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Plastics — Thermoplastic polyurethanes for moulding and extrusion

Part 1: Designation system and basis for specifications

*Plastiques — Polyuréthanes thermoplastiques pour moulage et extrusion —
Partie 1: Système de désignation et base de spécification*

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Contents

	Page
Foreword	iv
1 Scope	1
2 Normative references	1
3 Designation system	2
4 Examples of designations	7

DRAFT

13

1

0

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

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70

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92

93

94

95

96

97

98

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100

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Foreword

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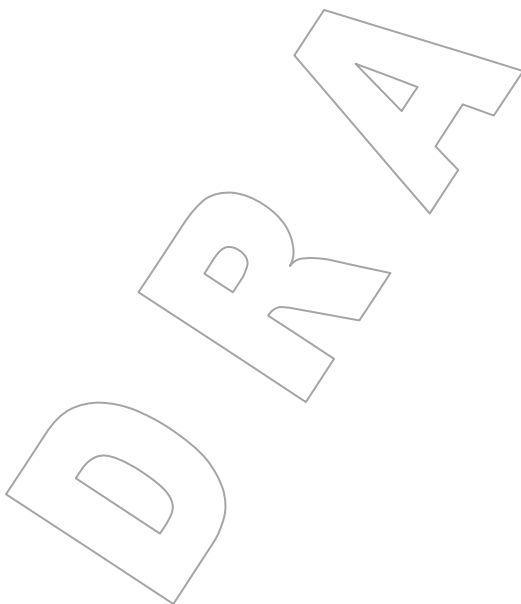
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ISO 16365-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 16365 consists of the following parts, under the general title *Plastics — Thermoplastic urethanes for moulding and extrusion*:

- *Part 1: Designation system and basis for specifications*
- *Part 2: Preparation of test specimen and determination of properties*
- *Part 3: Distinction of Ether TPU and Ester TPU and mixtures by analysis*



Plastics — Thermoplastic urethanes for moulding and extrusion — Part 1: Designation system and basis for specifications

1 Scope

This part of ISO 16365 establishes a system of designation for thermoplastic polyurethane elastomers, which is based on ISO 1043 and ISO 11469.

The designation system may be used as the basis for specifications.

The designation system is applicable to all thermoplastic polyurethane elastomers. It applies to materials ready for normal use in the form of powder, granules or pellets, unmodified or modified by colourants, fillers or other additives, etc.

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

- a) hardness;
- b) tensile/flexural modulus of elasticity (optional);

and on information about on the alternating hard and soft segments in the main chain, the intended application and/or method of processing, important properties, additives, colour, fillers and reinforcing materials.

It is not intended to imply that materials having the same designation give necessarily the same performance. This part of ISO 16365 does not provide engineering data, performance data or data on processing conditions which may be required to specify a material for a particular application and/or method of processing. If such additional properties are required, they shall be determined in accordance with the test methods specified in part 2 of ISO 16365, if suitable.

In order to specify a thermoplastic elastomer for a particular application or reproducible processing, additional requirements shall be given in Data Block 5 (3.1, 3.6).

2 Normative references

The following referenced documents are indispensable for the application 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 472; *Plastics - Vocabulary*

ISO 527-1; *Plastics -- Determination of tensile properties -- Part 1: General principles*

ISO 527-2; *Plastics -- Determination of tensile properties -- Part 2: Test conditions for moulding and extrusion plastics*

ISO 868; *Plastics and ebonite -- Determination of indentation hardness by means of a durometer (Shore hardness)*

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

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

ISO 1043-3, *Plastics — Symbols and abbreviated terms — Part 3: Plasticizers*

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

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

ISO 18064, *Thermoplastic elastomers -- Nomenclature and abbreviated terms*

ISO 16365-2, *Plastics — Thermoplastic polyurethane elastomers for moulding and extrusion — Part 2: Preparation of test specimens and determination of properties*

3 Designation system

3.1 General

The designation system for polyurethanes is based on the following standardized pattern (fig 1).

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

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: Identification of the thermoplastic polyurethane by its abbreviated symbol (TPU), in accordance with ISO 18064, and optional information on the alternating hard and soft segments in the main chain (see 3.2).
- Data Block 2:
 - Fillers reinforcement incl summarized nominal content (3.3)
 - Important properties, impact modifier and flame retardant (3.3)
 - declaration of recyclate: R followed by a number representing the percentage by mass of recyclate (3.3)
- Data Block 3: Position 1: method of processing (3.4).
Positions 2 and further: additives, supplementary information and other characteristics (3.4).
- Data Block 4: designatory properties (3.5).
 - hardness
 - modulus

- Data Block 5: For the purpose of specifications, a fifth Data Block containing additional information may be used (3.6). The kind of information and the code-letters used are not the subject of this part of ISO 16365.

The first character of the individual Item Block shall be a hyphen.

