INTERNATIONAL STANDARD

ISO 11542-1

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Plastics — Ultra-high-molecular-weight polyethylene (PE-UHMW) moulding and extrusion materials —

Part 1: Designation system and basis for specifications

Plastiques — Matériaux à base de polyéthylène à très haute masse moléculaire (PE-UHMW) pour moulage et extrusion —

Partie 1: Système de désignation et base de spécification

Reference number
ISO 11542-1:1994(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11542-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

ISO 11542 consists of the following parts, under the general title *Plastics — Ultra-high-molecular-weight polyethylene (PE-UHMW) moulding and extrusion materials*:

— *Part 1: Designation system and basis for specifications*

— *Part 2: Preparation of test specimens and determination of properties*

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Plastics — Ultra-high-molecular-weight polyethylene (PE-UHMW) moulding and extrusion materials —

Part 1:
Designation system and basis for specifications

1 Scope

1.1 This part of ISO 11542 establishes a system of designation for PE-UHMW thermoplastic material which may be used as the basis for specifications.

For the purposes of this part of ISO 11542, PE-UHMW materials are polyethylene materials having a melt mass-flow rate (MFR), measured at 190 °C and 21,6 kg load, of less than 0,1 g/10 min.

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

a) density

b) viscosity number

c) elongational stress

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

1.3 This part of ISO 11542 is applicable to all PE-UHMW homopolymers and to ultra-high-molecular-weight copolymers of ethylene having a content of other 1-olefinic monomers of less than 50 % (*m/m*) and a content of non-olefinic monomers with functional groups up to a maximum of 3 % (*m/m*).

It applies to materials ready for normal use in the form of powder, granules or pellets and to materials unmodified or modified by colorants, additives, fillers, etc.

1.4 It is not intended to imply that materials having the same designation give necessarily the same performance. This part of ISO 11542 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.

A part 2 to this International Standard covering the preparation of test specimens and determination of properties is being prepared for use if such data are required.

1.5 In order to specify a thermoplastic material for a particular application or to ensure reproducible processing, additional requirements may be given in data block 5 (see clause 3, introductory paragraph).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 11542. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 11542 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1043-1:1987, *Plastics — Symbols — Part 1: Basic polymers and their special characteristics.*

ISO 1043-2:1988, *Plastics — Symbols — Part 2: Fillers and reinforcing materials.*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

ISO 1628-3:1991, *Plastics — Determination of viscosity number and limiting viscosity number — Part 3: Polyethylenes and polypropylenes.*

3 Designation and specification system

The designation and specification system for thermoplastics is based on the following standardized pattern:

<table>
<tr><td colspan="7">Designation</td></tr>
<tr><td rowspan="3">Description block
(optional)</td><td colspan="6">Identity block</td></tr>
<tr><td rowspan="2">International Standard Number block</td><td colspan="5">Individual-item block</td></tr>
<tr><td>Data block 1</td><td>Data block 2</td><td>Data block 3</td><td>Data block 4</td><td>Data block 5</td></tr>
</table>

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 coding, the individual-item block is subdivided into 5 data blocks comprising the following information:

— Data block 1: Identification of the plastic by its symbol PE-UHMW in accordance with ISO 1043-1 (see 3.1).

— Data block 2: Position 1: Intended application or method of processing (see 3.2).

Positions 2 to 8: Important properties, additives and supplementary information (see 3.2).

— Data block 3: Designatory properties (see 3.3).

— Data block 4: Fillers or reinforcing materials and their nominal content (see 3.4).

— Data block 5: For the purpose of specifications, a fifth data block may be added containing additional information.

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 (,,).

3.1 Data block 1

In this data block, after the hyphen, PE-UHMW plastics are identified by the symbol "PE-UHMW", in accordance with ISO 1043-1.

3.2 Data block 2

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 1.

If information is presented in positions 2 to 8 and no specific information is given in position 1, the letter X shall be inserted in position 1.

