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# Plastics — Polyetheretherketone (PEEK) moulding and extrusion materials —

## Part 1: Designation system and basis for specifications

*Plastiques — Matériaux à base de polyétheréthercétone (PEEK) pour moulage et extrusion —*

*Partie 1: Système de désignation et base de spécifications*



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# 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*.

A list of all parts in the ISO 23153 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.



# Plastics — Polyetheretherketone (PEEK) moulding and extrusion materials —

# Part 1: Designation system and basis for specifications

## 1 Scope

This document establishes a system of designation for polyetheretherketone (PEEK) moulding and extrusion materials which can be used as the basis for specifications. Polyetheretherketone polymer chains are composed of phenylene rings linked in (1,4) position by a sequence of two ether groups followed by one ketone group.

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

a) melt viscosity or melt volume-flow rate;

b) tensile modulus;

c) tensile strength;

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

The designation system is applicable to all polyetheretherketones.

It applies to materials ready for normal use in the form of powder, granules or pellets, unmodified or modified by colourants, fillers, reinforcements or other additives.

It is not intended to imply that materials having the same designation necessarily 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 for a particular application and/or method of processing.

If such additional properties are required, they are intended to be determined in accordance with the test methods specified in ISO 23153-2, if suitable.

In order to specify a thermoplastic material for a particular application or to ensure reproducible processing, additional requirements are 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 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 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 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 11443, *Plastics — Determination of the fluidity of plastics using capillary and slit-die rheometers*

## 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 http://www.electropedia.org/

## 4 Designation and specification system

### 4.1 General

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

| Designation | | | | | | |
|---|---|---|---|---|---|---|
| Description block (optional) | Identity block | | | | | |
| | International Standard Number 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: Identification of the plastic by its abbreviated term PEEK in accordance with ISO 1043-1 (see 4.2).

Data block 2: Fillers or reinforcing materials and their nominal content (see 4.3).

Data block 3: Position 1: Intended application or method of processing (see 4.4).

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 transforming the designation specified in this document into another 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 (,,).

### 4.2 Data block 1

In this data block, after the hyphen, the polyetheretherketone plastic is identified by its abbreviated term PEEK in accordance with ISO 1043-1.



## 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. The code-letters listed in Table 1 being as specified in ISO 1043-2. Subsequently (without a space), the mass content may be given by a 2-figure number in positions 3 and 4.

In accordance with ISO 1043-2 there are exceptions where additional code-letters may be required for unanimous designation of material and/or form of fillers.

**Table 1 — Code-letters used for fillers and reinforcing materials in data block 2**

| Code-letter | Material (Position 1) | Code-letter | Form (Position 2) |
|---|---|---|---|
| **A** | Aramid | | |
| **B** | Boron[a] | **B** | Beads, spheres, balls |
| **C** | Carbon[a] | **Cc** | Chips, cuttings |
| | | **Cm** | Chopped-strand mat |
| | | **D** | Fines, powder |
| | | **F** | Fibre |
| | | **Fl** | Long fibres |
| **G** | Glass | **G** | Ground |
| | | **H** | Whiskers |
| | | **K** | Knitted fabric |
| | | **L** | Layer, laminate |
| **Mi, Me** | Mineral[a], metal[a] | **M** | Mat (thick) |
| | | **Mc** | Continuous (endless) strand mat |
| | | **N** | Non-woven (fabric, thin) |
| | | **Nf** | Nano fibres |
| | | **Nt** | Nano tubes |
| **P** | Mica[a] | **P** | Paper |
| **Q** | Silica | | |
| | | **R** | Roving |
| **S** | Synthetic, organic[a] | **S** | Scales, flakes |
| **T** | Talc | **T** | Twisted or braided fabric, cord, tube |
| | | **W** | Woven fabric |
| **X** | Not specified | **X** | Not specified |
| | | **Y** | Yarn |
| **Z** | Others[a] | **Z** | Others[a] |

[a] These materials may be further defined by their chemical symbol or composition, special form, or additional specifiers as 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 or alloy.

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).

## 4.4 Data block 3

In this data block, information about the 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 2.