The five Data Blocks shall be separated from each other by a comma.

If a Data Block is not used, this shall be indicated by doubling the separation sign, i.e. by two commas (,,).

Terminal commas may be omitted.

For part marking the first two data blocks of the designation are used, connected with a hyphen, and placed between the punctuation marks '>' and '<', where no spaces are used between the codes.

EXAMPLE See page 5

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 & Origin			Application & Processing		Properties	Additional information
	Type	Segment (optional)	Filler	Flame retardant	Recyclate	Processing	Characteristics			
Thermoplastics	16365	TPU	-ARES	(GF+MD)35	FR(30)	R50	M	A	40-75	
>Part marking<										
No	No	Yes		Yes			No	No	No	No

Designation: ISO 16365-TPU,(GF+MD)35 FR(30) (R50),MA,40-75,,

3.2 Data Block 1

In this Data Block, after the hyphen, the Thermoplastic Urethane is identified by using the symbols and designations specified below.

The prefix TP is followed by a letter representing the category of the thermoplastic elastomer as detailed in ISO 18064. For urethane thermoplastic elastomers the prefix TP is followed by the letter U.

Urethane thermoplastic elastomers consists of a block copolymer of alternating hard and soft segments with urethane chemical linkages in the hard blocks and ether, ester or carbonate linkages or mixtures of them in the soft blocks. The "TPU" group is sub-categorized into groups according to the linkages in the soft blocks. The following symbols shall be used.

- TPU-ARES Aromatic isocyanate, polyester polyol
- TPU-ARET Aromatic isocyanate, polyether polyol
- TPU-AREE Aromatic isocyanate, polyol with ester and ether linkages
- TPU-ARCE Aromatic isocyanate, polycarbonate polyol
- TPU-ARCL Aromatic isocyanate, polycaprolactone polyol
- TPU-ALES Aliphatic isocyanate, polyester polyol
- TPU-ALET Aliphatic isocyanate, polyether polyol

The identification of the sub-catogories by the above mentioned symbols is optional.

3.3 Data Block 2

In this data block, the type of filler or reinforcing material is represented by single code-letter and its physical form by a second code-letter, the code letters being as specified in table 6. Subsequently (without a space), the mass content may be given by a two-figure code-number.

Mixtures of filler materials or forms may be indicated by combining the relevant codes using the sign "+" within parenthesis followed by the total filler content outside the parenthesis. For example, a mixture of 25 % by mass glass fibre (GF) and 10 % by mass mineral powder (MD) would be indicated by (GF+MD)35.

Separated from the reinforcement code by a space, the addition of a flame retardant or flame retardant behaviour is represented by the code FR, where the type of flame retardant according ISO 1043-4 is given by a two letter code between parenthesis.

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 parenthesis (R). Following the code R the mass content may be given between the parenthesis without a space. For example, a TPU material containing 20% glass fibres resulting from an overall minimum 70% of weight recyclate and 30% of virgin material would be indicated TPU-GF20 (R70).

Table 1 — 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		Fiber
G	Glass	Granules; ground
H		Whiskers
K	Calcium Carbonate (CaCO ₃)	
M	Mineral ^a	
ME	Metal ^b	
S	Organic; synthetic ^a	
T	Talc	
X	Not specified	Not specified
Z	Others ^a	Others

^a These materials may 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, steel whiskers may be designated "MEH05FE".

3.4 Data block 3

In this data block, information about intended applications or method of processing is represented by a code letter, followed by code letters about additives, supplementary information, and other characteristics. The code-letters are specified in table 2.

If no specific information is given on the method of processing the letter X shall be used as the first code-letter.

Table 2 — Codes used in Data Block 3

Code-Letter	First letter	Letters 2 to 8
A	Adhesive	Processing stabilized
B	Blow moulding	Antiblocking
C	Calendering	Coloured
D	Disc manufacture	Powder
E	Extrusion	Expandable
F	Extrusion of films	Special burning characteristics
G	General use	Granules
H	Coating	Heat stabilized
K	Cable and wire coating	
L	Monofilament extrusion	Light and/or weather stabilized
M	Moulding	Nucleated
N	Multiple processing modes	Natural (no colour added)
O		Stabilized against oxidation
R	Rotational moulding	Mould release agent
S		Lubricated
T		Transparent
W		Stabilized against hydrolysis
X	No indication	
Z		Antistatic

3.5 Data Block 4

3.5.1 General

In this data block, the hardness is represented by a 2-figure code-number (see 3.5.2) and the tensile modulus of elasticity by a 3-figure code-number (see 3.5.3). The code-numbers are separated from each other by hyphens.

If no specific information is given in one of the two positions, the letter X shall be used.

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 polymers.

3.5.2 Hardness

The Shore hardness shall be determined in accordance with ISO 868.

The possible values of the hardness are divided into 16 ranges, each represented by a 2-figure code-number as specified in table 3.