Table 1 — Code-letters used in data block 2

Code-letter	Position 1	Code-letter	Positions 2 to 8
		A	Processing stabilized
		C	Coloured
		D	Powder
E	Extrusion	**E**	Expandable
F	Extrusion of films	**F**	Special burning characteristics
G	General use	**G**	Granules
		H	Heat ageing stabilized
		K	Metal deactivated
		L	Light or weather stabilized
M	Moulding		
		N	Natural (no colour added)
Q	Compression moulding		
		R	Mould release agent
S	Sintering	**S**	Lubricated
X	No indication	**X**	Crosslinkable
Y	Textile yarns, spinning	**Y**	Increased electrical conductivity
		Z	Antistatic

3.3 Data block 3

In this data block, the range of the density is represented by a 2-figure code-number (see 3.3.1), the viscosity number by a 1-figure code-number (see 3.3.2) and the elongational stress by a 1-figure code-number (see 3.3.3). 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 1 Not all combinations of the values of the designatory properties have to be provided for currently available polymers.

3.3.1 Density

The density shall be determined in accordance with ISO 1183 on a piece of the test specimen as used for elongational-stress determination.

The possible values of density are divided into 6 ranges, each represented by a 2-figure code-number as specified in table 2.

Table 2 — Ranges of density in data block 3

Code-number	Range of density kg/m³
20	⩽ 922
25	> 922 but ⩽ 927
30	> 927 but ⩽ 932
35	> 932 but ⩽ 937
40	> 937 but ⩽ 942
45	> 942

3.3.2 Viscosity number

The viscosity number shall be determined in accordance with ISO 1628-3, preferably using a nitrogen atmosphere.

The possible values of viscosity number are divided into 6 ranges, each represented by a 1-figure code-number as specified in table 3.

Table 3 — Ranges of viscosity number in data block 3

Code-number	Range of viscosity number ml/g
0	⩽ 1 710
1	> 1 710 but ⩽ 2 190
2	> 2 190 but ⩽ 2 700
3	> 2 700 but ⩽ 3 400
4	> 3 400 but ⩽ 4 100
5	> 4 100

3.3.3 Elongational stress

The elongational stress shall be determined by a method agreed on between the interested parties. An ISO test method is being prepared and will be included in part 2 of this International Standard.

The possible values of elongational stress are divided into 5 ranges, each represented by a 1-figure code-number as specified in table 4.

Table 4 — Ranges of elongational stress in data block 3

Code-number	Range of elongational stress MPa
1	> 0,1 but ⩽ 0,2
2	> 0,2 but ⩽ 0,3
3	> 0,3 but ⩽ 0,5
5	> 0,5 but ⩽ 0,7
7	> 0,7

3.4 Data block 4

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 5. Subsequently (without a space), the mass content may be given by a 2-figure number in positions 3 and 4.

Table 5 — Code-letters for fillers and reinforcing materials in data block 4

Code-letter	Material	Code-letter	Form
B	Boron	**B**	Beads, spheres, balls
C	Carbon[1)]		
		D	Powder
		F	Fibre
G	Glass	**G**	Ground
		H	Whiskers
K	Calcium carbonate		
M	Mineral[1) 2)], metal[1)]		
S	Synthetic, organic[1)]	**S**	Scales, flakes
T	Talc		
X	Not specified	**X**	Not specified
Z	Others[1)]	**Z**	Others[1)]

1) These materials may be further defined by their chemical symbol, for example, or additional symbols defined in the relevant International Standard. In the case of metals (M) it is essential to indicate the type of metal by means of its chemical symbol.

2) Mineral fillers should be designated more precisely if a symbol is available.

Mixtures of materials and/or forms may be indicated by combining the relevant codes using the sign "+" and placing the whole between parentheses. For example, a mixture of 25 % glass fibres (GF) and 10 % mineral powder (MD) would be indicated by (GF25+MD10).