If a material can be used for more than one application and/or method of processing the most important shall be given in position 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 2 — Code-letters used in data block 3**

| Code-letter | Position 1 | Code-letter | Position 2 to 8 |
|---|---|---|---|
| | | **A** | Processing stabilized |
| **B** | Blow moulding | **B** | Antiblocking |
| | | **C** | Coloured |
| | | **D** | Powder |
| **E** | Extrusion of pipes, profiles and sheets | | |
| **F** | Extrusion of films | **F** | Special burning characteristics |
| **G** | General use | **G** | Granules, pellets |
| **H** | Coating | **H** | Heat ageing stabilized |
| **J** | Cable and wire insulating | **J** | Elevated heat performance |
| **K** | Cable and wire sheathing | | |
| **L** | Monofilament extrusion | **L** | Light or weather stabilized |
| **M** | Injection moulding | **M** | Nucleated |
| | | **N** | Natural (no colour added) |
| **P** | Compounding | **P** | Impact modified |
| **Q** | Compression moulding | | |
| **R** | Rotational moulding | **R** | Mould release agent |
| **S** | Sintering | **S** | Lubricated |
| **T** | Tape manufacture | **T** | Transparent |
| | | **W** | Wear resistant, low friction |
| **X** | No indication | **X** | Crosslinkable |
| | | **Y** | Increased electrical conductivity |
| | | **Z** | Antistatic |



## 4.5 Data block 4

### 4.5.1 General

In this data block, the melt viscosity (MV) or melt volume-flow rate (MVR) is represented by a combination of a single code-character representing test conditions and a single code-number representing value ranges (see 4.5.2), the tensile modulus by a 2-figure code-number (see 4.5.3), and the tensile strength by a 3-figure code-number (see 4.5.3). The three codes are separated from each other by hyphens.

If a property value falls on or near a range limit for a particular product, the manufacturer of that product shall state which range will designate that product. If test values for subsequent lots of that product lie on or near either side of the range limit because of manufacturing variability the designation shall not be affected.

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

### 4.5.2 Melt viscosity and melt volume-flow rate

The melt viscosity shall be determined in accordance with ISO 11443 using a test temperature of 400 °C and a shear rate of 1 000 $s^{-1}$ (condition A). Alternatively, the melt volume-flow rate may be determined

in accordance with ISO 1133-1 using a test temperature of 400 °C and 2,16 kg load (condition B). For MVR values below 2,5 $cm^3$/10 min the higher load of 10 kg shall be used (condition C).

The possible values of melt viscosity or melt volume-flow rate are divided into 6 ranges, each represented by a combination of a single code-character representing test conditions and a single code-number representing value ranges as specified in Table 3.

**Table 3 — Ranges of melt viscosity (MV) and melt volume-flow rate (MVR) in data block 4**

| Code | Range of MV at 400 °C/1 000 $s^{-1}$ Pa.s | Range of MVR at 400 °C/2,16 kg $cm^3$/10 min | Range of MVR at 400 °C/10 kg $cm^3$/10 min |
|---|---|---|---|
| Character<br>Number | A | B | C |
| 1 | ≤ 100 | > 50 | Not applicable[a] |
| 2 | > 100 but ≤ 200 | > 20 but ≤ 50 | Not applicable[a] |
| 3 | > 200 but ≤ 400 | > 5 but ≤ 20 | > 50 |
| 4 | > 400 but ≤ 600 | ≤ 5 | > 20 but ≤ 50 |
| 5 | > 600 but ≤ 800 | Not applicable[a] | > 5 but ≤ 20 |
| 6 | > 800 | Not applicable[a] | ≤ 5 |

[a] Ranges largely outside of recommendations given in ISO 1133-1.

### 4.5.3 Tensile modulus

The tensile modulus shall be determined using test conditions specified in ISO 527-1 and ISO 527-2.

The possible values of tensile modulus are divided into 6 ranges, each represented by a 2-figure code-number as specified in Table 4.

