 96% (*m/m*) sulfuric acid should preferably be used as solvent, but some copolyamides dissolve better in *m*-cresol or phenol/1,1,2,2-tetrachloroethane (60/40%). Information concerning the most suitable solvent can be obtained from the supplier of copolyamides and homopolyamides which are not covered in the last column of Table 5.

Table 5 — Code numbers for designatory property viscosity number in data block 4

Code number	Range of viscosity number			Applicable to
	Solvent 96 % (*m*/*m*) sulfuric acid	Solvent *m*-cresol	Solvent phenol/1,1,2,2-tetrachloroethane (60/40 %)	
S09	≤90			PA 6, PA 66, PA 69, PA 610, PA 612, PA 613, PA MXD6 and copolyamides
S10	>90 to ≤110			
S12	>110 to ≤130			
S14	>130 to ≤160			
S18	>160 to ≤200			
S22	>200 to ≤240			
S27	>240 to ≤290			
S32	>290 to ≤340			
S34	>340			
C11		≤110		PA 1010, PA 1012, PA 1212, PA 11, PA 12 and copolyamides
C12		>110 to ≤130		
C14		>130 to ≤150		
C16		>150 to ≤170		
C18		>170 to ≤200		
C22		>200 to ≤240		
C24		>240		
P12			≤120	PA 6T/66, PA 6I/66, PA 6I/6T, PA 6T/6I/66, PA 6T/6I, PA 10T PA 6I/6T/66, PPA and copolyamides
P13			>120 to ≤140	
P15			>140 to ≤160	
P17			>160 to ≤180	
P19			>180 to ≤200	
P20			>200	

NOTE Viscosity numbers determined with 90 % (*m*/*m*) formic acid as solvent can be converted into viscosity numbers determined in 96 % (*m*/*m*) sulfuric acid using the following formulae, in accordance with ISO 307:

For PA 6: $\ln y = 0{,}416\ 1 + 0{,}927\ 6 \ln x$

For PA 66: $\ln y = 0{,}454\ 1 + 0{,}926\ 1 \ln X$

For PA 69: $\ln y = 0{,}463\ 4 + 0{,}909\ 5 \ln x$

For PA 610: $\ln y = 0{,}982\ 3 + 0{,}793\ 2 \ln x$

where

x is the viscosity number in 90 % (*m*/*m*) formic acid;

y is the viscosity number in 96 % (*m*/*m*) sulfuric acid.

For the viscosity number of PA 612, which can be determined in accordance with ISO 307 in either *m*-cresol or 96 % (*m*/*m*) sulfuric acid, the following conversion formula applies:

$\ln y = 0{,}285\ 7 + 0{,}985\ 9 \ln x$

where

x is the viscosity number in 96 % (*m/m*) sulfuric acid;

y is the viscosity number in m-cresol.

These conversion formulae have been calculated from the results of an interlaboratory investigation carried out in 1982 (ISO 307). The accuracy of the conversions depends on both the size of the viscosity number and the type of PA, the latter resulting from the fact that different numbers of the different PA-types were included in the investigation. The 95 % confidence intervals for the values of the nominal viscosity number in 96 % (*m/m*) sulfuric acid, converted from different values of the nominal viscosity number in the other solvent, are given in Table 6.

Table 6 — Confidence intervals

Nominal viscosity number[a]	95 % confidence intervals for converted nominal viscosity numbers in 96 % (*m/m*) sulfuric acid				
	PA 6	PA 66	PA 69	PA 610	PA 612
100	±0,8	±1,6	±2,0	±4,7	±4.4
140	±0,8	±1,4	±1,9	±4,1	±4,9
180	±0,7	±1,2	±2,9	±5,8	±10,2
220	±0,7	±1,3	±4,7	±9,0	±17,6
260	±0,8	±1,7	±6,9	±12,9	±26,0
300	±1,0	±2,4	±9,3	±17,2	±35,3
340	±1,3	±3,3	±11,9	±21,8	±45,3

[a] Solvents: 90 % (m/m) formic acid for PA 6, PA 66, PA 69, and PA 610; m-cresol for PA 612.

3.5.3 Tensile modulus of elasticity

The tensile modulus of elasticity shall be determined in the dry state in accordance with ISO 527 under the test conditions specified in ISO 1874-2. The possible values of the designatory property tensile modulus of elasticity are divided into ranges, each represented by a 3-figure code number as specified in Table 7.