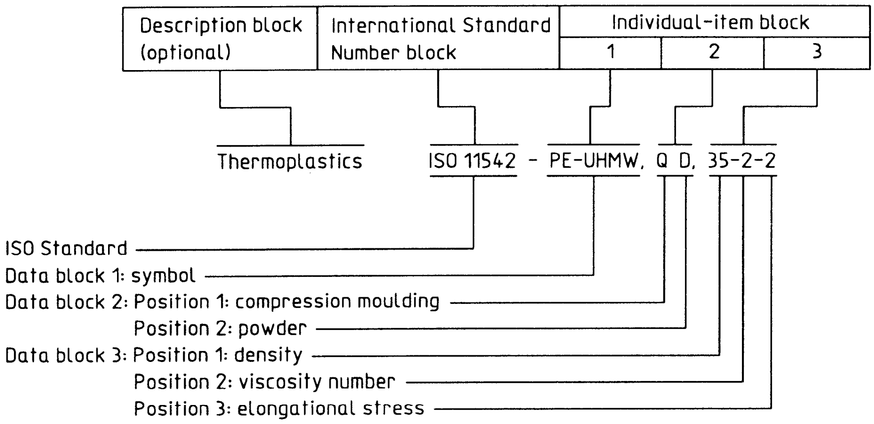
3.5 Data block 5

Indication of additional requirements in this optional data block is a way of transforming the designation of a material into a specification for a particular application. This may 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 Designation only

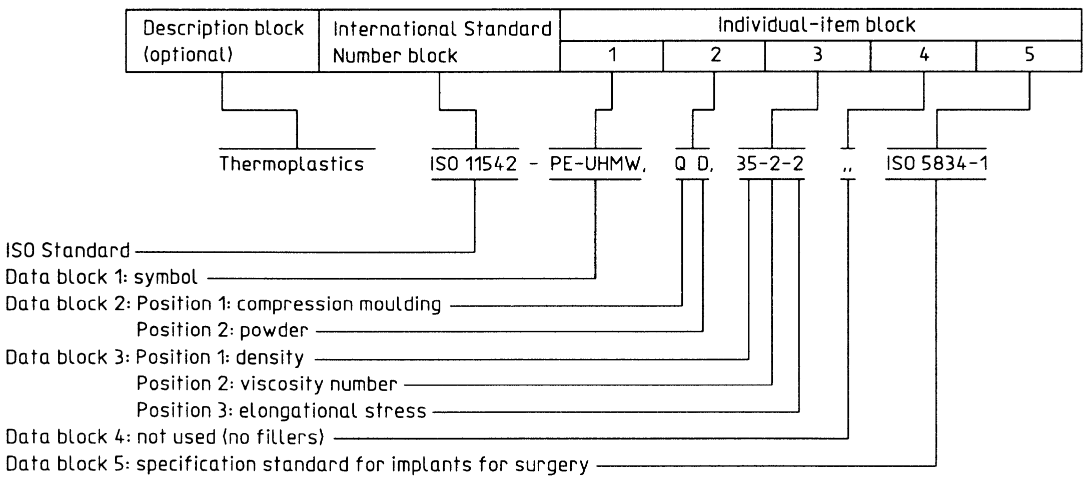
An ultra-high-molecular-weight polyethylene thermoplastic material (PE-UHMW) in the form of powder (D) intended for compression moulding (Q), with a density of 933 kg/m^3 (35), a viscosity number of 2 400 ml/g (2) and an elongational stress of 0,25 MPa (2) would be designated:



Designation: ISO 11542-PE-UHMW,QD,35-2-2

4.2 Designation transformed into a specification

An ultra-high-molecular-weight polyethylene thermoplastic material (PE-UHMW) for implants for surgery, in the form of a powder (D) intended for compression moulding (Q), with a density of 933 kg/m^3 (35), a viscosity number of 2 400 ml/g (2) and an elongational stress of 0,25 MPa (2), would be specified:



Specification: ISO 11542-PE-UHMW,QD,35-2-2,,ISO 5834-1

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