**Table 4 — Ranges of tensile modulus in data block 4**

| Code-number | Range of tensile modulus GPa |
|---|---|
| 05 | ≤ 5 |
| 07 | > 5 but ≤ 10 |
| 15 | > 10 but ≤ 20 |
| 25 | > 20 but ≤ 30 |
| 35 | > 30 but ≤ 40 |
| 40 | > 40 |

### 4.5.4 Tensile strength

The tensile strength shall be determined using test conditions specified in ISO 527-1 and ISO 527-2.

The possible values of tensile strength are divided into 4 ranges, each represented by a 3-figure code-number as specified in Table 5.

**Table 5 — Ranges of tensile strength in data block 4**

| Code-number | Range of tensile strength<br>MPa |
|---|---|
| **120** | ≤ 120 |
| **170** | > 120 but ≤ 220 |
| **270** | > 220 but ≤ 320 |
| **320** | > 320 |

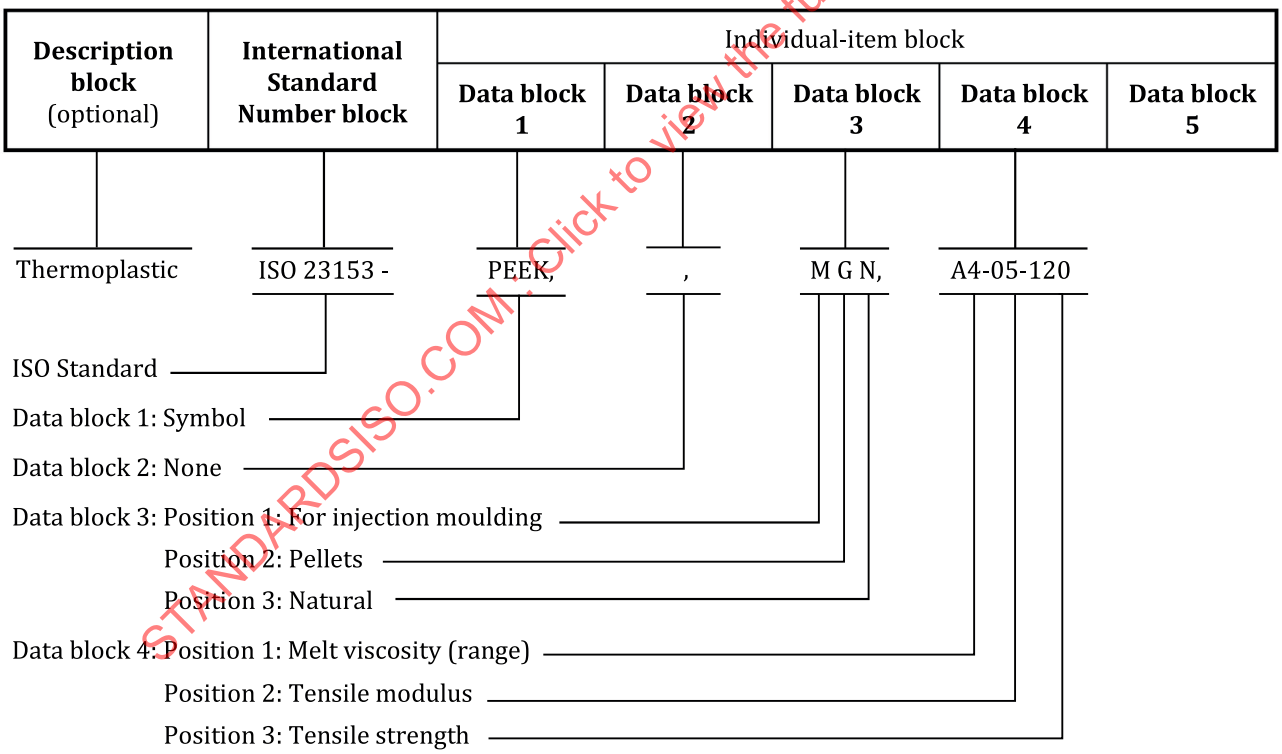
### 4.6 Data block 5

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 shall be done for example by reference to a suitable national standard or to a standard-like, generally established specification.