Table 7 — Code numbers for designatory property tensile modulus of elasticity in data block 4

Tensile modulus of elasticity	
Code number	Range MPa
001	≤150
002	>150 to 250
003	>250 to 350
004	>350 to 450
005	>450 to 600
007	>600 to 800
010	>800 to 1 500
020	>1 500 to 2 500
030	>2 500 to 3 500
040	>3 500 to 4 500
050	>4 500 to 5 500
060	>5 500 to 6 500

Table 7 *(continued)*

Tensile modulus of elasticity	
Code number	**Range MPa**
070	>6 500 to 7 500
080	>7 500 to 8 500
090	>8 500 to 9 500
100	>9 500 to 10 500
110	>10 500 to 11 500
120	>11 500 to 13 000
140	>13 000 to 15 000
160	>15 000 to 17 000
190	>17 000 to 20 000
220	>20 000 to 23 000
250	>23 000

3.6 Data block 5

Indication of additional requirements in this data block transforms the designation of a material into a specification for a particular material. This can be done, for example, by reference to a suitable national standard or to a standard-like, generally established specification.

4 Examples of designations

4.1 Designations without specification

An unfilled polyamide material PA 6 for injection moulding (M), with moulding release agent (R), having a viscosity number of 150 ml/g (S14) and a tensile modulus of elasticity of 2 700 MPa (030), and with a nucleating additive (N), would be designated.

DESIGNATION										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin related information			Application and processing		Properties	Additional information
		Type	Modification	Filler	Flame retardant	Recyclate	Processing	Characteristics		
Thermo-plastics	16396	-PA 6					M	R	S14–030N	
>Part marking<										
No	No	Yes		Yes			No		No	No

Designation: Thermoplastics ISO 16396-PA 6,,MR,S14-030N,, or

ISO 16396-PA 6,,MR,S14-030N,, or

ISO 16396-PA 6,,MR,S14-030N

Part marking:>PA 6<

A polyamide material (PA 66) reinforced with 37 % glass fiber (GF) for injection moulding (M) containing heat-ageing stabilizer (H), and having a viscosity number of 140 ml/g (S14) and a tensile modulus of elasticity of 10200 MPa (100), would be designated.

DESIGNATION										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin related information			Application and processing		Properties	Additional information
		Type	Modification	Filler	Flame retardant	Recyclate	Processing	Characteristics		
Thermo-plastics	16396	-PA 66		GF37			M	H	S14–100	
>Part marking<										
No	No	Yes		Yes			No		No	No

Designation: Thermoplastics ISO 16396-PA 66,GF37,MH,S14-100,, or

ISO 16396-PA 66,GF37,MH,S14-100,, or

ISO 16396-PA 66,GF37,MH,S14-100

Part marking:>PA 66-GF37<

An unfilled polyamide (PA 12) material containing plasticizer (PA 12-P) for extrusion of pipes, profiles, and sheets (E), with a heat-ageing stabilizer (H) and a light and weather stabilizer (L), and having a viscosity number of 210 ml/g (S22) and a tensile modulus of elasticity of 280 MPa (003), would be designated.

DESIGNATION										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin related information			Application and processing		Properties	Additional information
		Type	Modification	Filler	Flame retardant	Recyclate	Processing	Characteristics		
Thermo-plastics	16396	-PA 12	-P				E	HL	S22–003	
>Part marking<										
No	No	Yes		Yes			No		No	No

Designation: Thermoplastics ISO 16396-PA 12-P,,EHL,S22-003,, or

ISO 16396-PA 12,,EHL,S22-003,, or

ISO 16396-PA 12,,EHL,S22-003

Part marking:>PA 12-P<

4.2 Designation transformed into a specification

This subclause provides examples of how to use this designation system and how to turn the designations into specifications. When used only as designations, the pattern employs information from data blocks 1-4. When converting the designation into a specification, the pattern also includes information from data block 5

An unfilled polyamide material (PA 6) for injection moulding (M), containing heat aging stabilizer (H), having a viscosity number of 150 ml/g (S14), and a tensile modulus of elasticity of 2 200 MPa (020), and meeting the requirements of ASTM D6779 PA0213 would have the specification.

DESIGNATION										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin related information			Application and processing		Properties	Additional information
		Type	Modification	Filler	Flame retardant	Recyclate	Processing	Characteristics		
Thermoplastics	16396	-PA 6					M	H	S14–020	ASTM D6779 PA0213
>Part marking<										
No	No	Yes		Yes			No		No	No

Specification: Thermoplastics ISO 16396-PA 6,,MH,S14-020,ASTM D6779 PA0213 or

ISO 16396-PA 6,,MH,S14-020,ASTM D6779 PA0213

Part marking:>PA 6<

A polyamide material (PA 6T/6I) reinforced with 33% of glass fiber (GF) with special burning characteristics (FR) for injection moulding (M), having a tensile modulus of elasticity of 8 000 MPA (080) and meeting the requirements of ASTM D5336 PPA0121FL34 would have the specification.

DESIGNATION										
Description block (optional)	Identity block									
	ISO Standard	Individual-item block								
		Data block 1		Data block 2			Data block 3		Data block 4	Data block 5
		Polymer		Performance and origin related information			Application and processing		Properties	Additional information
		Type	Modification	Filler	Flame retardant	Recyclate	Processing	Characteristics		
Thermoplastics	16396	-PA 6T/6I		GF33	FR		M		X-080	ASTM D5336 PPA0 12FL34
Part marking<										
No	No	Yes		Yes			No		No	No

Specification: Thermoplastics ISO 16396-PA 6T/6I,GF33 FR,M,X-080,ASTM D5336 PPA012FL34 or ISO 16396-PA 6T/6I,GF33 FR,M,X-080,ASTM D5336 PPA012FL34

Part marking:>PA 6T/6I-GF33FR<

Annex A
(normative)

Definition and designation of polyamides

Polyamide materials are thermoplastic materials that contain carboxylic amide groups, -CONH-, at regular intervals in the linear polymer chain.

Polyamide homopolymers can be built up from a single starting material (an aminocarboxylic acid or its lactam). In this case, they are designated by a number corresponding to the number of carbon atoms in the starting material (Table A.1).

Table A.1 — Designation of linear aliphatic polyamides of general formula –[NH-(CH2)*x* -CO]*n* –

Symbol	Value of *x*	Number of C atoms in the starting material
PA 6	5	6
PA 11	10	11
PA 12	11	12

However, polyamide homopolymers can also be built up from one starting material with amino groups plus one starting material with carboxylic acid groups. These polyamides based on diamines and dicaboxylic acids are designated by a two-digit, three-digit, or four-digit number, respectively. The first digit (or the first and second digits) corresponds to the number of C atoms in the linear aliphatic diamine and the second digit (or with some materials the second and third or the third and fourth digits) corresponds to the number of C atoms in the linear aliphatic dicarboxylic acid (Table A.2).

Table A.2 — Designation of linear aliphatic polyamides of general formula – [NH-(CH2)*x*-NH-CO-(CH2)*y*-CO]*n/2* –

Symbol	Value of	
	x	***y***
PA 46	4	4
PA 66	6	4
PA 610	6	8
PA 612	6	10
PA 1212	12	10

Copolymer polyamides, also called copolyamides, can be built up from various starting materials (lactams, aminocarboxylic acids, equimolar amounts of diamines, and dicarboxylilc acids). These copolyamides are designated PA plus numbers representing the components of the copolyamide, the numbers being separated by an oblique stroke (ISO 1043-1:2011, A.6). But copolyamides with the same numbers or symbols can give quite different properties, depending on the ratio of the starting materials. Therefore, if there is a need for a more exact designation, the mass content ratio shall be included. If it is necessary to indicate this ratio, the two figures, separated by an oblique stroke, can be placed in parentheses at the end of the designation (Table 2).

Starting materials (monomers) for copolyamides, as well as for homopolyamides, include not only linear aliphatic compounds, but also branched aliphatic-aromatic, cyclo-aliphatic, and aromatic compounds. The monomer units of these non-linear aliphatic compounds can be derived from the substances listed, together with their designations, in Table A.3. Because of the large number of possible combinations of copolyamides, only a few examples have been listed in Table 2.

Table A.3 — Symbols of aromatic and nonlinear aliphatic monomer units

Symbol of monomer unit[a]	Monomer unit derived from
T	Terephthalic acid
I	Isophthalic acid
N	2,6-Naphthalenedicarboxylic acid
PACP	2,2-Bis (*p*-aminocyclohexyl) propane
MACM	3,3'-Dimethyl-4,4'-diaminodicyclohexylmethane
PACM	Bis (*p*-aminocyclohexyl) methane
IPD	Isophorone diamine
ND	1,6-Diamino-2,2,4-trimethylhexane
IND	1,6-Diamino-2,4,4-trimethylhexane
PPGD	Polypropylene glycoldiamine
PBGD	Polybutylene glycoldiamine
MXD	*m*-Xylylene diamine
PXD	*p*-Xylylene diamine
PTD	*p*-Toluylene diamine
MTD	*m*-Toluylene diamine
PABM	Diphenylmethane-4,4'-diamine
MC	1,3-Bis (aminomethyl) cyclohexane
MPMD	2-Methylpentamethylenediamine
XX	Unspecified diamine
YY	Unspecified diacid

[a] The designations ND and IND are derived from the chemical names nonyldiamine and isononyldiamine to avoid having to include numbers in the designations.

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[4] ISO 1043-2, *Plastics — Symbols and abbreviated terms — Part 2: Fillers and reinforcing materials*

[5] ISO 1043-4, *Plastics — Symbols and abbreviated terms — Part 4: Flame retardants*

[6] ISO 3451-4, *Plastics — Determination of ash — Part 4: Polyamides*

[7] ISO 11469, *Plastics — Generic identification and marking of plastics products*

[8] ASTM D5336 — 09, *Standard Specification for Polyphthalamide (PPA) Injection Molding Materials*

[9] ASTM D6779-12a, *Standard Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)*

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