## 5 Examples of designation

### 5.1 Example 1

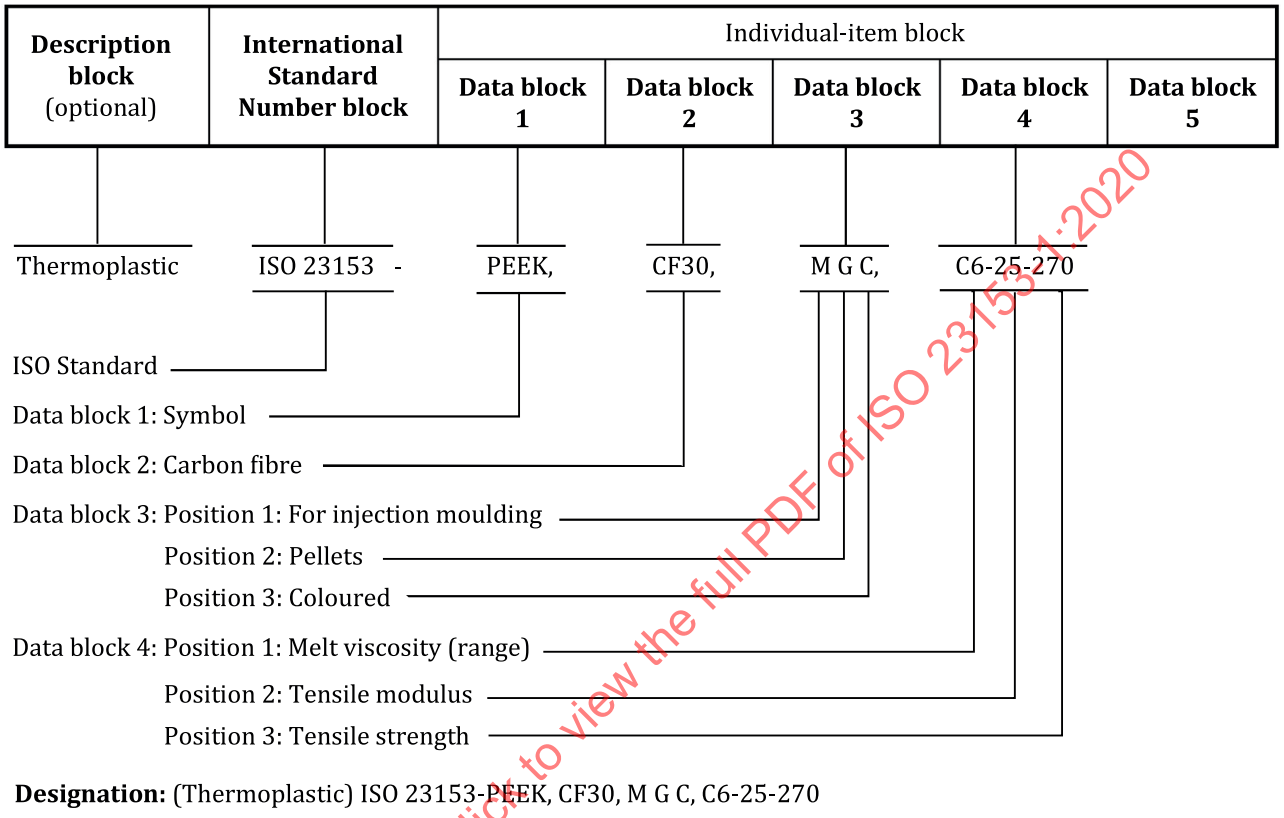
A polyetheretherketone thermoplastic material which is unfilled and intended for injection moulding (M) composed of granules (G) of natural colour (N), having a melt viscosity of 500 Pa.s (A4) and a tensile modulus of 4 GPa (05) and tensile strength 90 MPa (120) would be designated:




**Designation:** (Thermoplastic) ISO 23153-PEEK, , M G N, A4-05-120

## 5.2 Example 2

A polyetheretherketone thermoplastic material containing 30 % carbon fibres (CF30) intended for injection moulding (M) composed of pellets (G) of black colour (C), having a melt volume-flow rate of 4 $cm^3$/10 min at 10 kg load (C6) and a tensile modulus of 25 GPa (25) and tensile strength 260 MPa (270) would be designated:




**Designation:** (Thermoplastic) ISO 23153-PEEK, CF30, M G C, C6-25-270